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A DESCRIPTIVE STUDY ON MATERNAL NEAR MISS CASES IN A TERTIARY MEDICAL COLLEGE, KOLKATA

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Abstract

Background: Maternal near miss (MNM) cases offer critical insights into the quality of obstetric care and help identify preventable factors leading to severe maternal outcomes. This study evaluated the incidence, causes, and management patterns of MNM cases at a tertiary care hospital.

Methods: An observational, cross-sectional study was conducted over 18 months at R.G. Kar Medical College & Hospital, Kolkata. A total of 203 MNM cases were identified using WHO near miss criteria. Data were analyzed on sociodemographic, obstetric profile, delays, interventions, and outcomes.

Results: The MNM incidence ratio was 9.19 per 1,000 live births, with a near miss to mortality ratio of 6.15:1. Most patients were aged 20–29 years and multiparous. Haemorrhage (43.8%) and hypertensive disorders (35.5%) were leading causes. Significant delays in seeking and reaching care were observed in 72% and 92% of cases, respectively. Interventions included blood transfusion (80.8%), ICU admission (29.6%), and emergency surgeries.

Conclusion: Haemorrhage, hypertensive disorders, and systemic delays are major contributors to MNM. Strengthening antenatal services, timely referrals, and critical care capacity can improve maternal outcomes in similar resource-constrained settings.

Keywords: Maternal near miss, severe maternal morbidity, obstetric haemorrhage, hypertensive disorders, maternal mortality.

INTRODUCTION

Despite substantial progress in reducing maternal mortality worldwide, maternal health continues to pose a significant public health challenge, especially in low- and middle-income countries. Globally, maternal mortality remains a key indicator of health system performance and reflects disparities in access, quality of care, and social determinants of health. According to the World Bank, an estimated 295,000 maternal deaths occurred globally in 2017, underscoring the need for continued vigilance in maternal health interventions [1].

India, despite notable improvements in maternal health outcomes, still accounts for a significant proportion of the global maternal death burden. According to the Sample Registration System (SRS) Bulletin 2016–2018, India reported a maternal mortality ratio (MMR) of 113 per 100,000 live births, with wide inter-state variations [2]. UNICEF also highlights that many of these deaths are preventable through timely and adequate obstetric care [3].

However, a sole focus on maternal mortality underestimates the burden of severe maternal complications. In recent years, the concept of Maternal Near Miss (MNM) has gained prominence as a complementary indicator to maternal mortality, offering insights into life-threatening events that women survive during pregnancy, childbirth, or within 42 days of termination of pregnancy. The UK-based HQIP program supports the view that analyzing MNM cases can help identify failures and successes in obstetric care systems [4].

Pioneering work by Atrash et al. and Stones et al. advocated for the importance of understanding maternal morbidity and "near miss" episodes to improve the quality of care [5,6]. These events, although non-fatal, often share common causal pathways with maternal deaths and provide a unique opportunity to analyze lapses in the health care system [7].

The World Health Organization (WHO) has since developed standardized criteria for identifying maternal near miss cases, based on clinical, laboratory, and management-based markers of organ dysfunction [8]. These tools aim to shift the focus from mortality alone to a broader assessment of maternal health care quality [9].

Numerous studies across India have applied these criteria in tertiary care settings to evaluate the frequency, causes, and delays associated with near miss events. For example, Kamal et al. reported the clinical profile of MNM cases in Jharkhand, identifying hypertensive disorders and hemorrhage as leading causes [10]. Roopa et al. found that most MNM cases were preventable and associated with avoidable delays in seeking and receiving care [11]. National and international studies have also confirmed that the "three delays model"—delay in seeking care, delay in reaching health facilities, and delay in receiving appropriate care—remains critical in understanding poor maternal outcomes [12].
Furthermore, research by Jayaratnam et al. emphasized the need for structured tools to assess and audit MNM cases, ensuring that such events inform quality improvement strategies in maternal health systems [13].
Given this context, the present study was conducted to evaluate the profile and determinants of maternal near miss cases in a tertiary care hospital in eastern India, using the WHO near miss approach. The objective was to identify patterns, risk factors, and care delays associated with MNM, thereby contributing evidence to strengthen maternal health services at institutional and policy levels.

AIMS AND OBJECTIVES

The primary aim of this study was to evaluate the clinical profile and determinants of maternal near miss (MNM) cases in a tertiary care setting. Specific objectives included:

1. To estimate the incidence of maternal near miss cases using WHO criteria.
2. To assess the socio-demographic and obstetric characteristics of MNM patients.
3. To identify the common etiologies and contributing factors associated with MNM.
4. To analyze the pattern of delays experienced in accessing and receiving care.
5. To evaluate maternal health indicators such as the MNM incidence ratio, severe maternal outcome ratio, and mortality index.

