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Original Research Article

## Incidence of maternal near-miss events in a tertiary care hospital of Gujarat, India

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### ABSTRACT

**Background:** Maternal near miss is said to have occurred when women presented with life threatening complication during pregnancy, child birth and within 42 days after delivery, but survive by chance or good institutional care. For identifying near-miss cases five-factor scoring system was used. In 2009 WHO working group has standardized the criteria for selecting these cases. Because maternal mortality is a rare event, it is important to study maternal near-miss as a complement to evaluate and improve the quality of obstetric care. Thus, the study was conducted with the aim of assessing the incidence and causes of maternal near-miss.

**Methods:** A facility-based cross-sectional study was conducted in the department of obstetrics and gynecology in GMERS medical college and hospital, Sola, Ahmedabad from January 1, 2019 to August 31, 2019. All maternal near-miss cases admitted to the hospital during the study period were recruited. World Health Organization criteria were used to identify maternal near-miss cases. The number of maternal near-miss cases over one year per 1000 live births occurring during the same year was calculated to determine the incidence of maternal near-miss. Underlying and contributing causes of maternal near-miss were documented from each participant's record.

**Results:** During the period of study, 3235 deliveries were done at the institution while 16 cases of near-miss were identified. The prevalence of near-miss case in this study was 0.5%. Near-miss per 1000 delivery was 5%. Maternal death to near miss ratio was 1:2.67. The leading causes of maternal near miss were hypertensive disorders (62%) and haemorrhage (32%) The morbidity was high in un-booked cases.

**Conclusions:** Maternal near miss is good alternative indicator of health care system. Efforts made toward improvement in the management of life-threatening obstetric complications could reduce the occurrence of maternal near-miss problems that occur during hospitalization.

**Keywords:** Haemorrhage, Hypertensive disorders, Indicators, Maternal near-miss, Maternal death, Mortality, Morbidity, Prevalence, WHO

### INTRODUCTION

Worldwide, more than half a million women between age 15-49 die each year from the complication of pregnancy and childbirth.<sup>1</sup> Near misses have emerged as a useful complement to the investigation of maternal deaths.<sup>2</sup> Near miss is defined as “a woman who nearly died but

survived a complication that occurred during pregnancy, childbirth, or within 42 days of termination pregnancy.<sup>2,3</sup> The patient survived either by chance or because of hospital care she received.”

Globally, about 800 women die every day of preventable causes related to pregnancy and childbirth; 20 per cent of

these women are from India. Annually, it is estimated that 44,000 women die due to preventable pregnancy-related causes in India.<sup>4</sup> The maternal mortality ratio - the number of maternal deaths per 100,000 live births - reduced from 212 in 2007 to 167 in 2013 to 130 in 2016.<sup>4</sup>

The near-miss concept is efficient in exploring the differences, similarities, and relationships between characteristics of women who survived life-threatening pregnancy-related complications and women who actually died of them, to enable us to thoroughly gauge the quality of obstetric healthcare. This concept is equally applicable in both developed as well as developing countries.<sup>5</sup> Near-miss helps in connecting the dots of the cascade of events which eventually culminated in maternal death.

As compared to maternal mortality, near-miss patients are more in number and provide first-hand knowledge of remote and immediate factors that may be linked to morbidity and mortality during pregnancy or within 42 days of its termination.

The near-miss concept also allows initiation of awareness-based preventive programs to enhance the quality of maternal healthcare. Comparison of maternal mortality with near-miss cases helps in examining personal, social, financial, and structural predictors of maternal mortality.<sup>6</sup> Effective implementation of the near-miss concept will help analyse the high-risk group, plan relevant interventions for dealing with obstetric emergencies, and reinforce the entire healthcare setup for enabling favourable outcome.

The aim of this study is to evaluate the characteristics of near-miss obstetric cases in a tertiary care hospital.

Objective of this study was to primary outcomes were to evaluate the associated risk factors of the near miss events.

