# STUDY OF MATERNAL NEAR MISS EVENTS AT NEPAL MEDICAL COLLEGE AND TEACHING HOSPITAL

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## ABSTRACT

Maternal near miss (MNM) is defined as woman who nearly died from complication during pregnancy, childbirth or within 42 days of termination of pregnancy but survives either due to care she receives or due to chance. Maternal near miss and maternal deaths share many characteristics and pathological processes and MNM being more frequent than death, review of MNM gives us an opportunity to assess the quality of obstetric care in the institutions and area of improvement. As maternal morbidity precedes maternal deaths, the study of near miss cases provides understanding of the determinants of maternal morbidity and mortality and help in reducing it. The aim of this study was to assess the MNM events in our institutions based on WHO organ dysfunction-based criteria. A descriptive cross-sectional study was carried out in a tertiary care hospital in Kathmandu over two years period from July 2020 to June 2022 after taking ethical clearance from Institutional Review Committee. During the study period, there were 3493 live births, 40 maternal near miss cases and no maternal deaths. The MNM ratio was 11.45/1000 live births and the prevalence of MNM was 1.13%. Postpartum hemorrhage 11 (27.5%), early pregnancy complications 8 (20%) and hypertensive disorder of pregnancy 5 (12.5%) were the major contributor of MNM. Coagulation/ Hematological system dysfunction 22 (55%) was the most common organ involved in MNM. ICU admission and blood transfusion more than five units were the common intervention done. Effective use of critical care, evidence-based intervention and timely referral will help to reduce maternal morbidity and mortality.

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# INTRODUCTION

Every day in 2017, approximately 810 women died from preventable causes related to pregnancy and childbirth and majority (94%) occurred in low-income countries.[1] Nepal is one of the countries in the world with high Maternal Mortality Ratio (MMR) and in the year 2016, 12% deaths among reproductive aged women were classified as maternal deaths.[2]

Women who survive life-threatening complications in pregnancy and delivery have many aspects common with those who die of such complications.[3] Maternal near miss (MNM) is defined as woman who nearly died from complication during pregnancy, childbirth or within 42 days of termination of pregnancy but survives either due to care she receives or due to chance. WHO, in 2009 introduced the new concept of MNM based on the organ dysfunction based criteria which includes 25 parameters grouped into clinical, laboratory and management based for evaluating the quality of care as shown in table no. 1.[4,5] MNM is more valuable indicator for analysis of obstetric care than maternal mortality because greater number of cases are available for analysis, acceptability of institutions since death did not occur and possibility of interviewing the woman herself.[6] These criteria may be used in any settings, comparable across settings and over time and has high threshold for identification of cases.

Because maternal morbidity precedes maternal death, the study of near miss cases provide understanding of the determinants of maternal mortality and may help in reducing it.[7] Therefore this study was conducted to determine the causes of MNM and maternal death at Nepal Medical College and Teaching Hospital.

# MATERIALS AND METHODS

A descriptive cross-sectional study was carried out in department of Obstetrics and Gynecology at Nepal Medical College and Teaching Hospital over the period of two years from July 2020 to June 2022 after taking ethical clearance from Institutional Review Committee. Maternal near miss cases were identified every day in the department of obstetrics and gynecology as women who suffered potentially life-threatening condition meeting WHO 2009 organ dysfunction-based criteria of near miss (Table 1). The patients were identified from labor room, antenatal ward, postnatal ward, gynecology ward, intensive care unit and emergency ward and were enrolled for

| Table 1: WHO criteria for maternal near miss | | |
|---|---|---|
| **Clinical criteria** | **Laboratory criteria** | **Management based criteria** |
| Acute cyanosis | Oxygen saturation <90% for > 60 minutes | Use of continuous vasoactive drugs |
| Gasping | PaO2/ FiO2< 200mmHg | Hysterectomy following infection or haemorrhage |
| RR> 40 for > 60 mins | Creatinine ≥ 3.5 mg/dl | Transfusion of ≥ 5 units of blood |
| Shock | Bilirubin > 6mg% | Intubation and ventilation ≥ 60 minutes not related to anaesthesia |
| Oliguria not responsive to fluids or diuretics | pH <7.1 | Dialysis for acute renal failure |
| Failure to form clots | Lactate > 5 | Cardio-pulmonary resuscitation CPR |
| Loss of consciousness lasting >12 hrs | Acute thrombocytopenia < 50,000/cumm | |
| Cardiac arrest | Loss of consciousness and presence of glucose and ketoacids in urine | |
| Stroke | | |
| Uncontrolled fits/ total paralysis | | |
| Jaundice in presence of preeclampsia | | |

