

DOI: <https://dx.doi.org/10.18203/2320-1770.ijrcog20221273>

Original Research Article

Maternal near miss events, an obstetrician's nightmare

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Received: 18 January 2022

Revised: 03 March 2022

Accepted: 30 March 2022

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ABSTRACT

Background: Near-miss obstetric cases are those who have survived childbirth after a life-threatening complication of pregnancy. The aim of this study is to assess the prevalence of maternal near miss events, fetomaternal outcome and alongside analyze the importance of high dependency unit care for near miss patients in reducing maternal morbidity and mortality.

Methods: This hospital based cross-sectional study was conducted in the obstetrics and gynaecology department of Southern railway hospital during June 2019 July 2021. In this study, pregnant or postnatal women with life threatening complications are admitted to the HDU using SAMM composite score and maternal & perinatal outcome are documented. Data entry was done in Microsoft Excel and data were analyzed using Epi Info software (7.1.0.6).

Results: Many indicators of maternal near miss are calculated. The incidence of near-miss events was 11.5/1,000 live births. The ratio of near-miss to maternal mortality was 7:1. Hypertensive disorders complicating pregnancy and Obstetric haemorrhage were the most common direct and cardiac diseases complicating pregnancies were the most common indirect causes of admission into HDU care.

Conclusions: Evaluation of maternal near miss events provides a good sense about our deficiencies in referral system, treatment protocols and any delay in admission to intervention time. Good maternal outcome after HDU care in MNM patients and also cost-effective benefits.

Keywords: Maternal near miss, HDU, SAMM score, Maternal mortality

INTRODUCTION

Maternal health refers to health of the women during pregnancy, childbirth and postnatal period. These events are considered critical in women's reproductive life. Maternal morbidity is a broader spectrum and refers to any health condition attributed to and/or aggravated by pregnancy and childbirth that has a negative impact on women's well being.¹⁻³ These morbid events can range from less severe symptoms to life threatening complications, either having short term or sometimes lifelong negative impact on women's health. Maternal mortality ratio refers to the annual number of female deaths from any cause related to or aggravated by

pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy.⁴ Adding to the WHO definition, the CDC extends the period of consideration to include up to 1 year within the end of a pregnancy regardless of the outcome.⁵ Worldwide, nearly 810 women had died every single day due to complications during pregnancy and childbirth in 2017.^{6,7} Out of which 94% of all maternal deaths occur in low and lower middle-income countries.^{6,7} Women in less developed countries have, on average, many more pregnancies than women in developed countries, and their lifetime risk of death due to pregnancy is higher.

Women die as a result of complications during and following pregnancy and childbirth. Most of these complications develop during pregnancy and most are preventable or treatable. Other complications may exist before pregnancy but are worsened during pregnancy, especially if not managed as part of the woman's care. The major complications that account for nearly 75% of all maternal deaths are hemorrhage, sepsis, hypertensive disorders of pregnancy, complications from delivery and unsafe abortion.⁸ The remainder are associated with chronic conditions like cardiac diseases or diabetes. India alone contributes 15% of maternal deaths worldwide and recent statistics on the maternal mortality rate of India is 167 per lakh live births compared to 374 per lakh live births during the year 2000, which has fallen by 44.6%.^{9,10} Besides the higher effect on health, Pregnancy related deaths results in loss of social and economic development. The women who die are in the prime of life responsible for the health and wellbeing of their families. Maternal near miss (MNM) is a relatively new concept and is used as an adjunct to maternal mortality rates to assess the maternal healthcare services worldwide. The WHO has published the MNM criteria based on markers of clinical management and end organ dysfunction, which would help in identification of near miss patients.¹¹ Maternal Near miss is defined as "a women who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy".¹¹ Despite the high maternal death burden in India, there are relatively few studies which validate the evidences and help in making appropriate treatment protocols and management plans. HDU is an area in the hospital where patients can be cared more exclusively and extensively than in a normal ward but not to the point of intensive care unit. It is called as Intermediate care unit between labor room and ICU. These special units manage high risk pregnancies requiring vigilant monitoring and early interventions by multidisciplinary teams involving the senior obstetrician, anesthetist, physician, cardiologist, intensivists and neonatologist. This study aims to assess the prevalence of maternal near miss events, fetomaternal outcome and alongside analyze the importance of high dependency unit care for near miss patients in reducing maternal morbidity and mortality.

Aim and objectives

Aim and objective of current study were to assess the frequency of maternal near miss events at our tertiary care hospital and to analyze the causes, the spectrum and the interventions during maternal near miss events along with their fetomaternal outcomes.

