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Original Research Article

## Maternal near miss: an Indian tertiary care centre audit

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### ABSTRACT

**Background:** In practical terms, women are considered near-miss cases when they survive conditions which threaten their life i.e. organ dysfunction. Despite advances in medical science and increased awareness of measures for safe childbirth, unacceptably high maternal morbidity and mortality continues to plague developing countries like India. Our's being a tertiary care centre, draws a lot number of high-risk patients and referrals. By auditing these near miss cases, we aim to identify the causes, factors leading to near miss, to identify management gaps to prevent near misses and maternal death.

**Methods:** Retro-prospective cross-sectional study done over one and a half year. Patients were included based on the inclusion criteria. A questionnaire was used to evaluate the prospective cases and the indoor case sheets were used for retrospective cases. After data entry in excel sheet, data analysis was done using SPSS 21. Results were tabulated.

**Results:** High number of Near Miss cases with preeclampsia being the commonest. Lack of proper facilities at the periphery health centers was the most common cause for referrals. Level 1 and level 2 delays were found in most cases.

**Conclusions:** Timely referral, with adequate treatment at the peripheral hospitals will majorly reduce Near miss. Hence, proper development and functioning of peripheral hospitals are needed.

**Keywords:** Audit, Maternal near-miss, Preeclampsia, Severe acute maternal morbidity

### INTRODUCTION

Maternal near miss is defined as a woman who otherwise would have died due to a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy, but survived. The prevalence of maternal near miss varies among different countries based on availability and quality of health care. In a systematic review using disease specific criteria, near miss rates are reported to be between 0.6% and 14.98%.<sup>1</sup> Mumbai being India's one of the leading cities in providing good health care, with four tertiary hospitals, multiple private hospitals, and peripheral hospitals, still has an alarming rate of maternal mortality and morbidity,

despite continuous efforts to reduce it. It is difficult to reflect pregnant women's health status by only mortality indicators; hence Severe Acute Maternal Morbidity (SAMM) is used. SAMM is superior to mortality indicators in giving attention to surviving women's reproductive health and lives, and can be used in developed as well as developing countries. In 2009 WHO set up clinical, laboratory and management criteria for the identification of these cases.

The place of study is a metropolitan tertiary care center and also drains nearby areas. Because of delay in referral, resource constraints like non-availability of blood and blood products, rapidly developing antibiotic resistant

bacterial strains; cases become critical. Traffic congestion, unorganised referral systems cause delay in transfer.<sup>2,3</sup> Low risk cases that should otherwise be managed by peripheral hospitals are primarily registered in tertiary set ups and consume resources and are also responsible for nosocomial infection. Unfavourable ratio of nursing and other staff to patients causes increases the burden on the existing staff.<sup>4</sup>

This paper analyses the near misses from the above points of view and suggests recommendations and strategies to reduce the morbidity of mothers.

## METHODS

It was a retro-prospective study at a metropolitan tertiary care centre, which included women according to the WHO near miss inclusion criteria over 20 months. Institutional ethics committee approval was taken. All details were recorded by studying the case sheets of the patients. Gaps in diagnosis and treatment of near miss cases were identified. Prospective study was done by means of personal interview and asking relevant questions to the patients themselves or their relatives in case of very sick women. The questions focused on the patients' condition at the time when they were referred to the hospital e.g. their symptoms, treatment given, causes of referral. This helped to identify system gaps.

The number of maternal deaths during the same period was noted. Comparing the maternal deaths with near-miss would give the ratio of deaths to near miss indicating the efficiency of health system.

### *Inclusion criteria*

Women who were pregnant/ in labor/ delivered/ aborted; up to 42 days from termination of pregnancy, admitted in Obstetric department with any of the listed conditions or those who developed any of these conditions during their indoor stay.

### *Conditions*

- Severe Post-partum hemorrhage,
- Eclampsia,
- Severe sepsis (with multi organ dysfunction),
- Rupture of uterus,
- Admission to the intensive care unit,
- Cardiovascular dysfunction like shock,
- Use of vasoactive drugs,
- Cardiopulmonary resuscitation,
- Severe hypotension/ acidosis (pH <7.1),
- Respiratory dysfunction like acute cyanosis, acute respiratory distress syndrome,
- Acute renal failure, oliguria not responding to fluids or diuretics,
- Massive blood transfusion (>5unit),

- Severe acute thrombocytopenia (platelets <50,000/ml),
- Hepatic dysfunction like jaundice in the presence of pre-eclampsia, bilirubin >6mg/dl,
- Uterine infection or infection leading to hysterectomy,
- Neurological dysfunction like coma, stroke, status epilepticus, total paralysis.

### *Exclusion criteria*

- Women that developed the above conditions unrelated to pregnancy,
- Those not willing to participate in the study,
- Unconscious patients whose relatives do not wish to participate in the study.

