

DOI: <https://dx.doi.org/10.18203/2320-1770.ijrcog20214640>

Original Research Article

## A prospective observational study on maternal near miss cases in a rural teaching hospital

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**Received:** 28 August 2021

**Revised:** 19 October 2021

**Accepted:** 20 October 2021

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### ABSTRACT

**Background:** Women who have survived complications during pregnancy and child birth have been studied and termed Maternal near miss (MNM). All near misses should be interpreted as free lesson and opportunities to improve the quality of service provision. The aim of the study was to know the incidence, risk factors and underline causes of MNM in our setup as there is limited data from Himachal Pradesh.

**Methods:** The present study was a prospective observational study that was carried out in the department of Obstetrics and Gynecology, Dr. Rajendra Prasad Government Medical College Kangra at Tanda (HP), from 1st January 2018 to 31st December 2018. The patients in this study were, pregnant women who nearly died but survived a complication that occurred during pregnancy, child birth or within 42 days of termination of pregnancy as per WHO MNM criteria 2009.

**Results:** A total of 9690 live births, 5 maternal deaths and 116 MNM cases were reported during the study period. Incidence of MNM observed was 12%. Hypertensive disorders of pregnancy 39.6% cases were most common cause for MNM followed by obstetric hemorrhage 31.03% cases. Majority of neonates i.e.; 58% were admitted to NICU and only 52.7% survived the postnatal complications.

**Conclusions:** Critical analysis of MNM cases will help us in identifying the deficiencies in obstetric care. Maternal mortality and morbidity can be reduced if timely and effective care can be given to women experiencing acute pregnancy related complications. There is need for validation of 'MNM' criteria at peripheral levels which will enable them in early identification and timely referral of such cases to tertiary centers.

**Keywords:** Maternal near miss, Maternal mortality, Mortality index

### INTRODUCTION

Each year in India, roughly 28 million women experience pregnancy and 26 million have live births, of these an estimated 67000 maternal deaths occur every year.<sup>1</sup> Maternal mortality is one of the most important indicators used for the overall development of a nation. India has committed itself to achieve Sustainable development goals (SDGP) over the next 15 years. SDG goal 3A targets to

reduce the global Maternal mortality ratio (MMR) to less than 70 per 100,000 live births by 2030.<sup>2</sup>

MMR in India has steadily declined over the years but it is still almost double SDGP. It is estimated that every woman who dies 20 or more survive severe maternal complications as a result of the pregnancy or delivery.<sup>3</sup> Investigating these women will increase the understanding of failures in obstetrical care within the health care system. In 2009, WHO introduced the concept of 'maternal near-

miss (MNM)' for evaluating the quality of care for severe pregnancy complications.<sup>4</sup> A woman who survives life-threatening conditions during pregnancy, abortion, and childbirth or within 42 days of pregnancy termination, irrespective of receiving emergency medical/surgical intervention, is called MNM.<sup>5</sup>

The WHO the near-miss approach was published in 2011 to serve as a manual for conducting MNM studies.<sup>5</sup> The manual provides guidelines to implement MNM studies, calculations of MNM indicators, a data collection tool as well as guidance for interpretation.

As MNM cases occur much more frequently than maternal deaths, there has been increasing interest internationally in studying these cases. The maternal death review system has been institutionalized in India. Once we unfold the reasons for near-miss cases, we can take effective measures to avoid these eventualities. MNM guidelines will be useful to the states in identifying the required action needed for improving both maternal and neonatal health.

The aim of the study was to recognize these women and review the common pathways leading to severe morbidity. A review of these cases has the potential to highlight the deficiencies, as well as the positive elements in the provision of obstetric services in our health system.

#### ***Aim and objectives***

The aim and objective of the study were (a) to study the incidence of MNM cases and to identify the causes responsible for the MNM cases; and (b) to study maternal and fetal outcomes in MNM cases.

#### **METHODS**

The present study was a prospective observational study that was carried out in the department of Obstetrics and Gynecology, Dr. Rajendra Prasad Government Medical College Kangra at Tanda (HP), from 1<sup>st</sup> January 2018 to 31<sup>st</sup> December 2018 after taking approval from the institutional ethics committee.