the study. The women or the nearest family member were explained about the study and verbal consent was taken. These patients were followed up daily during the hospital stay till the discharge and the clinical symptoms, investigations done and treatment received were reviewed. Data were collected by reviewing the charts, interviewing the patient and treating medical personnel. Patients characteristics like age, parity, gestational age, booking status, type of delivery, detail of HDU/ICU admission and duration of hospital stay and any surgical intervention done to save life of mother were recorded in the preformed Performa. Details related to the near miss using the organ system dysfunction-based approach were included in the performa. Patient were categorized depending on primary obstetric factors that initiated the events leading to near miss, direct cause as obstetric hemorrhage, hypertension, sepsis, dystocia and indirect cause as anemia, thrombocytopenia and other medical disorders. Data were entered in the Microsoft excel sheet and analysis was done using simple percentage, frequency tables and cross tabulations.

## RESULTS

During the two years study period, there were 3493 live births, 40 maternal near miss cases and no maternal deaths. The maternal near miss ratio was 11.45/1000 live births. The prevalence of maternal near miss was 1.13%. Maternal near miss to mortality ratio and maternal mortality ratio could not be calculated in this study as no death occurred during this

period. Among the maternal near miss cases, the characteristics are shown in Table 2. Over one half of the women 22 (55%) were in the age group 20-29 years with mean age 28.72 ± 4.9 years, 34 (85%) women were multiparous and 6 (15%) were nulliparous. There were 21 (52.5%) antenatal patients, 10 (25%) patients were postnatal and 9 (22.5%) patients were with early pregnancy complications. The criteria for near miss were present in 26 (65%) women at the time of admission while 14 (35%) women developed the condition after admission to hospital. Among 21 patients admitted in 3rd trimester of pregnancy, 17 (80%) had antenatal checkup and 11 (52.4%) had caesarean section and 10 (47.6%) had vaginal delivery. Among these 21 patients, 9 had maternal near miss criteria present on admission and 12 developed the event after delivery. All the 10 patients admitted in the postpartum period with maternal near miss had institutional delivery, 6 were conducted at NMCTH and 4 in other hospital.

Most cases of severe maternal outcome were from direct obstetric causes with the most common etiology being postpartum hemorrhage 11 (27.5%) followed by early pregnancy complications 8 (20%), pregnancy related infection 6 (15%) and hypertensive

### Table 2 : Clinical characteristics of maternal near miss patients

| Characteristics | n | % |
|---|---|---|
| **Age** | | |
| ≤ 19 years | 3 | 7.5 |
| 20 - 29 years | 22 | 55.0 |
| – 39 years | 13 | 32.5 |
| ≥ 40 years | 2 | 5.0 |
| **Gravida** | | |
| Nulliparous | 6 | 15.0 |
| Multiparous | 34 | 85.0 |
| **Gestational age** | | |
| 1st trimester | 9 | 22.5 |
| 3rd trimester | 21 | 52.5 |
| Post partum | 10 | 25.0 |
| **Booking status of antenatal patients(n=21)** | | |
| Booked | 17 | 80.9 |
| Unbooked | 4 | 19.0 |

### Table 3: Potentially life-threatening complications in maternal near miss

| Complications | n=40 | % |
|---|---|---|
| Postpartum hemorrhage | 11 | 27.5 |
| Hemorrhage in early pregnancy | 8 | 20 |
| Abortion complications with severe anemia | 5 | |
| Ruptured ectopic pregnancy in shock | 2 | |
| Invasive mole with severe anemia | 1 | |
| Hemorrhage in late pregnancy (abruptio placenta with DIC) | 1 | 2.5 |
| Pregnancy related infections | 6 | 15 |
| Hypertensive disorder | 5 | 12.5 |
| Severe preeclampsia with HELLP syndrome | 4 | |
| Eclampsia with DIC | 1 | |
| Others | 9 | 22.5 |
| Peripartum cardiomyopathy | 3 | |
| Pneumonia with ARDS | 4 | |
| Pulmonary embolism | 2 | |