As per WHO recommendations, severe maternal outcomes (deaths plus near misses) divided by number of women giving birth within a given time period was considered for sample size calculation.

On an average, no. of maternal deaths plus no. of near-miss cases in OBGYN department is 900 (calculated from annual data compiled in the year 2013) and total no. of women giving birth is on average 8000 per year, therefore prevalence is 11%. Sample size calculated by this method is very less; hence, convenience sampling method was applied. Total number of cases taken were 600, 500 retrospective and 100 prospective.

### *Statistical analysis*

After data collection, data entry was done in Excel. Data analysis was done with the help of SPSS Software version 21. Quantitative data like duration of Hospital stay and age is presented with the help of Mean, Standard Deviation, Median and IQR. Qualitative data like Gravida Para Status and symptoms treatment given, level of delay, referral causes etc are presented with the help of Frequency and Percentage table and presented with pie chart and bar diagrams.

## RESULTS

There from April 2016 to May 2017, author had a total of 600 near miss cases, with 42 maternal deaths in the same time period and total live births of 5330. The near miss ratio per 1000 live birth was 112.57. The proportion between maternal near miss cases and maternal death was 14.28.

Being a tertiary care centre very high risk cases primarily register in the set up under study. 21-30 years corresponds to the most susceptible age group for pregnancy, hence this explains why most near miss cases fall into this age group. Mean age was 26.96±4.7 years. Most were primiparas (Table 1).

**Table 1: Distribution of antenatal registrations, and parity status.**

Antenatal care status	Frequency	Percentage
Unregistered	33	6%
Registered*	315	53%
Transferred ( but registered elsewhere)	252	42%
<b>Parity</b>		
Primipara	364	61%
Multipara	196	33%
Total	560	93%
<b>Age groups</b>		
<20 years	32	5%
21-30 years	446	74%
31-40 years	118	20%
>40 years	4	1%

Most common cause of maternal near miss was severe preeclampsia, with 10% being eclampsia. Severe postpartum hemorrhage was in 10%, sepsis in 7% and ruptured uterus in 3%. Commonest organs that were affected heart and liver (Table 2).

**Table 2: Causes of maternal near miss and organ dysfunctions.**

Obstetric complication	Frequency	Percentage
Severe PPH	59	10%
Severe preeclampsia (including HELLP)	306	51%
Eclampsia	57	10%
Sepsis	41	7%
Ruptured uterus	19	3%
<b>Critical Organ dysfunction/ life threatening conditions</b>		
CVS dysfunction	91	15%
Respiratory dysfunction	36	6%
Renal dysfunction	54	9%
Coagulation/hematologic dysfunction	46	8%
Hepatic dysfunction	85	14%
Neurologic dysfunction	41	7%
Uterine dysfunction/ hysterectomy	15	3%

There were 31.5% required blood and blood product transfusion, with 25% being admitted in the intensive care unit. Most peripheral hospitals do not have blood banks and intensive care units making these the most common causes for referrals (Table 3).

Most common cause of delay was at level 1 where patients themselves did not reach the health care set up in time; or first point of care was deficient. Level 2 delay was 11% where in patients initially went to a public health centre or to a private physician close to their home. They were treated with anti-hypertensive and Magnesium

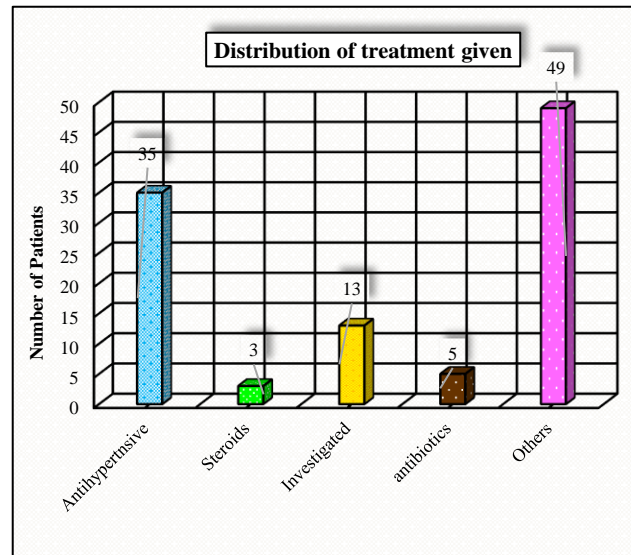
sulfate, a few were investigated for their initial complaint, some were given steroids for fetal lung maturation, and some others were not treated (49%), and were directly transferred to the tertiary health centre. This delay comprised of the majority reflecting inadequacy of peripheral hospitals (Table 4).