MATERIALS AND METHODS

Study Design

This was an observational descriptive study with a cross-sectional design, conducted according to WHO guidelines for maternal near miss case review.

Study Setting

The study was conducted in the Department of Obstetrics and Gynecology, R.G. Kar Medical College and Hospital, Kolkata, which serves as a major regional referral centre for maternal care in West Bengal.

Study Period

The data collection was carried out over a period of 18 months, from January 2019 to June 2020.

Study Population

The study included all patients admitted to the department who fulfilled the WHO criteria for Severe Acute Maternal Morbidity (SAMM). This included women in the antepartum, intrapartum, postpartum (up to 42 days following delivery), or post-abortion period.

Sample Size

A total of 203 maternal near miss cases were identified during the study period. All cases were included consecutively as per eligibility, forming the study cohort.

Data Collection

Data were collected using a structured proforma covering:

- Socio-demographic data: age, BMI, parity, socioeconomic status.
- Obstetric details: gestational age, gravida status, delivery or abortion status.
- Clinical features: presence of organ dysfunction, ICU admission, and outcomes.
- Delays: analyzed using the "three delays" model — delay in seeking care, delay in reaching facility, and delay in receiving appropriate care.

Case Definition

Maternal near miss cases were defined using WHO near miss criteria, which include clinical, laboratory, and management-based indicators of organ dysfunction or failure.

Data Analysis

All data were compiled and analyzed using Microsoft Excel. Results were presented using descriptive statistics such as proportions and percentages. Maternal health indicators such as MNM incidence ratio, severe maternal outcome ratio, MNM to mortality ratio, and mortality index were calculated to quantify burden and outcomes.

RESULTS

Incidence and Core Indicators

During the 18-month study period, a total of 22,386 deliveries occurred at the study center, resulting in 22,082 live births. Among these, 203 cases met the WHO criteria for Maternal Near Miss (MNM), while 33 maternal deaths were reported. This yielded a total of 236 women with life-threatening conditions (WLTC).

The calculated MNM incidence ratio was 9.193 per 1,000 live births, and the Severe Maternal Outcome Ratio (SMOR) was 10.68 per 1,000 live births. The MNM to mortality ratio was 6.15:1, indicating that for every maternal death, over six women survived a life-threatening condition. The mortality index was 0.139, reflecting that approximately 13.9% of WLTC cases resulted in death.

Table 1: Maternal Health Indicators

Indicator	Value
Total Deliveries	22386
Live Births	22082
Maternal Near Miss (MNM) Cases	203
Maternal Deaths (MD)	33
Women with Life-Threatening Conditions (WLTC)	236
MNM Incidence Ratio (per 1000 LB)	9.193
Severe Maternal Outcome Ratio (SMOR) (per 1000 LB)	10.68
Maternal Near Miss to Mortality Ratio	6.15:1
Mortality Index (MI)	0.139

Socio-demographic Characteristics

The majority of maternal near miss (MNM) cases in this study were among women aged 20–29 years (62.56%), followed by 29.56% in the 30–40 years group and 7.88% aged 19 or younger. Normal body mass index (18.5–24.9) was observed in 93.1% of the women. Underweight (BMI <18.5), overweight (BMI 25–29.9), and obesity (BMI ≥30) were infrequent.

Most patients were multiparous (62.6%), with nulliparous and grand multiparous comprising 32.5% and 4.9%, respectively. Socioeconomic analysis revealed that 82.8% belonged to the upper-lower class, while 7.9%, 5.4%, and 3.9% belonged to the lower-middle, lower, and upper-middle classes, respectively. No patient was from the upper class.

Table 2: Socio-demographic Characteristics of MNM Cases

Category	Frequency (n)	Percentage (%)
Age ≤19	16	7.88
Age 20–29	127	62.56
Age 30–40	60	29.56
BMI <18.5	1	0.5
BMI 18.5–24.9	189	93.1
BMI 25–29.9	12	5.9
BMI ≥30	1	0.5
Nulliparous	66	32.5
Multiparous	127	62.6
Grand multipara	10	4.9
Upper lower	168	82.8
Lower middle	16	7.9
Lower	11	5.4
Upper middle	8	3.9
Upper	0	0.0