METHODS

This is a hospital based cross sectional study conducted at the obstetrics and gynecology department in Southern Railway zonal hospital, Chennai Tamil Nadu during June 2019 July 2021. It is a 505 bedded tertiary care hospital established during the British rule of India. It

incorporates a five bedded HDU (out of the 22 bedded ICU) of standard recommended size close to the operating theaters and the postoperative recovery area and is staffed by anesthetic and obstetric consultants and postgraduate residents. The total number of antenatal cases cared for in the department during the study period was 2612. Nearly 2428 antenatal women have delivered during the study period. Those women admitted with potentially life-threatening complications in the antepartum and postpartum period, who met WHO 2009 criteria were considered as high-risk cases. WHO criteria included a set of clinical, laboratory and management-based criteria.

Inclusion criteria

According to WHO, any of the following conditions that is/are present during their stay at the health-care facility would be eligible. Women that develop those conditions unrelated to pregnancy (i.e., not during pregnancy or 42 days after termination of pregnancy) are not eligible. Women who are already dead when they are brought to the health-care facility or those who die on arrival at the facility should be included because they are likely to represent cases involving a major delay in accessing care. The eligibility is not restricted by gestational age at which complications occurred (i.e., women having abortions or ectopic pregnancies and presenting with any of the inclusion criteria are eligible).

Severe maternal complications

Severe postpartum hemorrhage, severe pre-eclampsia, eclampsia, sepsis or severe systemic infection, ruptured uterus and severe complications of abortion.

Critical interventions or intensive care unit use

Admission to intensive care unit, interventional radiology, laparotomy (includes hysterectomy, excludes caesarean section) and use of blood products.

Life-threatening conditions (near-miss criteria)

Cardiovascular dysfunction: shock, cardiac arrest (absence of pulse/ heart beat and loss of consciousness), use of continuous vasoactive drugs, cardiopulmonary resuscitation, severe hypoperfusion (lactate >5 mmol/l or >45 mg/dl), severe acidosis (pH <7.35 breaths per minute), severe bradypnea (respiratory rate <10 μ mol/l or >6.0 mg/dl), neurological dysfunction, prolonged unconsciousness (lasting \geq 12 hours)/coma (including metabolic coma), stroke, uncontrollable fits/status epilepticus, total paralysis and uterine dysfunction: uterine hemorrhage or infection leading to hysterectomy.

Exclusion criteria

High risk patient but do not fit into the above mentioned criteria, those not willing to participate in the study were

excluded from the study. The SAMM (severe acute maternal morbidity score) score was then used in the high risk group and those with a composite score of more than 6 was managed in the high dependency unit (HDU). The SAMM score (Table 1) is a five-factor scoring system.

Table 1: Severe acute maternal morbidity score (SAMM score).

Factors	Score
Organ failure (more than 1 organ system)	5
Extended intubation (more than 12 hours)	4
ICU admission	3
Surgical intervention	2
Blood transfusion (more than 3 units)	1
Total score	15

A score of more than 6 is considered for HDU care. On admission to HDU, patient characteristics age, gestational age on admission, risk factors, onset and mode of delivery, duration of hospital stay and perinatal outcome were recorded. Maternal Mortality during the same period was also analyzed. Data entry was done in Microsoft Excel and data were analyzed using Epi Info software (7.1.0.6). Descriptive statistics was used to summarize quantitative variables with mean and standard deviation, while frequency and percentages was used to summarize categorical (qualitative) variables.

RESULTS

During our study period, there were 2428 deliveries in our institute. High risk patients with medical and surgical disorders complicating pregnancies were 696. There were 32 patients (1.3%) required monitoring in high dependency unit. Twenty-eight patients recovered (87.5%) without any long-term sequel and there were 4 deaths (12.5%) (Figure 3). Among the 32 patients, 16 each were booked at our institution and referred from outside respectively. In our study, the mean age of all women who needed HDU observation and fulfilling the SAMM score was 27.1 years. Majority of women were in the age group of 21-30 years (78.1%). Among the 32 women required HDU, 13 patients (40.6%) were Primigravida and 19 patients (59.3%) were multiparous. Among the 32 women there were twenty five antenatal patients (78.2%) and seven postnatal patients (21.8%) requiring HDU. Among the 32 women, 14 patients (43.75%) were in the late 3rd trimester and immediate postnatal indicating that the worst affected period requiring HDU management. Only 2 and 3 patients were in 1st trimester and 2nd trimester respectively. The patient characteristics, parturition and perinatal outcome of patients admitted to HDU is shown in (Table 2). In our study, among the 32 HDU admission, 18 (56.25%) were due to direct obstetric causes and 14 (43.75%) were due to indirect or coincidental causes of SAMM. The most common type of near miss events were due to hypertensive disorders of pregnancy (N=11, 34.3%)

(Figure 1), obstetric hemorrhage (N=6, 18.75%) and 1 case due to hyperemesis gravidarum with ketoacidosis.

