

Study of maternal near miss cases at a tertiary centre in South India

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Abstract:

Background: Maternal mortality is a sentinel event to assess the quality of a women's health care system. As the mortality rates are consistently decreasing the focus is shifted on maternal near miss which describes severe maternal morbidity which shares the common pathway as mortality. **Objective:** To assess and analyze the incidence of maternal near miss and the mortality indicators. **Materials and methods:** This is a retrospective descriptive study carried out in the department of obstetrics and gynaecology of a tertiary centre over six years. All women who fulfil the World Health Organisation (WHO) criteria of Maternal Near Miss (MNM) were included in the study. Relevant demographic and obstetric, further course and events leading to maternal near miss were studied. Finally the indices like maternal near miss incidence ratio, maternal near miss: maternal mortality ratio and mortality index were calculated. **Results:** During the six year study period, 21,692 deliveries took place at our institution and 539 women were identified as near-miss cases. The prevalence of near-miss case was 2.56%. Maternal near miss ratio was 25.66 per 1000 live births and maternal near miss to mortality ratio was 60:1. The leading medical co-morbidity causing maternal near miss was hypertensive disorder of pregnancy (47.1%) and the most common cause was obstetric hemorrhage in 77.1% cases. Majority of the cases (91.8%) were referral cases. **Conclusion:** The study of maternal near miss cases is a good indicator of our health care system. Emergency obstetric care training at the peripheries helps reduce the overall maternal morbidity and lessen the burden to health care system.

Keywords: Maternal near miss, maternal mortality, obstetric hemorrhage.

Each year approximately 529,000 women die of complication during pregnancy and delivery, almost all of them (99%) occur in low resources countries.¹ According to Millennium Development Goals (MDG), by 2015, it was aimed to improve the maternal health and reduce maternal mortality rate by 75%. We are still falling way below our target.² Recognising the MNM will identify the deficiencies, strengthen the obstetrical health services and reduces maternal mortality and long term morbidity rates of our country.³

The WHO defines a MNM case as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy."⁴ In our study, we aim to study the prevalence, etiology of MNM in a tertiary care hospital in Bangalore, based upon accepted WHO criteria and calculate the MNM indicators.

Materials and Methods

This is a retrospective descriptive study carried out in the department of obstetrics and gynecology of a tertiary centre over six years (June 2011 to June 2017). Relevant details regarding age, parity, gestational age, course at hospital and final maternal and neonatal outcome were studied from the hospital records. Permission for conducting this study was obtained from ethical board of the institute.

Study Place: Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore.

Inclusion Criteria: All patients who fulfil the WHO criteria of Maternal Near Miss ⁴ -

Clinical criteria:

- Acute cyanosis, loss of consciousness lasting >12 hours.
- Gasping, absence of pulse/heartbeat
- Respiratory rate > 40 or <6/min
- Stroke
- Shock, uncontrolled fit/total paralysis
- Oliguria, jaundice in the presence of pre-eclampsia
- Clotting failure

Laboratory-based criteria:

- Oxygen saturation < 50% for >60 mins, Ph <7.1
- PaO₂/FiO₂ < 200mmHg, Lactate > 5
- Creatinine > 300µmol/l or >3.5mg/dl
- Acute thrombocytopenia (< 50000 platelets)
- Bilirubin > 100µmol/l or > 6.0 mg/dl
- Loss of consciousness and the presence of glucose and ketoacids in urine

Management-based criteria:

- Use of continuous vasoactive drugs, intubation and ventilation for > 60 mins not related to anaesthesia
- Hysterectomy following infection or hemorrhage
- Dialysis for acute renal failure
- Transfusion > 5 U of red cell transfusion requiring cardio pulmonary resuscitation (CPR).