Figure 1: Age Distribution of MNM Cases

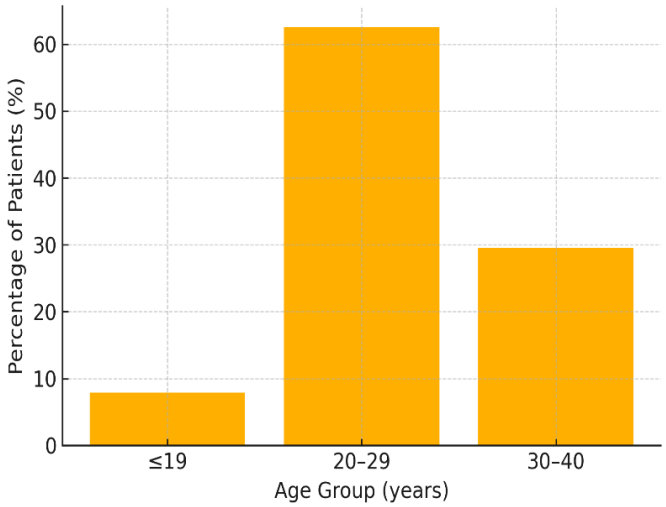
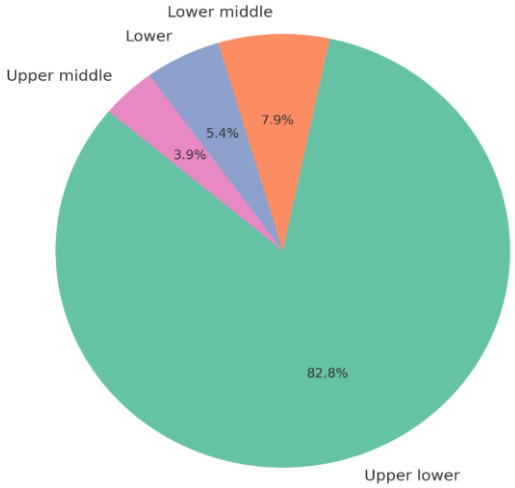


Figure 2: Socioeconomic Status Distribution of MNM Cases



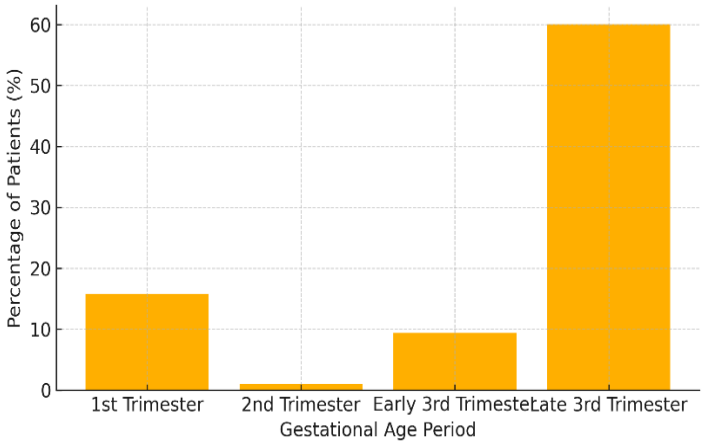
Obstetric Characteristics

Among the 203 MNM cases, the majority were multigravida (58.62%), while 27.58% were primigravida. Regarding gestational age at the time of the near miss event, 60.1% were in the late third trimester, 9.4% in the early third trimester, 15.8% in the first trimester, and only 1.0% in the second trimester. Most near miss cases occurred during the antepartum period (86.2%), while 13.8% were in the postpartum phase. These distributions suggest that the third trimester and antepartum period are high-risk intervals for maternal near miss events.

Table 3: Obstetric Characteristics of MNM Cases

Parameter	Frequency (n)	Percentage (%)
Primigravida	56	27.58
Multigravida	119	58.62
Gestational Age: First Trimester	32	15.8
Second Trimester	2	1.0
Early Third Trimester	19	9.4
Late Third Trimester	122	60.1
Antepartum MNM	175	86.2
Postpartum MNM	28	13.8

Figure 3: Gestational Age Distribution of MNM Cases



Causes, Interventions, and Critical Care

Obstetric hemorrhage (38.4%) and hypertensive disorders (31.5%) were the two leading causes of maternal near miss (MNM) events in this study. Sepsis (10.3%) and severe anemia (5.9%) were also significant contributors. Among organ-specific complications, respiratory (20.2%), cardiovascular (18.7%), coagulation (17.7%), and renal dysfunctions (13.8%) were frequently observed, in line with WHO's near miss criteria.

In terms of clinical interventions, blood transfusions were the most common (80.8%), followed by ICU admissions (29.6%) and mechanical ventilation (22.2%). A subset of patients (11.3%) required emergency laparotomy, reflecting the severity and acute management requirements in MNM scenarios.