Table 2: Patient characteristics, parturition and perinatal outcome of patients admitted to HDU (n=32).

Variables	N	%
Age (years)		
Less than 20	1	3.1
21-30	25	78.1
more than 30	6	18.8
Parity		
Primigravida	13	40.6
Multigravida	19	59.3
Gestational age (weeks)		
Term	14	43.7
30-36	9	28.1
20-30	6	18.7
less than 20	3	9.37
Onset of labour		
Termination of pregnancy/induction	23	71.8
Spontaneous	7	21.8
No intervention	2	6.25
Mode of delivery		
Vaginal delivery	9	28.1
LSCS	17	53.1
MTP	2	6.3
Salpingectomy	2	6.3
No intervention	2	6.3

The most common indirect cause of near miss event in our study was cardiovascular disease complicating pregnancy (N=5, 15.62%). The spectrum of hypertensive disorders complicating pregnancy ranged from severe preeclampsia (N=7), eclampsia (N=2), HELLP syndrome (N=1) and abruptio placentae (N=1). Tuberculous meningitis, non Hodgkin's lymphoma, Subarachnoid hemorrhage, ITP and SLE in pregnancy were other near miss events requiring HDU. Regarding mode of delivery in the near miss events patients, most of the cases (n=23, 71.87%) had termination of pregnancy due to severe maternal morbidity. In rest of the seven patients labor started spontaneously. Two patients remain undelivered. Nine patients (28.1%) delivered vaginally and 17 patients (53.1%) underwent LSCS. Two patients (6.25%) underwent laparotomy and 2 patients (6.25%) had surgical evacuation. The mean duration of stay in HDU is 17 days. Majority of the patients (N=23, 71.9%) stayed in the HDU for 8-21 days. In our study, a composite score of 6 or more was taken for recruitment into HDU. Nearly 75% of patients were in the range of 6-10 SAMM score. The causes of maternal death in our study were pulmonary embolism, Non-Hodgkin lymphoma, TB meningitis and Sub arachnoid hemorrhage each. As far as perinatal morbidity, proportion of near miss events to live births during our study period was 13/1000 live births. Among the 32 women, there was 24 live births and rest

has not crossed the period of viability and therefore was not salvageable.

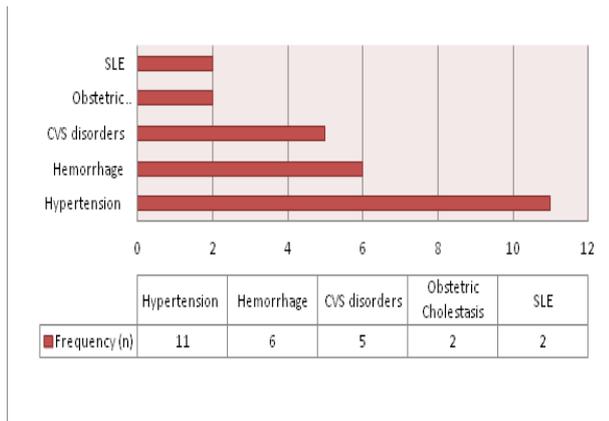


Figure 1: The common causes for maternal near miss events in our study.

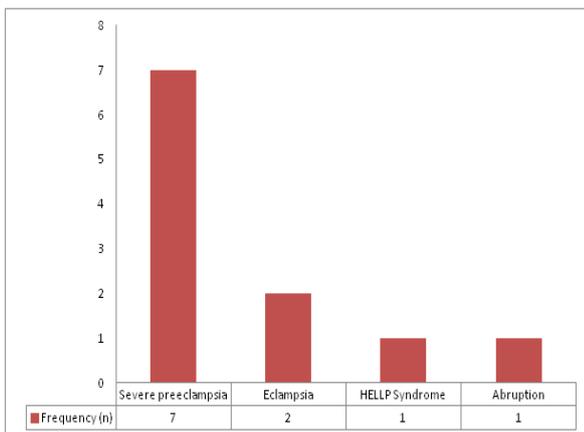


Figure 2: Spectrum of hypertensive disorders complicating pregnancy attributing to maternal near miss events.

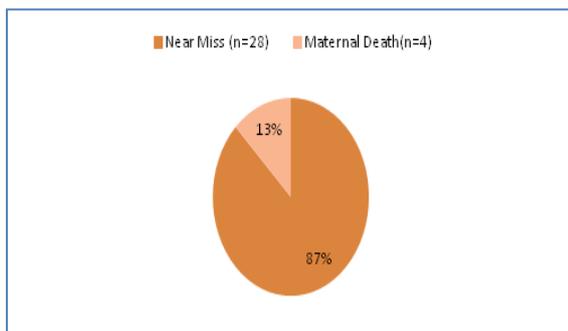


Figure 3: Maternal near miss and maternal mortality in patients admitted to HDU in our study.