Identification criteria:

(Identification criteria where organs/system dysfunction are life threatening condition)

- Cardiovascular dysfunction -
 - Shock
 - Cardiac arrest
 - Severe hypoperfusion (lactate >5 mmol/L or >45 mg/dL)
 - Severe acidosis (pH<7.1)
 - Use of continuous vasoactive drugs
 - Cardio-pulmonary resuscitation
- Respiratory dysfunction -
 - Acute cyanosis
 - Gasping
 - Severe tachypnea (respiratory rate>40 breaths per minute)
 - Severe bradypnea (respiratory rate<6 breaths per minute)
 - Severe hypoxemia(O₂ saturation <90% for ≥60min or PAO₂/FiO₂<200)
 - Intubation and ventilation not related to anesthesia
- Renal dysfunction -
 - Oliguria non responsive to fluids or diuretics
 - Severe acute azotemia (creatinine >300 µmol/ml or >3.5 mg/dL)
 - Dialysis for acute renal failure
 - Coagulation dysfunction

- Failure to form clots
- Severe acute thrombocytopenia ($<50,000$ platelets/ml)
- Massive transfusion of blood or red cells (≥ 5 units)
- Hepatic dysfunction -
 - Jaundice in the presence of pre-eclampsia
 - Severe acute hyperbilirubinemia (bilirubin >100 $\mu\text{mol/L}$ or >6.0 mg/dL)
- Neurologic dysfunction -
 - Prolonged unconsciousness or coma (lasting >12 hours)
 - Stroke
 - Uncontrollable fit / status epilepticus
 - Global paralysis
- Uterine dysfunction -
 - Hysterectomy due to uterine infection or hemorrhage

Definitions -

MNM indicators:

- Maternal near-miss refers to a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy.
- Maternal Death (MD) is the death of a woman while pregnant or within 42 days of termination of pregnancy or its management, but not from accidental or incidental causes.
- Live Birth (LB) refers to the birth of an offspring which breathes or shows evidence of life.
- Severe maternal outcome refers to a life-threatening condition (that is, organ dysfunction) including all maternal deaths and maternal near-miss cases.
- Women with Life - Threatening conditions (WLTC) refers to all women who either qualified as MNM cases or those who died (that is, women presenting a severe maternal outcome). It is the sum of maternal near-miss and maternal deaths ($WLTC = MNM + MD$).
- Severe Maternal Outcome Ratio (SMOR) refers to the number of women with life-threatening conditions ($MNM + MD$) per 1000 Live Births (LB). This indicator gives an estimate of the amount of care and resources that would be needed in an area or facility [$SMOR = (MNM + MD)/LB$].
- MNM Ratio (MNMR) refers to the number of MNM cases per 1000 live births ($MNMR = MNM/LB$). Similar to the SMOR, this indicator gives an estimation of the amount of care and resources that would be needed in an area or facility.
- Maternal near-miss mortality ratio refers to the ratio between maternal near miss cases and maternal deaths. Higher ratios indicate better care.
- Mortality index refers to the number of maternal deaths divided by the number of women with life-threatening conditions expressed as a percentage [$MI = MD/(MNM + MD)$]. The higher the index the more women with life-threatening conditions die (low quality of care), whereas the lower the index the fewer women with life-threatening conditions die (better quality of care).

Statistical Analysis: Data is entered into a computer database using Microsoft Excel spreadsheet and data analyzed. The following indicators were calculated; Maternal near miss, Maternal mortality, SMOR, MNM Ratio, MNM: Mortality Ratio, Mortality Index.

Results

During the six year study period, we had a total of 21,692 deliveries out of which 539 cases fit into our inclusion criteria of maternal near miss with a prevalence rate of 2.54%.

Table 1 describes the age, gestational age at presentation and booking status of all cases. The common age group affected is the women in their 20s (78.5%). But mortality rates were higher among women below the age of 20 years highlighting the fact that adverse outcomes are more with teenage pregnancies. With regard to the gestational age, in our study, we found most cases (40.8%) of maternal miss occurring at term. A vast majority of 91.8% (495) cases were referred to us from other primary and urban health centers. This is the case among both the maternal near miss and the mortality columns with 77.8% of maternal mortality cases being a referral.