### Table 4: Criteria for maternal near miss

| Criteria for maternal near miss | n | % |
|---|---|---|
| **Clinical criteria** | **9** | **18** |
| Resp rate > 40 for > 60 mins | 4 | |
| Shock | 3 | |
| Stroke | 1 | |
| Oliguria | 1 | |
| **Laboratory criteria** | **18** | **36** |
| Oxygen saturation <90% for > 60 minutes | 10 | |
| Acute thrombocytopenia < 50,000/cumm | 6 | |
| Creatinine ≥ 3.5 mg/dl | 2 | |
| **Management based criteria** | **23** | **46** |
| Transfusion of ≥ 5 units of blood (8 patients had hysterectomy following hemorrhage) | 19 | |
| Use of continuous vasoactive drugs | 4 | |
| 10 patients had more than one criteria for defining maternal near miss | | |

### Table 6: Organ system involved in maternal near miss

| Organ dysfunction | n | % |
|---|---|---|
| Coagulation/Hematological system | 22 | 55 |
| Respiratory | 10 | 25 |
| Cardiac | 9 | 22.5 |
| Uterine dysfunction | 8 | 20 |
| Neurological | 2 | 5 |
| Renal | 2 | 5 |

* 13 (32.5%) patients of maternal near miss had more than one system involved

### Table 7: Indication for post-partum admission with complications

| Postpartum admission indications | n (10) | % |
|---|---|---|
| Peripartum cardiomyopathy | 3 | 30 |
| Pneumonia with ARDS | 2 | 20 |
| Secondary PPH with severe anemia | 1 | 10 |
| Puerperal sepsis with AKI | 2 | 20 |
| Puerperal sepsis with septic shock | 2 | 20 |

disorder of pregnancy 5 (12.5%). Indirect etiology was present in 9 (22.5%) cases as shown in Table 3. Management based criteria defined by WHO was the most common near miss criteria and identified in 23 (46%) women followed by laboratory-based criteria 18 (36%) and clinical criteria 9 (18%) as shown in Table 4 and 5. In this study, more than one near miss criteria were present in 10 patients.

In our study, coagulation/ hematological system dysfunction 22 (55%) was the most common organ involved in maternal near miss followed by respiratory dysfunction 10 (25%), cardiac dysfunction 9 (22.5%), uterine dysfunction 8 (20%), neurological 2 (5%) and renal dysfunction 2 (5%) as shown in Table 6. The treatment received for hematological system dysfunction was blood transfusion more than 5 units in 19 patients. The massive blood transfusion was done in 11 patients for severe postpartum hemorrhage (8 had peripartum hysterectomy to control hemorrhage), 5 patients for incomplete abortion with severe anemia (all had history of medical abortion done outside

### Table 5: Criteria for maternal near miss

| Criteria for maternal near miss | n (40) | % |
|---|---|---|
| Clinical criteria | 2 | 5 |
| Laboratory based criteria | 12 | 30 |
| Management based criteria | 16 | 40 |
| Clinical and management based criteria | 4 | 10 |
| Clinical and laboratory based criteria | 3 | 7.5 |
| Laboratory and management based criteria | 3 | 7.5 |

### Table 8: Critical intervention in maternal near miss

| Critical intervention | n (40) | % |
|---|---|---|
| ICU admission | 35 | 87.5 |
| Massive blood transfusion | 19 | 47.5 |
| Peripartum hysterectomy for PPH | 8 | 20 |
| Use of continuous vasoactive drug | 4 | 10 |
| Relaparotomy following LSCS | 2 | 5 |
| Mechanical ventilation | 2 | 5 |

of hospital), 2 for ruptured cornual ectopic pregnancy with hemoperitoneum and one for invasive mole with severe anemia. When the indications for post-partum admission were analyzed, puerperal sepsis with complication was the most common reason for admission followed by peripartum cardiomyopathy as shown in Table 7. Among 40 maternal near miss cases, 35 (87.5%) were admitted to ICU and managed. The mean duration of hospital stay of these patients was 9.92 ± 5.34 days and mean duration of ICU stay was 5.28 ± 3.86 days. The critical interventions done is shown in Table 8. There were eight patients who underwent peripartum hysterectomy to control post-partum hemorrhage, 5 following LSCS and 3 after vaginal delivery. All 3 patients with vaginal delivery had massive obstetric hemorrhage due to uterine atony and refractory to uterotonics and other management. Among 5 patients with LSCS with PPH, 3 had placenta previa with accreta, one had huge fibroid in lower uterine segment and one had complete placenta previa.