The maternal near miss indicators derived from this study were as follows: total women with life threatening complication (WLTC) were 32. MNM was 28 and Maternal death was 4, WLTC=MNM+MD, total live birth was 2428, maternal near miss ratio (MNMR) was

11.5 per 1000 live births (MNMR= MNM/LB). Severe maternal outcome ratio (SMOR) was 13.17 per 1000 live births (SMOR=MNM+MD/LB), maternal near miss mortality ratio was 7:1 (MNM:1MD). Higher ratios indicate better care. Mortality index was 12.5% (MI=MD/MD+MNM). The higher the index the more women with life threatening conditions (low quality of care).

DISCUSSION

Since a long time, we have been using maternal death audit meetings to assess and investigate the barriers in providing good maternal healthcare. Now the concept of Maternal Near Miss events is increasingly used to define the quality of maternal healthcare provided to the antenatal and postnatal mothers. The theory backing this approach was initially put forth by Pattinson.¹² The sequence from good health to death is a pregnant women is a clinical insult, followed by a systemic inflammatory response, organ failure and finally death. By viewing pregnancy and its potential outcomes as a continuum, beginning at normal pregnancy and concluding with maternal death, the number can be studied meaningfully can be increased by examining the group of outcomes closet to death." By reviewing the first-hand information provided by the near miss cases can tell not just the causes and risk factors for severe maternal morbidity, but also exposes the deficiencies in the referral system and clinical interventions available. Our study predominately focuses on the prevalence of causative factors leading to near miss events and whether HDU management and early involvement of multi-disciplinary team decreases maternal mortality. Our study revealed the proportion of near miss to be 11.53/1000 obstetric admissions and 13/1000 live births. The ratio of near miss to mortality was 7:1. In a similar Indian study, near miss incidence was 30.1/1000 obstetric admissions, 31.4/1000 live births and near miss to mortality ratio was 3.8:1.¹³ The maternal morbidity and mortality parameters stated above is comparably higher in the other study. This is because of the availability and early admission to HDU management of patients with a higher SAMM score in our study place. In our study, the major risk factor for admission into HDU was spectrum of hypertensive disorders of pregnancy (34.3%) and Obstetric hemorrhage (18.75%). In the study by Sultana et al, the prevalence of risk factors were almost similar. Another study by Sharma et al the most common cause of maternal morbidity was hemorrhage (31.8%) predominately postpartum PPH due to atonic uterus or morbidly adherent placenta.¹² However, literature also reports the major risk factors for maternal morbidity was Obstetric hemorrhage and hypertensive disorders.¹³⁻¹⁶ Cardiac diseases complicating pregnancy was the most common indirect cause of near miss events in our study. Being a middle-income country, many of these women has never undergone medical screening and are unaware that they have a valvular heart disease. Cardiac failure, arrhythmias and thrombotic events were some of the common causes for HDU

management in women having cardiac diseases complicating pregnancy.¹⁷ In our study, all the 5 pregnant women with cardiac diseases requiring HDU management returned back to their normal life without any acute morbidity or long-term complications. This is due to the early multidisciplinary team involvement and HDU observation during and after parturition. Sepsis has also been an important cause for near miss events. However, in our study we did not have any patient of puerperal sepsis needing HDU management. HDU care within the obstetric setting has potential benefits such as holistic care, facilitation of bonding with the newborn and availability of senior obstetrician and anesthetists. However, there are many other confounding factors responsible for the poor outcome of patients like delay in seeking medical attention, delay in initiation of treatment, inaccessibility to blood and blood products, non-availability of skilled personnel and limited financial resources. To evaluate these gaps, more research and follow up is required in this grey area of maternal near miss events. Admission to HDU is also cost effective by reducing the admission to intensive care unit.

Limitations

Our study only demonstrates the better maternal and fetal outcome of high-risk women with SAMM score of more than 6 admitted to HDU. Our study does not compare the demographic variables, risk factors and outcome between maternal near miss events and maternal mortality patients. Moreover, other factors like various levels of delays in maternal health seeking behavior responsible for the increased incidence of complications in high-risk patients were not evaluated.

CONCLUSION

Early identification of maternal near miss events with the WHO criteria, using the SAMM composite score to stratify the high-risk cases and early involvement of the specialists team would definitely improve the outcome of maternal morbidity. HDU care may now be a relatively newer concept to follow, but proper antenatal screening of high-risk cases, prompt admission in HDU in case of complications and reflection of what early intervention was done to decrease the mortality of every near miss event would actually help us find out the deficiencies in our management protocols and promote a much safer motherhood.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Kalyani S, Prashanthi SS. Maternal near miss events, an obstetrician's nightmare. *Int J Reprod Contracept Obstet Gynecol* 2022;11:1432-7.