Table 1: Details of age, gestational age and booking status among cases of MNM (n=539) and maternal mortality (n=9)		
Variables	MNM (n=539)	Maternal mortality (n=9)
Age		
<20 yrs	38 (7.1%)	7 (77.8%)
<20 30 yrs	423(78.5%)	2 (22.2%)
> 30 yrs	78(14.5%)	-
Gestational age		
Term	220(40.8%)	5 (55.6%)
28-38 wks	192(35.6%)	3 (33.3%)
< 28 wks	127(23.6%)	1(11.1%)
Booking status		
Booked	44 (8.2%)	2(22.2%)
Referred	495 (91.8%)	7(77.8%)

Table 2: Type of admission (among MNM and maternal mortality cases)		
Variables	MNM (n=539)	Maternal mortality (n=9)
Patients with severe illness	221 (41%)	8(88.9%)
Normal patients into MNM	47(8.7%)	-
Patients with associated disorder	271(50.3%)	1 (11.1%)

Table 2 describes the general condition of the patient on admission. As we look into the table, we find majority of the patients (50.3%) had an associated co morbidity in the form of hypertension, diabetes, epilepsy, or anemia on admission and later on went on to develop complications leading to maternal near miss state. We had 221(41%) cases presenting to us in a state of severe illness with most of them requiring ICU care. 47 ladies who were a case of low risk pregnancy subsequently developed complications during intrapartum and postpartum stages and constituted to the remaining 8.7% of maternal miss cases.

Table 3: Underlying disorders, complications, progression and need for MICU care		
Variables	MNM (n=539)	Maternal mortality (n=9)
Hypertension		
Eclampsia	75 (13.9%)	4(44.4%)
HELLP syndrome	7 (1.3%)	2(22.2%)
Severe PIH	172 (31.9%)	1(11.1%)
Obstetric haemorrhage (OH)		
Atonic PPH	298 (55.3%)	7 (77.8%)
Traumatic PPH	52 (9.6%)	1(11.1%)
Abruption	50 (9.3%)	-
Retained placenta	10 (1.8%)	-
Incomplete abortion	16 (2.9%)	1(11.1%)
Sepsis	53 (9.8%)	-
Ruptured ectopic	49 (9.1%)	-
Ruptured uterus	5 (0.9%)	-
Thrombosis	6 (1.1%)	-
Medical disorders		
Anaemia	52 (9.6%)	-
Hypothyroidism	16 (2.9%)	-
Epilepsy	3 (0.5%)	-
Cardiac disease	-	1(11.1%)
Diabetes	51 (9.5%)	-
Progression of complications		
Shock	343 (63.6%)	5 (55.5%)
Cardiac failure	8 (1.5%)	-

Respiratory failure	71 (13.2%)	3 (33.3%)
Renal failure	6 (1.1%)	1(11.1%)
DIC	63 (11.7%)	1(11.1%)
Septic shock	50 (9.3%)	-
Embolism	7 (1.3%)	4 (44.4%)
Need for MICU care	MNM (n=539)	Maternal Mortality (n=9)
Yes	90 (16.7%)	8 (88.9%)
HELLP - Hemolysis, elevated liver enzymes, low platelet count, PIH - Pregnancy induced hypertension, PPH - Postpartum hemorrhage, DIC - Disseminated intravascular coagulation, MICU - Medical intensive care unit.		

Table 3 describes the underlying disorders complications and progression of cases leading to their maternal miss scenario. Hypertensive disorder of pregnancy was the most common underlying disorder seen in 254 (47.1%) cases. Other medical disorders comprised of anemia, hypothyroidism, diabetes, and epilepsy seen in 122 cases (22.6%). The remainder of the cases had no underlying disorder on admission but subsequently developed complications. Obstetric hemorrhage was the most common complication contributing to maternal near miss state comprising of early pregnancy hemorrhage due to incomplete and septic abortions and ruptured ectopic, antepartum hemorrhage in the form of abruption and placenta previa and postpartum hemorrhage of atonic, traumatic thrombotic types and secondary PPH secondary to retained tissues. 90 cases (16.7%) had maternal ICU requirement.

