

# Maternal Near Miss in a Tertiary Care Teaching Hospital

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**Abstract** Near miss maternal morbidity indicators compliment the mortality indicators in ascertaining the maternal health as well as the health care delivery status. This study was conducted with the aim to find out the maternal near miss indicators of our centre and to determine the causes and nature of the maternal near miss and deaths. All cases who met the WHO organ system dysfunction criteria based on clinical, laboratory or management based criteria for maternal near miss were included in the study. This was a prospective observational study conducted for 24 months from September 2013 to August 2015. There were 7.7 maternal near misses per 1000 live births. The maternal mortality ratio was 76.7 per 1000 live births. Maternal near miss mortality ratio was 10 and mortality index was 9.1%. Hypertensive disorders (45%) and severe haemorrhages (30%) were the major contributors to maternal near miss. As for maternal deaths, 2 out of 4 occurred due to direct cause like hypertensive disorder and haemorrhage and the remaining 2 due to indirect causes.

**Keywords:** *maternal near miss, maternal deaths, WHO organ system based criteria*

**Cite This Article:** Junu Shrestha, Rami Shrestha, Ruhee Tuladhar, Sangeeta Gurung, and Ashika Shrestha, "Maternal Near Miss in a Tertiary Care Teaching Hospital." *Journal Name*, vol. 3, no. 5A (2015): 17-21. doi: 10.12691/ajphr-3-5A-5.

## 1. Introduction

Maternal mortality is a serious health concern in developing country like ours. It projects not only the health status of women and the quality of health care delivery system of the country but also the social status of the women.

Traditionally, evaluation of maternal health relied on the enquiries into the maternal deaths. However, pregnant women's health care status is not only reflected by the mortality indicators alone. Recently, the concept of reviewing severe acute maternal morbidity, "near miss obstetrics events" has been a useful tool to compliment the mortality indicators [1,2]. Near miss events are defined as acute obstetric complications that immediately threatens a women's survival but do not result in death either by chance or because of hospital care she receives during pregnancy, labour or within six weeks of termination of pregnancy or delivery [3]. The advantage of evaluating the near miss cases in adjunct to maternal deaths as compared to mortality alone is that near miss events are more frequent and hence, comprehensive and reliable information can be drawn and rapid audits can be conducted [1,2,4,5]. At the same time, the survivor herself can be a source of information. As surviving a near miss event mainly occurs because of the care provided, inquiring into the events of near miss would boost up the morale of the care providers and the system unlike in cases of confidential inquiries into maternal deaths.

Usually, severe acute maternal morbidity precedes maternal death. Therefore, identifying and analyzing the cases of maternal near miss helps in understanding the factors that determine maternal mortality [6,7]. Also since

survival of near miss is based in the health care delivery system, strength and weaknesses of the system can be analyzed. This would help in bringing about improvements and subsequently in decreasing the maternal mortality.

There has been marked improvement in the maternal mortality status of Nepal with Maternal mortality Ratio (MMR) declining from 430 per 100,000 live births in 2000 to 190 per 100,000 live births in 2013 [8]. Nevertheless, we have a short time frame to meet the Millennium Development Goal (MDG). Analyzing near miss cases would be of help in adjunct to maternal deaths in bringing about the improvements.

There are many ways of identifying maternal near miss cases using various sets of criteria like disease specific, management specific and organ system dysfunction based. Amongst these, organ system dysfunction based criteria have been noted to be epidemiologically sound and less affected by bias in identifying maternal near miss cases [9]. In 2009, World Health Organization (WHO) has developed new system based on organ system dysfunction which incorporates clinical, laboratory and management based criteria for identifying maternal near miss [4]. It has been then after recommended that WHO near miss approach for maternal death be uniformly used in analyzing the cases of near miss maternal mortality [3], which has been followed in this study for identifying cases of maternal near miss.

Although maternal mortality is extensively reviewed in Nepal, experience with maternal near miss events is limited. Therefore, this study was conducted with the aim to determine the Maternal Near Miss (MNM) indicators and Maternal Deaths (MD). It also aims to find out the causes and nature of the Maternal Near Miss and Maternal Deaths.