**Table 3: Distribution of Critical interventions or intensive care unit admission.**

	Frequency	Percentage
Use of blood products	189	31.5%
Interventional radiology	2	0.3%
Laparotomy	14	2.3%
ICU admission	150	25%

**Table 4: Distribution of Cause of referral.**

	Frequency	Percentage
Non availability of doctor	13	2.1%
Non availability of OT	23	3.8%
Non availability of blood products	72	12%
Non availability of NICU	66	11%
Non Availability of essential facilities (HDU, equipment, super speciality)	218	36.33%
<b>Level of delay</b>		
Level 1	116	19%
Level 2	63	11%
Level 3	6	1%



**Figure 1: Percentage of initial treatment given at the periphery.**

**DISCUSSION**

Maternal mortality is the tip of the iceberg and there is a large base of the severe acute maternal morbidity, which

is frequently ignored. By auditing maternal morbidity, we can identify and fill the gaps of the health system. Traditionally, maternal deaths were being evaluated as a key to maternal death prevention, but this approach failed to provide complete information. Hence, now we audit maternal near misses to look into the whole picture regarding obstetrical care, its outcome, morbidity and mortality status of the mother, resources available, level of delay and most importantly, root cause of a maternal near miss. A near miss case if not treated appropriately and within the right time, can result in death. Therefore, identifying causes and circumstances leading to it is very important. Analysis of maternal near misses provides insights to better preventive planning. Since the mother survives, valuable details on her experience can be got. Maternal near miss is just one step away from maternal death, any information about the event will prove beneficial in preventing maternal death.<sup>5</sup> If both maternal near misses and maternal death are audited at the same time, maternal near misses can act as controls. According to the World Health statistics 2011, deliveries attended by skilled health personnel rose from 58% in 1990 to 68% in 2008. In India, The Janani Suraksha Yojana (JSY) scheme, cash incentive scheme, has been initiated to promote institutional delivery. The increase in load on the health facilities may compromise the quality of care, and hence financial resources and health care personnel should be increased proportionately. A study on the impact of JSY scheme has shown increase in institutional deliveries of maternal near misses but no decline in maternal deaths.<sup>6</sup>

Near miss incidence in our study is 112.57 per 1000 live births (a statistical artifact as cases in the municipal ward or district are not taken as denominator). Our booked patients consist of a large number of high risk patients, who are potential near misses. Maternal near miss ratio is 17.8 per 1000 in Manipal, 25.2 per 1000 in south east Iran, 44.3 per 1000 in Brazil, 3.83 per 1000 in Scotland, and 34 per 1000 in WHO survey.<sup>5,7-10</sup> There a wide variability on prevalence of maternal near miss in different parts of the world depending on the socioeconomic conditions of the area, the availability of health resources, the education of the people.

The near miss to mortality ratio, was 14.2:1 in this study, which means that for every 14-15 maternal near miss, there was 1 maternal death. Higher the ratio, better the health care. Syrian study had a ratio of 60:1, with a study in Nepal having a ratio of 7.2:1.<sup>11,12</sup> This ratio is also seen in African countries where it ranges from 5-12:1.<sup>13</sup> European countries have ratios of 117-223:1, indicating a far better health care.<sup>14</sup>

In our study 61% of the maternal near miss was primiparas, while 33% were multiparas (Table 1). It is similar to all other studies conducted in various parts of India and the world.<sup>5,7,15-17</sup> Our study had more incidence of pregnancy induced hypertension which may be due to more detection due to wider antenatal care coverage.

Most of the women fell into the age group between 21-30 years (74%), corresponding to the most susceptible age group for pregnancy, hence this explains why most near miss cases fall into this age group (Table 1). This is similar to study conducted by Purandare et al.<sup>18</sup> Mean age of near miss patients was 24±3 years, in Western Rajasthan.<sup>16</sup> Similar findings were present in a study done in Gwalior, Manipal and South East Iran.<sup>5,7,19</sup> On the contrary, study conducted in Pakistan, the mean age of maternal near miss was 28±5 years.<sup>20</sup> In a study in Assam, mean age of maternal near miss was 15-20 years, indicating early marriage and pregnancy, poverty and lack of education.<sup>16</sup>

In our tertiary care centre, a large number of high risk cases are registered for antenatal care (53%).

#### ***This indicates***

- Unmet need for well equipped referral care centers,
- Need for stronger linkage with peripheral centers via telemedicine which may enable expert opinion,
- Need for more incentives to doctors to practice in periphery.

In this study, 36.33% cases were referred due to non-availability of essential facilities at the periphery hospitals, which mostly comprised of non-availability of critical care, lack of medications and lack of skills. 12% were referred due to lack of blood and blood products, with 11% referred due to non-availability neonatal care services. 3.8% were referred due to non-availability of operation theatre, and 2.1% referred due to non-availability of doctor. These findings depict the lack of resources at the periphery hospitals (Table 4).