Table 4: Blood loss, need for blood and its products and need for surgical management		
Blood loss	MNM (n=539)	Maternal mortality (n=9)
<750 ml	161 (29.9%)	2 (22.2%)
>750 ml	378 (70.1%)	7 (77.8%)
Need for blood and blood products	MNM (n=539)	Maternal mortality (n=9)
Yes	433 (80.3%)	7 (77.8%)
No	106 (19.7%)	2(22.2%)
Need for surgical management	MNM (n=539)	Maternal mortality (n=9)
Requirement of compression sutures		
Yes	13 (2.4%)	2 (22.2%)
No	526 (97.6%)	7(77.8%)
Obstetric hysterectomy		
Yes	11 (2%)	3 (33.3%)
No	528 (98%)	6 (66.7%)

Table 4 explains in detail about the management of complications mostly arising from obstetric hemorrhage. 378 MNM cases (70.1%) had significant blood loss of more than 750ml requiring blood and blood products in a majority of them (80.3%). Even among the cases succumbing to death, significant blood loss was seen in 78% cases. A few patients (2.4%) required surgical management in addition to medical measures to control hemorrhage in the form of compression sutures and obstetric hysterectomy in 11 cases. When we look into the causes of maternal death in our study, out of the 9 cases, 7 were secondary to obstetric hemorrhage requiring surgical management stressing its importance as a major cause of maternal morbidity and mortality.

Table 5: Mode of delivery (for MNM and Maternal mortality)		
Variables	MNM (n=539)	Maternal mortality (n=9)
Normal delivery	207 (38.4%)	5 (55.6 %)
Cesarean section	259 (48.1%)	3 (33.3%)
Laparotomy	57 (10.6%)	
Evacuation	16(2.9%)	1(11.1%)
Baby details	MNM (n=539)	Maternal mortality (n=9)
Live	366 (67.9%)	4 (44.4%)
Dead	107 (19.9%)	4 (44.4%)
Neonatal death	66 (12.2%)	1 (11.1%)

Table 5 explains about the mode of delivery and fetal outcome. Caesarean section was the predominant mode of delivery seen in 48.1% cases in comparison to vaginal delivery in 38.4 % cases. 57 cases required laparotomy due to ruptured ectopic pregnancy, rupture uterus and medically uncontrolled postpartum hemorrhage requiring surgical management in the form of compression sutures in 13 cases and obstetric hysterectomy in 11 cases, respectively. Fetal outcome was favorable in our study with 67.9% live births.

Table 6: Mortality indicators	
Mortality indicators	Number
WLTC	548
SMOR	25.26 per 1000 live birth
MNMR	25.66 per 1000 live birth
Maternal near-miss mortality ratio	60:1
Mortality index	1.64%

Table 6 gives us details about all the mortality indicators. In our study, mortality index was 1.64% and maternal near miss ratio was 60:1, respectively.

Discussion

This retrospective cross-sectional study of MNM was conducted in a tertiary care centre in Bangalore using the modified WHO near-miss approach and criteria. This study highlights the burden of severe maternal outcome in a tertiary care centre in south India through the various indicators. In our study of six years, we had 548 cases of women with life threatening cases out of which nine women succumbed to maternal mortality. The maternal near miss incidence ratio in our study was 25.6 for 1000 live births. This value is quite high compared to a ratio of 11 per 1000 live births which was seen in a study conducted in Chhattisgarh by Bansal et al.⁵ This difference may be due to increased number of referral cases which come in severe conditions who survive due to timely management. Other studies conducted in other developing countries showed slightly higher values ranging from 18 to 25 per 1000 live births⁶⁻⁸.