#### **Secondary outcome was to calculate**

- MNM incidence ratio = maternal near miss cases per 1,000 livebirths (LB).  $MNMIR = MNM/LB$
- Maternal near miss: mortality ratio = proportion between maternal near miss cases and maternal deaths. Higher ratio indicates better care
- Mortality index = number of maternal deaths divided by the number of women with life threatening conditions, expressed as a percentage
- Severe maternal outcome ratio (SMOR) = the number of women with life-threatening conditions (MNM + MD) per 1000 live births (LB).

## **METHODS**

It was a prospective, cross-sectional, observational study conducted in the department of obstetrics and gynecology at the GMERS medical college and hospital, Sola,

Ahmedabad during an eight-month study period (January 1, 2018 - August 31, 2019). Among the patient admitted under the care of department of obstetrics and gynecology, potentially all life-threatening conditions were assessed, and those cases which met WHO criteria for near miss were given score as per Five factor scoring system and score of equal or more than 8 were enrolled in the study. Sample was taken on the basis of fulfilment of criteria.

**Table 1: Five factor scoring system.**

Factors	Score
Organ - system failure	5
ICU admission	4
Transfusion >3 units	3
Extended intubation (>12 hour)	2
Surgical intervention (hysterectomy, relaparotomy)	1

#### **Organ system failure (WHO: 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 <7.1).

##### *Respiratory dysfunction*

- Acute cyanosis
- Gaspings
- Severe tachypnoea (respiratory rate >40 breaths per minute)
- Severe bradypnea (respiratory rate <6 breaths per minute)
- Intubation and ventilation not related to anaesthesia
- severe hypoxemia ( $O_2$  saturation <90% for >60 minutes,  $PaO_2/FiO_2$  <200).

##### *Renal dysfunction*

- Oliguria non-responsive to fluids or diuretics, dialysis for acute renal failure
- Severe acute azotaemia (creatinine >300  $\mu$ mol/ml or >3.5 mg/dl).

##### *Coagulation/haematological dysfunction*

- Failure to form clots
- Massive transfusion of blood or red cells (>5 units)
- Severe acute thrombocytopenia (<50000 platelets/ml).

**Hepatic dysfunction**

- Jaundice in the presence of pre-eclampsia
- Severe acute hyperbilirubinemia (bilirubin >100 μmol/l or >6.0 mg/dl)

**Neurological dysfunction**

- Prolonged unconsciousness (lasting >12 hours)/coma (including metabolic coma)
- Stroke
- Uncontrollable fits/status epilepticus
- Total paralysis

**Uterine dysfunction**

- Uterine haemorrhage or infection leading to hysterectomy.

**Inclusion criteria**

- All maternal near misses that were admitted to Hospital were prospectively included in the study according to the WHO criteria mentioned above and during the above-mentioned period.

**Exclusion criteria**

- Women that do not fit into the above-mentioned WHO criteria
- Those not willing to participate in the study
- Unconscious patients whose relatives do not wish to participate in the study.

Women with complication beyond 42 days of childbirth and non-pregnant women with complications were excluded.

**Statistical analysis**

Data was entered into a computer database using Microsoft Excel spreadsheet and statistical analysis was performed. Results were presented as frequencies, percentages and descriptive statistics.

**RESULTS**

Table 2 shows the relationship of various characteristics with near-miss cases. Age has no significance in near-miss cases.

A total 62.5% of near-miss cases belong to multipara whereas 31.25% belong to primipara group. A total 31.25% of the cases are booked cases while 68.75% of the cases are un-booked unregistered.

Majority of the cases (62.5%) have been referred from other health centres while only 37.5% of them were from the institution itself.

**Table 2: Characteristics of near-miss cases.**

Characteristics	Number of cases (%)	
Age	<25 years	8 (50%)
	>25 years	8 (50%)
Parity	Primi	6 (37.5%)
	Multi	10 (62.5%)
Booked patient	Yes	5 (31.25%)
	No	11 (68.75%)
Referred	Yes	10 (62.5%)
	No	6 (37.5%)
System involved	1	6 (37.5%)
	>1	10 (62.5%)

Only 37.5% of cases had single system involvement while 62.5% of cases had >1 system involvement.