#### ***Study population***

The patients in the study were pregnant women who nearly died but survived a complication that occurred during pregnancy, childbirth, or within 42 days of termination of pregnancy as per WHO MNM criteria. Inclusion criteria as per WHO Near Miss Approach for maternal health (Table 1). These women were prospectively followed during or within 42 days of termination of pregnancy (including abortion) and maternal and fetal outcomes were assessed accordingly.

#### ***Exclusion criteria***

MNM or maternal death occurring after 42 days of termination of pregnancy. MNM or maternal death

occurring because of accidental or incidental causes. Patient characteristics including age, parity, gestational age at admission, booked or unbooked and referred and sociodemographic profiles were considered. Maternal outcomes observed were; ICU admission, mode of delivery, or other surgical intervention to save life of mother and whether blood transfusion was needed or not. Fetal outcomes studied were; live birth/stillbirth, pre-term/term, NICU admissions, and neonatal deaths.

#### ***Statistical analysis***

Data was presented as frequency and percentage.

#### **RESULTS**

A total of 9690 live births, 5 maternal deaths were reported and 116 women satisfied WHO MNM inclusion criteria and were included in the study.

Incidence of MNM observed was 12% (number of MNM cases divided by the total number of live births). Mortality index (MI): Number of maternal deaths divided by the number of women with life-threatening conditions expressed as a percentage. A low index suggests better quality of health care.  $(MI=MD/MNM+MD)100$  In the present study MI was 4.1%. Table 1 shows the characteristics of women with a near miss.

Majority of MNM cases were between 21-25 years (33.6%) and the least number of cases were reported in the age group less than 20 years. The mean age of MNM cases was  $27.82\pm 5.65$  years. The majority of MNM cases (47.4%) were referred from peripheral health centers. Our hospital caters to all high-risk pregnancies referred from other adjoining districts like Chamba, Una, Hamirpur and few areas from Mandi. Large catering area and unavailability of a tertiary care center is the major cause of such a high incidence of referrals. The majority of the cases (65.5%) did not receive any treatment before reaching our institution (Figure 1). Most of the patients were from rural backgrounds (67.4%). The majority of MNM cases 57.8% were multiparous while 42.2% cases were primigravida. A maximum number of pregnant women (55.2%) were at a period of gestation 29-40 weeks at the time of complication (Table 2).

Hypertensive disorders of pregnancy (39.6%) were the most common cause for MNM cases closely followed by obstetric hemorrhage (31.03%) in 14.6% of pregnant women ruptured ectopic pregnancy was the cause for MNM, incomplete abortion in 4.3% while sepsis was reported in 6.9% cases (Table 3).

Only 30.2% of the women required ICU admission (Figure 2). More than half of the pregnant women (56.9%) had a blood transfusion (>5 units of blood or blood products Figure 3).

Table 4 shows pregnancy outcome of MNM cases. There were 37.9% MNM cases who delivered vaginally, LSCS in 23.3% cases followed by exploratory laparotomy for ruptured ectopic in 14.7% cases. Out of 116 MNM cases, 8 (6.9%) women had peripartum hysterectomies for different indications like atonic PPH, placenta accreta, and

ruptured uterus. Table 5 shows neonatal outcome of MNM cases. There was a total of 53.4% live births and the majority of the neonates i.e., 58% were admitted to NICU in view of prematurity and low Apgar score at 1 and 5 minutes of birth. Only 52.7% of the neonates survived the postnatal complications.