Level 1 delay was found in 19% of the cases. These comprised of lack of awareness of the patient or caregivers. 11% of the cases had Level 2 delay due to late referral, or improper diagnosis and management at the periphery hospitals, or lack of transport facility. 1% delay was found at the tertiary care hospital, which was mostly due to late diagnosis and inadequate management. Delay could have been possible due to hospital management, non-availability of support staff, or non-availability of medicines, but these factors could not be evaluated in this study. Rest of the cases, there was no delay (Table 4). One study conducted by Purandare et al, in six medical colleges across India, delay in seeking help was seen in 60.6% of the cases, with other transport and logistical problems seen in 30.3%. Lack of blood was seen in 7.6%, with lack of health personnel and lack of skills seen in 16.7%.<sup>18</sup> In developing countries, 75% of women are already in critical state when they reach the tertiary care centre, thereby underscoring the significance of the first two delays.<sup>15,21</sup> Availability, accessibility of health care resources, cost of health care, education of the people, behavioral factors, awareness play an important role in the utilization of maternal health services.<sup>17,22-24</sup> Access to good emergency obstetric care unit (EmOC) will play

important role in improving maternal outcome. It is the term used to describe the essential elements of obstetric care for management of complications arising during pregnancy, delivery, and postpartum period.<sup>25</sup> Tamil Nadu has been successful in declining maternal deaths due to series of initiatives such as skilled birth attendance for all births and making emergency obstetric care units available.<sup>26</sup>

In the present study, it was found that most common cause of near miss is severe preeclampsia contributing to 51%, while eclampsia and severe postpartum hemorrhage being 10% each, followed by sepsis and ruptured uterus (Table 2). Most studies showed commonest cause to be haemorrhage.<sup>2,5,7,16,18</sup> The cause of hemorrhage being second to hypertensive disorders in our study could be due to lack of documentation of post partum hemorrhage.

15% cases had cardiovascular dysfunction, with 14% cases having hepatic dysfunction. Renal, respiratory, and neurological dysfunctions were seen in 9, 6 and 7% of the cases respectively. 8% cases had hematological problems, with 3% cases having uterine dysfunction (Table 2). Many patients had affectation of more than one organ systems. In contrast to our study, study conducted in Iran, 8.6% of the cases required ICU admission with 3.4% requiring blood transfusion.<sup>6</sup> Organ system dysfunction was present in 78.8% of the near miss cases in a study conducted in Assam, with cardiovascular system, neurological system and uterine rupture being most commonly involved, which is similar to a study in Nigeria, and another study done by Gandhi et al.<sup>16,27,28</sup> In a study conducted in Rwanda, 30% cases had peritonitis, 3% cases had malaria, and 3.6% cases had cardiomyopathy.<sup>29</sup> Our study did not have any case of peritonitis, malaria although we had one case of cardiomyopathy. We had multiple cases of hepatitis E, usually seen more in the monsoon months, leading to high incidence of hepatic dysfunction. Our area also sees a large number of Tuberculosis cases, which affect multiple organs, contributing to a significant number of maternal near- miss. In this study, death due to anesthetic cause has not been evaluated.

In this study, level 1 and level 2 delays were found to be very high, indicating that education of women, family support are important preventable factors of maternal near miss. Early recognition of the problem, in time referral, with good accessibility to transport, proper use of the health resources will play an important role in preventing maternal near miss. Our study had a high number of high risk registered cases; ensuring proper antenatal care of these patients with proper follow up of the patients in the outpatient department will significantly reduce near misses. Though the patients register at a tertiary care center, but due to long distance and difficulty in travelling, follow up is erratic, thereby resulting in late arrival at the hospital or with worsened medical condition. This leads to increased chances of mortality.

These women sometime follow up at a public hospital close to their residence, but these peripheral hospitals may have inadequate human resource due to which management may be compromised. Free medicinal supply is deficient, operation theatre and ICU facilities are often inadequate. Community education will improve women's reproductive health seeking, thereby reducing maternal near miss.

Peripheral hospitals see a large number of near miss cases, thus they should be well staffed, equipped with medications, well functioning operation theatre and blood bank.

Many peripheral hospitals in the city where the study has been conducted do not have medical and neonatal intensive care units. Many of our referrals are due to the above reason, thus increasing work load of a tertiary care hospital. This causes problems in resource allocation.

## CONCLUSION

All causes of maternal near miss cannot be prevented, but certain causes like infrastructural deficiencies, non-availability of health care providers can be rectified. Government along with the medical community have to work together to decrease the burden of Near miss. Mobile medical units should be made available to reach the periphery, rural patients should be encouraged to have regular antenatal visits so that hypertension, anemia, fetopelvic disproportion can be detected early. Telemedicine facilities should be made available for better treatment of patients. Public and private hospital partnership should be strengthened.

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