## 2. Methodology

### 2.1. Study Site

Pokhara is the headquarters of the Western Developmental region of Nepal. Manipal teaching hospital is a tertiary level 700 bedded referral care centre. This is a teaching hospital with undergraduate and postgraduate teaching programs. It serves as a tertiary care referral centre for the whole of Western Nepal. The department of obstetrics and gynecology has 118 beds. Obstetric case load of the department is high with about 250 to 300 monthly deliveries mostly of high risk pregnancies; with 30 to 35% cesarean deliveries. There are high risk pregnancy ward and well equipped labour ward. It provides antenatal care and delivery services to low risk as well as high risk pregnancies not only booked at the centre but referred from all over. Availability of intensive care

unit and multidisciplinary services are the added advantage of our centre in managing the high risk cases.

### 2.2. Study Design

This was a prospective observational study

### 2.3. Study Population

This study was conducted to find out the maternal near miss and maternal deaths. It was conducted in the department of Obstetrics and Gynaecology of Manipal Teaching Hospital for 24 months from September 2013 to August 2015. Maternal near miss cases were those who met the WHO criteria for maternal near miss. WHO criteria included set of criteria based on clinical, laboratory or management based findings. The WHO criteria for Maternal Near Miss are presented in [Table 1](#).

**Table 1. WHO Criteria for Maternal Near Miss Mortality [3]**

Clinical Criteria	Laboratory Criteria	Management Based Criteria
Acute cyanosis	Oxygen saturation <90% for > 60 minutes	Use of continuous vasoactive drugs
Gasping	PaO <sub>2</sub> / FiO <sub>2</sub> < 200mmHg	Hysterectomy following infection or haemorrhage
RR >40 for > 60 minutes	Creatinine ≥ 3.5 mg/dl	Transfusion of ≥ 5 units of Blood
Shock	pH <7.1	Intubation and ventilation ≥ 60 minutes not related to anaesthesia
Oliguria not responsive to fluids or diuretics	Lactate > 5 mEq/ml	Dialysis for acute renal failure
Failure to form clots	Acute thrombocytopenia < 50,000/cumm	CPR
Loss of consciousness lasting >12 hrs	Loss of consciousness and ketoacids in urine	
Cardiac arrest		
Stroke		
Uncontrolled fits /total paralysis		
Jaundice in presence of preeclampsia		

### 2.4. Ethical Considerations

Ethical clearance for the study was taken from the institutional ethical committee of Manipal teaching hospital. The participants were informed about the study and verbal consent taken.

### 2.5. Data Collection

Maternal near miss cases were identified during the morning meetings for handover of cases. They were identified from the labour, high risk pregnancy, postnatal and intensive care units as well. All those cases who met the WHO criteria for maternal near miss were included in the study. Cases of maternal deaths during the period were also reviewed. Data were taken from the patient themselves, from the case chart during the hospital stay and from the team of medical personnel whenever required. Preformed Performa was filled up which included the details of the patients and which criteria are met to be classified as maternal near miss.

### 2.6. Data Management, Analysis and Presentation

Data were entered in the Microsoft excel sheet and analysis was done using simple percentage. Patients' characteristics like age, parity, gestational age at time of death or near miss, status of booking at the institute, pregnancy and neonatal outcome were analyzed. Patients were categorized as direct or indirect causes of maternal near miss or deaths.

The indices like Maternal Near Miss Rate (MNMR), Mortality Index (MI), and Maternal Near Miss to Maternal Death ratio and maternal mortality ratio were also calculated.

## 3. Results

### 3.1. Maternal Near Miss Indicators

There were 40 cases of maternal near miss and 4 cases of maternal deaths. The indicators for maternal near miss and maternal deaths are presented in the following [Table 2](#).

**Table 2. Maternal Near Miss Indicators**

Maternal Near Miss Indicators	Indices
Maternal Near Miss (MNM)	40
Maternal Death (MD)	4
Live Birth (LB)	5214
Near Miss Rate(NMR- MNM/LB)	7.7 per 1000 LB
Mortality Index (MI – MD/MNM+MD)	9.1%
Maternal Near Miss Mortality Ratio (MNM:MD)	10:1
Maternal Mortality Ratio (MMR)	76.7 per 100,000 LB

### 3.2. Characteristics of Maternal Near Miss and Maternal Deaths

The maternal characteristics are presented in [Table 3](#).