**Table 3: Obstetric and neonatal outcome.**

Mode of delivery	Vaginal	5 (31.25%)
	Caesarean section	11 (68.75%)
Neonatal status	Alive	13 (81.25%)
	Dead	3 (18.75%)

Table 3 shows majority of the cases (68.75%) have been delivered by caesarean section while only 31.25% have been delivered vaginally.

Similarly, around 80% of the babies are live while only 18% have died.

**Table 4: Classification of near miss.**

Classification	Number of cases	Percentage
Pregnancy specific obstetrics and medical disorders	14	87.5
Pre-existing disorders aggravated in pregnancy	2	12.5
Accidental or incidental disorders	5	31.25

Table 4 shows the classification of near-miss cases into three categories. Most (87.5%) near-miss cases fall into the first category of classification of near-miss. 12.5% cases fall into the second category while 31.25% of cases fall into the third category.

**Table 5: Period at time of near-miss.**

Period	Number of cases	Percentage
Antepartum	9	56.25
Intrapartum	6	37.5
Postpartum	1	6.25

Table 5 shows the period at time of near-miss. Most (56.25%) cases of near-miss fall into the antenatal period.

37.5% of cases fall into intra-partum period while 6.25% of cases fall into postpartum period.

**Table 6: Monitoring.**

Monitoring	Number of cases	Percentage
Only observation	16	100
Intubation	10	62.5
Inotropic support	5	31.25

Table 6 shows the monitoring required in near-miss cases. All cases required observation while only 1/3<sup>rd</sup> required inotropic support and 2/3<sup>rd</sup> required intubation.

**Table 7: Causes.**

	Number of cases	Percentage
Hypertension	10	62.5
Haemorrhage	6	37.5
Sepsis	0	0
Cardiac	1	6.25

Table 7 shows the main causes for near-miss cases in our institution. Hypertension (62.5%) was the major cause identified among near-miss cases in our institution followed by haemorrhage in 37.5% of cases. Only 1 case was due to cardiac causes during this period in my study in our institution.

**Table 8: Intervention taken.**

Intervention taken	Number of cases	Percentage
ICU admission	16	100%
Massive blood transfusion	8	50
Use of inotropic drugs	5	31.25
Hysterectomy	6	37.5
Bladder repair	3	18.75

Table 8 shows the interventions that had to be taken in near-miss cases. Half (8) of the cases required massive blood transfusion while a little more than half (56.25%/9) required further surgical interventions during surgery like hysterectomy or bladder repair. 5 (31.25%) of the cases required the use of inotropic drugs.

Table 9 shows the month-wise distribution of the near-miss cases. Half of the cases have occurred in the month of February and August (4 each). 2 cases each have occurred in the month of January and April while 3 cases have occurred in the month of March and only 1 case in the month of May.

Table 10 shows the maternal near-miss indices in our institution over the period of eight months from January 2019-August 2019. A total of 3235 deliveries were attended during the study period of eight-months from January 1, 2019 to August 31, 2019.

**Table 9: Month-wise distribution.**

Month	Total delivery	Total near miss case (%)
January	422	2 (.47)
February	335	4 (1.19)
March	323	3 (0.92)
April	333	2 (1.6)
May	404	1 (0.24)
June	426	0
July	444	0
August	548	4 (0.72)
<b>Total</b>	<b>3235</b>	<b>16 (0.5)</b>

**Table 10: Secondary outcomes.**

Maternal near miss indicator	Indices	Range
Maternal near miss	16	0-46
Live births	3200	618-21543
Maternal deaths	6	0-9
Severe maternal outcome rate	6.87	2-16
Near miss rate (NMR)	5	1.4-16
Mortality index (MI)	0.27	0-0.45
Near miss per maternal death	2.67:1	0-12:1
Maternal mortality ratio	187	0-200

Multiparas were slightly more in the near-miss group. Mean age was around 25. Majority (56%) of the patients were in the antenatal period (third trimester).