**Table 1: Inclusion criteria- the WHO near-miss approach for maternal health.**

Inclusion criterias	
<b>Severe maternal complications</b>	<ul style="list-style-type: none"> <li>• Severe postpartum haemorrhage</li> <li>• Severe pre-eclampsia</li> <li>• Eclampsia</li> <li>• Sepsis or severe systemic infection</li> <li>• Ruptured uterus</li> <li>• Severe complications of abortion</li> </ul>
<b>Critical interventions or intensive care unit use</b>	<ul style="list-style-type: none"> <li>• Admission to intensive care unit</li> <li>• Interventional radiology</li> <li>• Laparotomy (includes hysterectomy, excludes caesarean section)</li> <li>• Use of blood products Life-threatening conditions (near-miss criteria)</li> </ul>
<b>Life-threatening conditions (near-miss criteria) Cardiovascular dysfunction</b>	<ul style="list-style-type: none"> <li>• Shock</li> <li>• Cardiac arrest (absence of pulse/heart beat and loss of consciousness),</li> <li>• Use of continuous vasoactive drugs</li> <li>• Cardiopulmonary resuscitation</li> <li>• Severe hypoperfusion (lactate &gt;5 mmol/l or &gt;45 mg/dl)</li> <li>• Severe acidosis (pH&lt;7.1)</li> </ul>
<b>Respiratory dysfunction</b>	<ul style="list-style-type: none"> <li>• Acute cyanosis</li> <li>• Gaspings,</li> <li>• Severe tachypnea (respiratory rate &gt;40 breaths per minute),</li> <li>• Severe bradypnea (respiratory rate &lt;200)</li> <li>• Intubation and ventilation not related to anaesthesia,</li> <li>• Severe hypoxemia (O<sub>2</sub> saturation &lt;90% for ≥60 min or PAO<sub>2</sub>/FiO<sub>2</sub>&lt;200)</li> </ul>
<b>Renal dysfunction</b>	<ul style="list-style-type: none"> <li>• Oliguria non-responsive to fluids or diuretics,</li> <li>• Dialysis for acute renal failure,</li> <li>• Severe acute azotemia (creatinine ≥300 µmol/ml or ≥3.5 mg/dl)</li> </ul>
<b>Coagulation/haematological dysfunction</b>	<ul style="list-style-type: none"> <li>• Failure to form clots,</li> <li>• Massive transfusion of blood or red cells (≥5 units),</li> <li>• Severe acute thrombocytopenia (&lt;50000 platelets per ml)</li> </ul>
<b>Hepatic dysfunction</b>	<ul style="list-style-type: none"> <li>• Jaundice in the presence of pre-eclampsia</li> <li>• Severe acute hyperbilirubinemia (bilirubin &gt;100 µmol/l or &gt;6.0 mg/dl)</li> </ul>
<b>Neurological dysfunction</b>	<ul style="list-style-type: none"> <li>• Prolonged unconsciousness (lasting ≥12 hours)</li> <li>• Coma (including metabolic coma), stroke, uncontrollable fits/status epilepticus</li> <li>• Total paralysis</li> </ul>
<b>Uterine dysfunction</b>	<ul style="list-style-type: none"> <li>• Uterine haemorrhage or infection leading to hysterectomy</li> </ul>

**Table 2: Maternal characteristics.**

Characteristics	N=116	%
<b>Mean maternal age in years</b>	27.82±5.65	
<b>Antenatal supervision</b>		
Referred	55	47.1
Booked	38	32.8
Unbooked	23	19.8
<b>Socio-demographic profile</b>		
Rural	75	64.7
Urban	41	35.3
<b>Parity</b>		
Primigravida	49	42.2

Continued.

Characteristics	N=116	%
Multigravida	67	57.8
<b>Gestational age (weeks)</b>		
≤12	18	15.5
13-28	18	15.5
29-40	64	55.2
<b>Postpartum period</b>	16	13.8

**Table 3: Underline cause of near miss cases (N=116).**

Underline cause	N	%
<b>Hypertensive disorders</b>	46	39.7
<b>Obstetric hemorrhage</b>	36	31.0
<b>Ectopic pregnancy</b>	17	14.7
<b>Sepsis</b>	8	6.9
<b>Incomplete abortion</b>	5	4.3
<b>Medical/surgical complications</b>	4	3.4

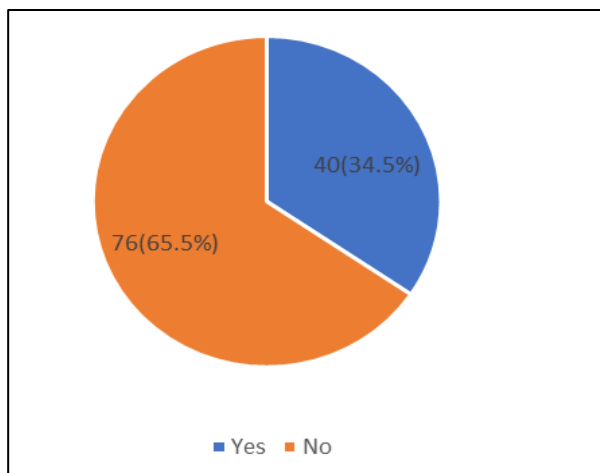
**Table 4: Pregnancy outcome of near miss cases (N=116).**