**Table 3. Characteristics of Maternal Near Miss and Maternal Deaths**

Characteristics		Maternal Near Miss (40)		Maternal Deaths (N=4)	
		Number	Percentage	Number	Percentage
Age	≤ 19 yrs	1	2.5	1	25
	20-35 yrs	36	90	2	50
	>35 yrs	3	7.5	1	25
Parity	0	2	5	1	25
	1 – 3	33	82.5	3	75
	≥ 4	5	12.5	-	-
Gestational Age	<13 weeks	2	5	1	25
	13-28 weeks	4	10	-	-
	>28 weeks	34	85	3	75
Booking Status	Booked at MTH	3	7.5	2	50
	Unbooked	37	92.5	2	50

Most of the maternal near miss mortality cases (90%) were between 20 to 35 years of age. Most of them were multiparous (82%) and were in third trimester (85%) at the time of near miss event.

Majority were not booked at our institute. Two out of 4 patients of maternal deaths were booked at our hospital.

Most of the cases of near miss delivered by vaginal route (42.5%) followed by cesarean section (40%). In one patient laparotomy was done for ruptured ectopic pregnancy. The delivery and its outcome were not known in two patients who had come during second trimester of pregnancy with a near miss event and were discharged later. They did not come later for delivery at our facility.

### 3.3. Pregnancy Outcome of Maternal Near Miss and Maternal Deaths

**Table 4. Pregnancy Outcome of Maternal Near Miss and Maternal Deaths**

Pregnancy Outcome		Maternal Near Miss (40)		Maternal Deaths (N=4)	
		Number	Percentage	Number	Percentage
Mode of Delivery/ Termination of Pregnancy	Vaginal Delivery	17	42.5	1	25
	Vacuum Delivery	3	7.5	-	-
	LSCS	16	40	2	50
	Laparotomy	1	2.5	-	-
	MVA	1	2.5	1	25
	Not Known	2	5	-	-
Neonatal Outcome	First trimester termination	2	5	1	25
	Live Birth	26	65	3	75
	Still Birth	8	20	-	-
	Neonatal Death	2	5	-	-
	Not Known	2	5	-	-

### 3.4. Life Threatening Condition in Maternal Near Miss and Maternal Deaths

Hypertensive disorders of pregnancy was the leading cause of maternal near miss events (45%) followed by postpartum hemorrhage (22.5%). Infection which is the indirect cause of maternal mortality and morbidity also contributed to 17.5% cases of maternal near miss cases. There was one case of near miss that had pelvic abscess following vaginal delivery. She underwent laparotomy and drainage of abscess. One patient had presented in

septic shock and others were due to lower respiratory tract infection following delivery or cesarean section. There were two cases of near miss who presented with cardiovascular failure – both had presented with septic shock requiring use of ionotropes and admission to ICU.

While analyzing the maternal mortality, direct causes like hemoperitoneum post cesarean section and severe preeclampsia and indirect causes like cardiac disorder and intracerebral hemorrhage contributed equally to the maternal deaths.

**Table 5. Life Threatening Condition in Maternal Near Miss and Maternal Deaths**

Complications		Maternal Near Miss (N=40)		Maternal Deaths (N =4)	
		Number	Percentage	Number	Percentage
Hemorrhage	Abortion	1	2.5	-	-
	Ruptured ectopic	1	2.5	-	-
	Hemoperitoneum post LSCS	1	2.5	1	25
	Postpartum Hemorrhage	9	22.5	-	-
Hypertensive disorders	Eclampsia	13	32.5	-	-
	Severe hypertension	5	12.5	1	25
Dystocia		3	7.5	-	-
Infection		7	17.5	-	-
Others		-	-	2	50

### 3.5. Organ System Dysfunction in Maternal Near Miss and Maternal Deaths

Hematological system dysfunction was commonly found in cases of maternal near miss requiring massive blood transfusion of more than five units. This was followed by neurological system dysfunction.