The near miss to mortality ratio in our study is 60:1, that is, for every 60 near miss cases, there was one maternal death. This is high when compared to values like 7.2 in other studies with similar setup.^{6,8,9} Higher ratios indicate better and timely care. High income countries like Europe have reported a ratio of 117-223:1.8. If this ratio increases over a period of time it reflects on the improvement achieved in the obstetric care.⁸ These large disparities may be due to differences in diagnostic criteria used to identify the near miss cases. Studies in developed countries commonly use ICU admission or organ-system dysfunction/ failure as their criteria for case selection. Though organ-system based criteria is regarded as the most specific and least vulnerable to bias, we adopted a clinical criteria that best fits the circumstances in our environment. The clinical criteria method which we choose to define our near miss cases has many advantages including its easy interpretation and ability to assess, both complication rate and quality of care of a particular disease.

In analogy to our study in which most cases were beyond 28 weeks, in a study conducted by Roopa et al⁶, women with 'near miss' outcome at gestational age 1-12, 13-28, >28weeks and postnatally were 17 (12.9%), 6 (4.6%), 75 (57.2%) and 33 (25.1%), respectively. In another study conducted in Kathmandu by Shrestha et al⁹, it was observed that pregnant women with gestational age of <13, 13-28, >28 weeks and postpartum period who belonged to near miss category were 11 (30.5%), 6 (16.66%), 10 (27.77%) and 9 (25%) women, respectively.

When we look into the underlying causes involved in maternal near miss, in our study, hypertensive disorder of pregnancy was the most common underlying medical disorder associated with MNM seen in 254 (47.1%) cases. Similar findings were seen in other studies conducted in Nepal, Sudan, Manipal, Jharkhand and New Zealand.^{5,6,8,9,11,12}

Hypertensive disorders are a major cause of high morbidity and eclampsia has a high rate of mortality as compared to severe pre-eclampsia. Majority of eclamptic patients were either unbooked cases or referred late with multiple seizures leading to progression to near miss and even death. This again strongly reiterates the importance of regular antenatal care and strengthening primary health centres.

The most common complication causing MNM was obstetric hemorrhage (OH) associated with major blood loss in 378(70.1%) cases requiring blood and its products transfusion. Third stage complications contributed to the majority of OH cases (77.1%) as seen in table 3. A decline in the number of first trimester events like septic abortions and ruptured ectopic causing near miss in our study may be due to improved early recognition of ectopic by ultrasonography and better management of septic abortions with antibiotic care. This is similar to what is seen in literature⁵⁻¹¹.

A total of 9 deaths were observed in our study. The main leading cause was OH secondary to preeclampsia/eclampsia. Maternal MI in our setup was 9.09. This ratio is similar to the study done in Nepal, which showed a ratio of 7.2:1. The study in Manipal⁶ shows 5.6:1. A study done in Syria¹³ had very high MI of 60:1. The higher the MI, more the women with the life threatening conditions dies (low quality of care), while a low index suggests better quality of health care.

This implies that efforts need to be focused on improving the protocols and resources for combating post-partum haemorrhage. Reduction of maternal death requires channelling of resources towards the prevention of haemorrhage and eclampsia at the low level of healthcare and strengthening the resources for their treatment in secondary and tertiary care centre. Along with increased awareness of one's own health, health education may go a long way in improving the quality of obstetric care.

Conclusion

Near miss cases share many characteristics with maternal deaths and are seen more commonly than mortality cases. Thus, they can provide more information about obstacles to be crossed and allows for corrective action to be taken to reduce mortality and long-term morbidity. As a majority of the cases of near miss occur in high risk cases, improving antenatal care can help in the early identification of high risk pregnancies including pre-eclampsia. Immediate referral of such cases can improve maternal outcome. Another measure that can be taken is to develop standard protocols to prevent/manage post-partum haemorrhage, highlighting the role of active management of third stage of labour. Training primary health care professionals in Emergency Obstetric Care (EmOC) can also play a major role in reducing maternal morbidity by quick recognition of complications, provision of initial management and prompt referral on time. There is a need for an effective audit system to look into aetiology and management of near miss and mortality cases.

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