A huge burden of maternal near-miss cases was referred (63%) while 68% of them were un-booked unregistered.

The study showed maternal near miss rate was 5 per 1000 live births and maternal mortality of 187 per 100000 live births.

Severe maternal outcome ratio was 6.87 per 1000 live births. Maternal near miss per maternal death ratio was 2.67:1. Mortality index was 0.27.

The study showed 62.5% had hypertension as the leading causes of near-miss. Haemorrhage was a distant second with 37% cases. Thus, in our institute there were not many cases of PPH. Major leading factor was severe pre-eclampsia and eclampsia.

The study showed age and literacy were not a significant factor for near-miss whereas quality check-up and antenatal visits helped prevent near-miss to a large extent.

The condition of the patient on arrival, i.e., if the patient had moderate to good GCS score, there were better chances of survival than a poor GCS score. Intubation was required in 62% of cases while 32% cases required inotropic support.

A total 68% underwent caesarean section while 81% patients had a good neonatal outcome.

Massive blood transfusion was required in 50% of the cases. Hysterectomy was done for 38% cases with bladder repair for 19% cases.

## DISCUSSION

In 2011, around 273,465 women died worldwide during pregnancy, childbirth or within 42 days after childbirth.<sup>6</sup> The majority of these women die in low-income countries, and Sub-Saharan Africa carries the highest burden, with a maternal mortality ratio (MMR) ranging between 169/100,000 live births in southern sub-Saharan Africa and 478/100,000 live births in west sub-Saharan Africa.<sup>7</sup>

The maternal mortality ratio (MMR) in India decreased substantially between 2004-06 and 2014-16, from 254 to 130 deaths per 100,000 births (NITI AAYOG-GOI). Improvements in maternal health services have been key in reducing the country's MMR. The health care services that a woman receives during pregnancy, childbirth, and the immediate postnatal period are important for the survival and well-being of both the mother and the child.

Studies done in the developing countries show the same trend of maternal near miss rate (MNMR) and vary from anywhere between 15-40/1000 live births.<sup>8</sup>

The maternal mortality ratio at our setup was 167/100000 live births. The Brazilian study showed a mortality rate of 260/100000 live births.<sup>9-11</sup> In other developing countries the maternal mortality ratios were in between 423/100000 live births to 324/100000 live births.<sup>12</sup>

This study showed hypertensive disorders as the leading risk factor for the near miss i.e. 62% followed by obstetric haemorrhage 31%. The core obstetric complications predisposing pregnant women to near-miss events are almost always similar. In comparison, the literature also reports haemorrhage and hypertensive disorders to be the major predictors of near-miss cases as well as maternal mortality.<sup>13-15</sup>

Some pregnancy-related complications leading to high-risk childbirth are almost unavoidable. The benefit of evaluating near-miss events in depth is that the records of these patients and the hindrances they had to witness can help in creating safer and more approachable obstetric healthcare for future patients. Some of these factors may be associated with things lacking at the patient's end such as desire for home delivery to maintain tradition, inadequate antenatal care, non-compliance with healthcare practitioner's advice, disbelief in modern medicine, and others. Some factors are associated with delay in reaching a tertiary care institution due to longer distances, lack of transport or funds. Factors related to health system include delay in providing immediate relief and/or referral, lack of adequate intensive care facility, well-trained staff, and others.<sup>16</sup>

## CONCLUSION

Obstetric emergencies demand prompt life-saving measures. Haemorrhage and hypertensive disorders are the leading causes of near miss events. Accepting the concept of near-miss and identifying the clinical characteristics of these patients is a substantial step towards preventing maternal mortality. Combating these issues at the level of primary care facilities has become essential. Evaluating patients for risk factors and providing high-risk and SAMM patients utmost intensive care can further decrease the ratio of maternal mortality. In order to reduce the incidence of near-miss cases, it is important to address women at basic levels including awareness about antenatal compliance, hygienic deliveries in proper healthcare facilities, and birth spacing.

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