**Table 6. Organ System Dysfunction in Maternal Near Miss and Maternal Deaths**

Dysfunctional Organ System	Maternal Near Miss		Maternal Deaths	
	Number (N=40)*	Percentage %	Number (N=4)*	Percentage %
Neurological	11	27.5	1	25
Respiratory	7	17.5	1	25
Cardiovascular	2	5	1	25
Hematological	17	42.5	1	25
Coagulation	5	12.5	1	25
Hepatic	1	2.5	-	-
Immunological	2	5	-	-
Renal	2	5	1	25
Uterine Dysfunction	4	10	-	-

\*11 cases (27.5%) of Maternal Near Miss and 2 cases (50%) of maternal death had more than one organ system dysfunction

### 3.6. Critical Intervention in Maternal Near Miss and Maternal Deaths

As many as three- fourth of the women with maternal near miss events required admission to intensive care unit (ICU). Transfusion of the blood and blood products was the intervention done in most of the cases. One patient who had vaginal delivery developed pelvic abscess required laparotomy for drainage of abscess. Re-

laparotomy was done in one patient for hemoperitonium following cesarean section. She was a referred case following cesarean section done at district hospital. Postpartum hysterectomy was done in four patients, three for ruptured uterus and one for PPH with morbidly adherent placenta. Craniotomy was done for a patient with pregnancy induced hypertension who developed intracranial hemorrhage in the postpartum period. Mechanical ventilation was required in two patients with eclampsia.

**Table 7. Critical Intervention in Maternal Near Miss and Maternal Deaths**

Critical Interventions	Maternal Near Miss		Maternal Deaths	
	Number (N=40)*	Percentage %	Number (N =4)*	Percentage %
Laparotomy	2	5		
Relaparotomy	1	2.5	1	25
Massive Blood and blood product transfusion	16	40	1	25
Use of high grade antibiotics	8	20	-	-
Hysterectomy	4	10	-	-
Inotrope support	2	5	-	-
Mechanical ventilation	2	5	-	-
Exploration and balloon tamponade	2	5	-	-
Craniotomy	1	2.5	1	25
Chest tube drain	1	5.5	-	-
ICU admission	29	72.5	4	-

\*More than one critical intervention in many cases of maternal near miss and maternal deaths.

### 3.7. Timing of the Maternal Near Miss event

**Table 8. Timing of Maternal Near Miss Event**

Time of Near miss	Maternal near miss		Maternal mortality	
	Number	Percentage	Number	Percentage
At admission	24	60	2	50
After admission	16	40	2	50

## 4. Discussions

Maternal near miss compliments maternal mortality studies to access the maternal health status and the quality of obstetric care. The prevalence of near miss is much higher than the mortality but the causes are more or less similar. The maternal near miss indicators have been suggested to indicate the quality of care [10]. The morbidity data have been found to be significant for the policy makers to know the requirements of essential and

emergency obstetric care. Morbidity data have been found to be better indicators for designing, monitoring and follow up of safe motherhood programs[1,2,11].

There were 40 cases of maternal near miss and 4 maternal deaths during the study period. The prevalence of maternal near miss was 0.75% of total deliveries. This was similar to other studies which use organ system dysfunction based criteria. [9] However, in other studies done in our country prevalence of near miss has been found to be 2.3% [12,13]. The higher prevalence is due to different criteria used in identifying the cases of near miss.

The maternal near miss rate(MNMR) is defined as the number of maternal near miss cases to live births. It is an estimation of the amount of care and resources needed in the facility or area. [10] The MNMR in our study was 7.7 per 1000 live births. Another study conducted in group of Kathmandu Valley based hospitals showed maternal near miss rate of 3.8 per 1000 live births[14]. This study had also used WHO organ dysfunction based criteria. Studies

from the other countries but using WHO criteria showed MNMR ranging from 9.8 to 23.6 per 1000 live births [15,16,17]. Higher MNMR was found to be more due to difference in the geographical location where these studies were conducted.

Maternal near miss mortality ratio is the ratio of number of cases of near miss to number of maternal deaths, higher ratio indicates better care [3,18]. In our study this ratio was 10 meaning that for every 10 life threatening condition, there was one maternal death. Maternal near miss mortality ratio in was 6 to 7.2 in other studies of Nepal [13,14]. This indicates better care of patients at our centre. The increase in this ratio over time would indicate improvement in the care provided to the patients. The same ranged from 4.7 to 60, the lower ratio reported in Nigeria to the highest ratio in Syria [15,16,17,19,20,21].