Suction evacuation	Vaginal delivery N=54 (46.55%)		LSCS	Laprotomy N=19 (16.38%)		Peripartum hysterectomy N=8 (6.9%)			Hysterotomy
	Normal delivery	Instrumental		Rupture uterus	Ectopic pregnancy	Atonic PPH	Placenta accreta	Rupture uterus	
<b>5 (4.3%)</b>	44 (37.9%)	10 (8.6%)	27 (23.3%)	2 (1.7%)	17 (14.7%)	3 (2.59%)	4 (3.45%)	1 (0.86%)	3 (2.6%)

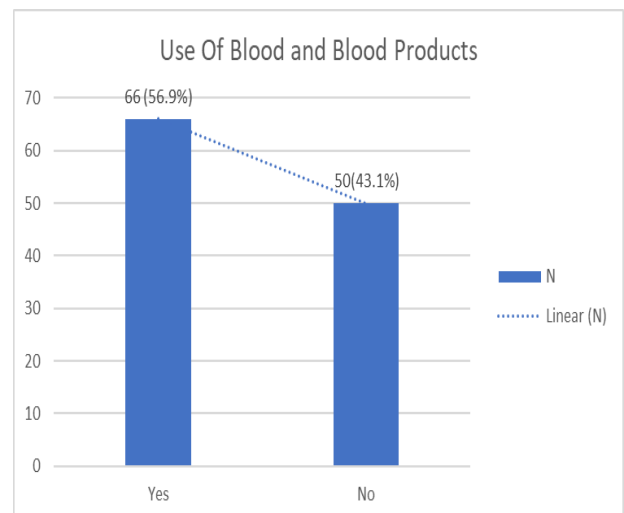
**Table 5: Neonatal outcome.**

Outcome*								
Gestation N=94		Stillbirth N=32		Livebirth N (%)	NICU Admission N=36 (58.06%)			
Preterm N (%)	Term N (%)	Fresh N (%)	Macerated N (%)		Indication	Outcome		
					Prematurity N (%)	Low Apgar score N (%)	Discharged N (%)	Died N (%)
<b>52 (55.3)</b>	42 (44.7)	12 (12.77)	20 (21.3)	62 (65.96)	20 (55.56)	16 (44.44)	19 (52.7)	17 (47.2)

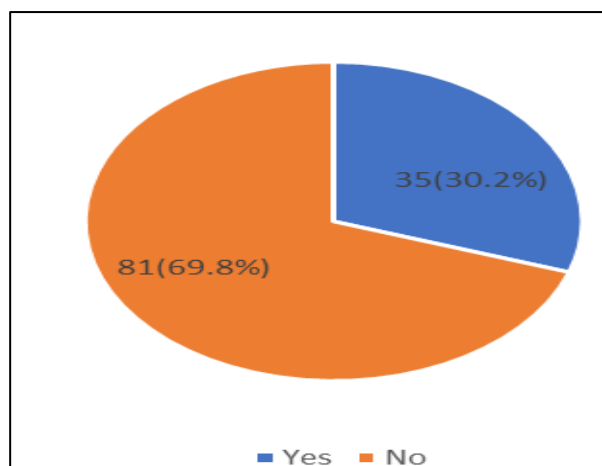
Note: \*Outcome of 94 cases (excluding ectopic pregnancy and incomplete abortion cases)



**Figure 1: Distribution of patients according to treatment received before admission.**



**Figure 2: Distribution of patients according to use of blood and blood products.**



**Figure 3: Distribution of patients according to ICU admission.**

## DISCUSSION

Maternal mortality is a critical indicator to assess the quality of services provided by a health care system. Globally, there has been a decline in MMR. There is a need to further accelerate this decline. This study was done to know the incidence, risk factors, and underline causes of MNM in our setup as there is limited published data from Himachal Pradesh.

In the present study, the incidence of MNM was found to be 12% which was similar to 11.6% as obtained by Yelikar et al in a tertiary care center in Maharashtra.<sup>6</sup> The reported incidence varies from 5.1% to 40% in other studies from all over India.<sup>4,7</sup> In our study we have 22 MNM for 1 maternal death, though it is appreciable with so much overload of deliveries still we need to improve to achieve national goals and targets.