## DISCUSSION

Women who experience severe complications in pregnancy share many clinical and circumstantial factors among themselves and while some of them die, many of then narrowly escape death. By assessing these cases of severe maternal outcome, lessons can be learnt about the care the pregnant women received or lacked to receive. The near miss approach yields result that can inform policy makers for improving the quality of maternal health in individual health care facilities and help in decreasing preventable maternal morbidity and mortality.

The maternal near miss ratio (MNMR) in this study was 11.45/1000 live birth. Maternal near miss: mortality ratio and maternal mortality ratio could not be calculated in this study as no death occurred during this period. This is similar to that reported by Maharjan *et al*[8] from Nepal as 7.31/1000 live birth, 9.1/1000LB by Tanimia *et al*[9] from Australia , and as 10.39/1000LB by Chandak *et al*[10] from India. However, it is lower than that reported as 16.6/1000 live births by Verma *et al*[11] from India. where 88.7% of cases were referred from different private hospital and government facilities to their center and many patients already had near miss criteria on admission. Akpan *et al*[12] from Nigeria reported it as 68.3/1000LB which is very high than our study. It is because of ignorance, poverty and superstitions that women fail to recognize the

danger signs and lead to delay in seeking care in Nigeria and most women had near miss criteria present on admission. The MNMR in Europe is reported as 3.55/1000LB by O Malley *et al*[13] and it reflects the good obstetrics care in developed country. The weighted pooled prevalence of MNM worldwide estimated by a systematic review and meta-analysis in 2019 was 18.67/1000LB.[14]

In our study, 55% of MNM cases were of 20-29 years and 85% were multiparous which is similar to that reported by Singh *et al*[15] from India where 70.61% of MNM cases were of age group 21-30 years and 61.13% were multiparous.

Maternal hemorrhagic disorder and hypertensive disorder in pregnancy are the leading causes of maternal near miss in many studies. In our study, post-partum hemorrhage 11 (27.5%) was the leading cause of MNM and hypertension in pregnancy 5 (12.5%) was the third in order of MNM. Similar to ours, in a multicentric surveillance study conducted in Nepal by Rana *et al*[16] post-partum hemorrhage was contributing factor in 40% of cases of MNM followed by hypertension in pregnancy in 16%. Roopa S *et al*[17] from India also reported post-partum hemorrhage (32.8%) as leading cause of MNM followed by hypertensive disorder of pregnancy (23.6%) in their study. Post-partum hemorrhage is the most important cause of MNM in many other studies conducted by Galvao *et al*[18] in Brazil, Gupta *et al*[19] in India and Habte *et al*[20] in Africa. In contrast to our study, hypertension in pregnancy was the main cause of MNM in other studies conducted by Shrestha *et al*[21] in Nepal, Patankar *et al*[22] in India and Liyew *et al*[23] in Africa. In our study, hypertension in pregnancy contributed to 12.5% of MNM and was 3rd leading cause. As the majority of patients in our study had antenatal checkup, hypertension was identified early and managed appropriately thus decreasing its contribution to MNM. On the other hand, postpartum hemorrhage is unpredictable and unavoidable in many cases and active management of third stage of labor has to be emphasized to control post-partum hemorrhage.

Hematological /Coagulation system dysfunction 22 (55%) was the most common organ involved in maternal near miss in our study with 19 (47.5%) patients requiring blood transfusion of five units or more. Similar to ours, hematological system was the most common organ involved in 36% as reported by Singh *et al*[15] from India, Benimana *et al*[7] from Africa as 60.3% and Shrestha *et al*[21] from Nepal as 42.5%.

Most of the patients 35 (87.5%) in our study were managed in ICU and average duration of ICU stay was 5.28 ± 3.86 days. Although ICU admission is not included in the WHO MNM criteria, it is still an important criteria in identifying severe maternal disease. In another study conducted in Nepal, 54% of women were managed in ICU.[16] Similarly, de Lima et al[24] from Brazil stated it as 94.5% and Patankar et al[22] from India as 64.2%. As the maximum number of patients were managed in ICU and ICU beds were readily available in our institutions, we did not witness any maternal mortality during the study period of 2 years.

In this study, maternal near miss ratio was 11.45/1000 live birth and the prevalence of MNM was 1.13%. There was no maternal death during our study period. Post-partum hemorrhage was the most important cause of maternal near miss so special attention should be given for its prevention and prompt management. Nearly two third of the patients had near miss criteria on admission and this emphasizes the role of community awareness and the patient and provider education so delay in seeking care can be avoided thus reducing the maternal near miss and mortality in our society.

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