Mortality index (MI) is defined as the number of maternal deaths divided by the number of women with life threatening condition and is expressed as percentage. Higher index suggest low quality of care as more women with life threatening condition is apt to die and lower index suggest better care. The MI in our study was 9.1% slightly better than those of other local studies while studies from African subcontinent showed high mortality index [17,19]. Study in Syria showed a very low index of 1.7% [21].

Maternal mortality ratio (MMR) in this study was found to be 76.7 per 100,000 live births much lesser than the country figures as expected as this study was institute based unlike that of country which considers the whole of community as well.

Analyzing the life threatening obstetric event leading to maternal near miss, the two major contributors were hypertensive disorders (45%) and hemorrhage (30%). Postpartum hemorrhage contributed by 22.5%. Infection also contributed to 17.5% cases of maternal near miss. Uterine rupture was seen in 7.5% of cases. In case of maternal mortality, 50% was contributed by direct obstetric causes like PPH and hypertensive disorders and the remaining 50% of deaths were due to indirect cause – congenital heart disease with Eisenmengers syndrome and intracerebral hemorrhage. Hypertensive disorders came second after hemorrhage as a contributing factor of near miss in the other two studies of Nepal [13,14] while hypertension was the major contributor in another study [12]. Hypertensive disorders have lead to neurological, respiratory, coagulation, renal and cardiac system dysfunction and the cases have been categorized as maternal near miss.

Most of the cases of our study were unbooked (92%) making early detection and management of these cases difficult and leading to severe obstetric morbidity. Amongst 12 cases of near miss with hemorrhage as the life threatening condition, there was 1 case each of ruptured ectopic pregnancy, incomplete abortion and hemoperitoneum following cesarean section. There were 9 cases of PPH, despite the fact that active management of third stage of labour is practiced in all patients delivered at our centre. All these patients required massive blood transfusion. Two out of 3 cases of ruptured uterus occurred after admission at our facility. Similar pattern of life threatening events were seen maternal near miss cases in studies from other parts of the world. [16,19,20,21]. This indicates that there is so much room for improvement

in the antenatal care by making early diagnosis of hypertension possible. Also active management of third stage of labour is to be emphasized to prevent PPH and its consequences. The fact that ruptured uterus had occurred after admission suggests need for improvement in intrapartum care.

Type of organ system dysfunction pattern in our study was similar to that in another study conducted in India [21]. Hematological system dysfunction was the commonest organ system affected with nearly 42.5% of cases requiring massive blood transfusion of five or more units. Blood transfusion was needed in all patients with haemorrhage and uterine dysfunction and some with infection. Neurological system (27.5%) came next following the haematological system. Compared to other studies, neurological organ system dysfunction is high in our study [13,14,20,21] as all these patients met the criteria of poor level of consciousness requiring ICU admission in patients with eclampsia. This was followed by respiratory system (17.5%), coagulation system (12.5%) and uterine dysfunction (10%). Renal and hepatic system dysfunction contributed less to the cases of near miss. Vascular system dysfunction was found to be the commonest organ system to be affected in one study while in other it came second to uterine dysfunction in other [13,14].

ICU admission (72.5%) was the most frequent critical intervention required in our patients as was found in another study [13] followed by massive blood transfusion (40%). It was found to be more with almost 67% patients requiring massive blood transfusion in other studies which could be due to different criteria to indicate massive transfusion or due to difference in the organ system affected in these studies [13,14]. Surgical intervention was required in 27.5% cases similar to other study [14].

Higher number of near miss events and mortality occurring after admission to hospital indicated room for improvements in the hospital care in our study. This pattern was almost similar to the other study [13].

## 5. Conclusion and Recommendation

The maternal near miss cases were almost ten times more common than the maternal deaths. The maternal near miss rate was 7.7 per 1000 live births and the maternal mortality ratio was 76 per 1000 live births. Hypertensive disorders and severe hemorrhage were the major causes of maternal near miss similar to maternal deaths. Therefore, efforts aimed at improving the management of near miss cases would ultimately assist in the reduction of maternal mortality. Evaluating the cases of maternal near miss is recommended to bring about improvements in the maternal health care delivery system.

## Competing Interests

The authors hereby declare that there is no competing interest in the study.

## Funding

No financial support for the research, authorship and/or publication of this article was received by the authors.

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