The mean age of MNM cases was  $27.82 \pm 5.65$  years and the majority of cases 64.7% were from rural areas, these observations were comparable to the study conducted by Kaur et al tertiary care hospital at Shimla, the mean age of MNM cases was  $26.62 \pm 5.63$  years and majority 79% MNM cases belonged to rural areas.<sup>8</sup>

In the present study, 57.8% of patients were multigravida and 42.2% were primigravida which was comparable to a study conducted by Kaur et al in a tertiary care hospital Punjab.<sup>9</sup> Out of 116 MNM cases, majority of cases i.e.; 64 (55.4%) were reported in the third trimester, similar findings were found in the study done by Bakshi et al and Roopa et al where 52.5% and 57.2% MNM cases respectively, reported in the third trimester.<sup>7,10</sup> Early age at marriage and conception, inappropriate antenatal care during pregnancy and late identification and late intervention of high-risk pregnancies are important contributors to MNM cases.

Hypertensive disorder (39.6%) was the underlying cause of MNM in the majority of women, a similar observation

was made in other studies.<sup>6,11,12</sup> While Taly et al, Roost et al and Manandhar et al reported hemorrhage 60%, 48%, and 41.66% as the most common cause of MNM respectively.<sup>13-15</sup> Though there is rampant use of drugs like labetalol, magnesium sulphate to control pre-eclampsia and eclampsia at peripheral health centers, we still need to work on prediction and prevention of hypertensive disorders in pregnancy. In the present study, sepsis was identified as a cause of maternal near-miss events in 6.9% of the cases, which is a good indicator of improvements in clean delivery practices in our state. Under a beneficiary scheme called “Janani Shishu Suraksha Karyakaram” which provides free of cost treatment and hospitalization, antibiotics are freely available in the hospital supply leading to a lowering of the sepsis rate. In present study out of 116 women 35 (30.2%) were admitted to ICU and most common indication being eclampsia and others being antepartum hemorrhage, PIH with heart disease, RHD (rheumatic heart disease), and chorioamnionitis.

Sixty-six (56.9%) women required >5 units of blood and blood products which were comparable with the study conducted by Kalra et al where 58.9% of MNM cases had a blood transfusion.<sup>16</sup> Twenty-four-hour blood bank facilities with availability of blood components are present at our institution, whereas most of private and government hospitals in the periphery lack blood bank facilities and making this the most common cause for referral. Anemia without hemorrhage was also an important indirect cause of MNM. Severe anemia is a major problem in India that needs to be addressed in order to reduce the incidence of a maternal near miss. The minor a procedure like suction and evacuation can be life-saving for women with incomplete abortion if timely done at peripheral health institution but due to strict PC PNDT act, lack of skill and manpower it is not done. Non-availability of blood bank and late reporting of these women to tertiary care center is an important cause of MNM.

There were 65.96% live births and 34.07% stillbirths which were comparable with the study conducted by Parmar et al where the total live birth rate was 61% and stillbirth was 39.2%.<sup>4</sup> Underline causes of MNM cases like a hypertensive disorder of pregnancy, APH may be the reason for the high stillbirth rate. There were more admissions to NICU i.e.; 58.06%, in contrast, to study conducted by Kaur et al where NICU admission was 43.3%.<sup>8</sup> High perinatal morbidity and mortality was attributed to un-booked cases, preterm births, and hypoxic insult due to pre-eclampsia and eclampsia.

## Limitation

The limitation of this study was short term study duration.

## CONCLUSION

India has made significant progress in reducing its maternal mortality rate and a lot more needs to be done. Through the present study, we have tried to understand the

causes responsible for maternal morbidity. A study of MNM and its associated factors has helped us to identify what important steps were not taken correctly before referral which has impacted survival high-risk cases. As the main cause of MNM in the present study were hypertensive disorders of pregnancy so management protocols should be strictly followed for hypertensive disorders. Obstetric units should practice drills on the management of life-threatening conditions regularly so that prompt action can be taken in time of need. All maternal near-miss cases are living lessons who in spite of their misery show us our deficiencies and thereby help us in advocacy with referral facility to develop a Standard operating protocol (SOP) for management of high-risk cases at peripheral health institutes before referral.

*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:** Mahajan M, Soni A, Sharma CD, Moudgil S. A prospective observational study on maternal near miss cases in a rural teaching hospital. *Int J Reprod Contracept Obstet Gynecol* 2021;10:4448-53.