Table 4: Causes, Organ Dysfunctions, and Interventions in MNM Cases

Category	Frequency (n)	Percentage (%)
Obstetric Hemorrhage	78	38.4
Hypertensive Disorders	64	31.5
Sepsis	21	10.3
Severe Anemia	12	5.9
Respiratory Dysfunction	41	20.2
Cardiovascular Dysfunction	38	18.7
Coagulation Dysfunction	36	17.7
Renal Dysfunction	28	13.8
Blood Transfusion	164	80.8
Mechanical Ventilation	45	22.2
ICU Admission	60	29.6
Emergency Laparotomy	23	11.3

Pattern of Delays and Outcomes

Analysis of the delay pattern using the WHO "Three Delays" model revealed that 25.6% of MNM cases experienced a first delay (delay in seeking care), 17.7% encountered a second delay (delay in reaching a facility), and 14.8% were subjected to a third delay (delay in receiving adequate care after arrival). Notably, 41.9% of patients did not experience any observable delay.

Regarding clinical outcomes, 58.1% of women recovered without morbidity, while 25.6% had morbidity following the near miss event. The overall maternal death rate among women with life-threatening conditions was 16.3%, matching the observed mortality index.

Table 5: Pattern of Delays and Outcomes Among MNM Cases

Category	Frequency (n)	Percentage (%)
First Delay (Delay in seeking care)	52	25.6
Second Delay (Delay in reaching facility)	36	17.7
Third Delay (Delay in receiving adequate care)	30	14.8
No Delay Noted	85	41.9
Recovered without morbidity	118	58.1
Recovered with morbidity	52	25.6
Progressed to maternal death	33	16.3

DISCUSSION

This study was conducted over an 18-month period at R.G. Kar Medical College & Hospital, aiming to evaluate the profile, causes, and clinical management of maternal near miss (MNM) cases. A total of 203 women met the WHO near miss criteria, revealing important insights into patterns of severe maternal morbidity.

The MNM incidence ratio (MNMIR) in our study was 9.19 per 1,000 live births, comparable to findings from Indian tertiary centres, including 17.8 per 1,000 in Karnataka and 24 per 1,000 in Jharkhand [14,15,16]. However, this figure was lower than the 54.8 per 1,000 reported in Brazil [17] and higher than 3–7 per 1,000 in developed countries [18,19,20], reflecting variations in health infrastructure and definitions applied. Our near miss to mortality ratio was 6.15:1, similar to that reported by Roopa et al. [15], and aligns with other regional estimates from Nepal and Brazil [20,21].

The majority of MNM patients (62.56%) were aged 20–29 years, consistent with studies from India and South Asia [14,22,23]. Most were multiparous (58.62%) and belonged to the upper-lower socioeconomic class, reaffirming the higher burden among underserved women. Notably, 60.1% of MNM cases occurred in the late third trimester, a critical window of vulnerability corroborated by previous Indian and African studies [14,17,23].

Only 37.9% of patients had four or more antenatal visits, and 35% had interpregnancy intervals <2 years—both established risk factors for adverse obstetric outcomes [24,25]. The prevalence of prior caesarean section was 33.5%, echoing findings from Chennai and The Netherlands, and may contribute to complications in subsequent pregnancies [26].

Haemorrhage (43.8%) and hypertensive disorders (35.5%) were the leading causes of MNM, consistent with global patterns [14,15,27,28,29]. Ectopic pregnancy was the main contributor in the first trimester, while eclampsia (27.5%) and antepartum haemorrhage (20.3%) predominated in the third trimester. This matches the findings of studies from Brazil, Nepal, and the United Kingdom [17,21,29].

Delays in seeking and receiving care were prominent. Nearly 72% of patients experienced a first delay (seeking care), and 92% had a second delay (reaching the hospital), significantly impacting outcomes. These delays mirror findings from Brazil and sub-Saharan Africa, where access and transport barriers increase MNM risk [30,27,19]. A considerable number of patients (90.1%) were MNM at arrival, underscoring the importance of timely referral and early risk identification.

Most patients required intensive management: 80.8% received ≥5 units of blood transfusion, 22.2% underwent mechanical ventilation, and 11.3% had emergency laparotomy. Peripartum hysterectomy was also notable, in line with international data showing increased rates due to postpartum haemorrhage and uterine rupture [17,29].

This study reaffirms that MNM surveillance is a powerful tool for identifying system gaps and improving maternal care. Findings strongly support integration of routine antenatal care, early referral, and resource-appropriate critical care, especially in the third trimester.

Limitations

This study was limited to a single tertiary care centre, which may not fully represent the broader population or rural settings. The observational design also restricts the ability to establish causal relationships, and recall bias may have affected self-reported data such as antenatal care and delays.

CONCLUSION

Maternal near miss (MNM) surveillance serves as a crucial tool for identifying gaps in obstetric care. This study demonstrates that haemorrhage, hypertensive disorders, and delays in accessing timely care are leading contributors to MNM. Early risk identification, improved referral systems, and strengthened critical care infrastructure are essential to reducing maternal morbidity and mortality in resource-limited settings.

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