

**MATERNAL NEAR MISS AND MATERNAL MORTALITY AS HEALTH INDICATORS IN A TERTIARY CARE HOSPITAL**Simarpreet Kaur<sup>1</sup>, Santosh Minhas<sup>2</sup>, B. R. Sharma<sup>3</sup>, Rajeev Sood<sup>4</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT: OBJECTIVES:** To assess the various causes and incidence of maternal near miss (MNM) and maternal deaths (MD) and to define the limitations and to search the level of delay. **METHODS:** A prospective and observational study, including women who were admitted in emergency from April 2012 to March 2013 with severe maternal complications and who fulfilled any of the WHO criteria of MNM. Results: A total of 6008 live births (LB) and 156 severe maternal outcomes (25.9/1000 LB) were observed, consisting of 140 MNM (23.3/1000 LB) and 16 MD(266/100, 000 LB). The maternal near miss/mortality ratio was 8.75. Hypertensive disorders accounted for the most common event of MNM (50.6%), followed by haemorrhagic disorders (38.6%). Majority of maternal deaths were due to hypertensive disorders (31.2%) and sepsis (25%). **CONCLUSION:** Reduction of present MNM and MD may be achieved by strictly following management protocols for hypertension and haemorrhage.

**KEYWORDS:** Maternal near miss, maternal mortality, haemorrhage.

**INTRODUCTION:** High rates of maternal mortality around the world are an unfortunate reality and over a half a million women die giving birth annually. Efforts have been made by international organizations to reduce maternal mortality rates and improve the health of women and children around the world. Millennium Development Goal Five, created by the United Nations, calls for a reduction in maternal mortality by two-thirds by 2015.<sup>1</sup>

There are major difficulties in allocating the limited available resources to decrease the maternal mortality rate. A major contributing factor appears to be the lack of accurate data which will identify women who are at highest risk of maternal death and what actions will best reduce that risk.

A maternal near miss case is defined as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy".<sup>2</sup> Near miss or severe acute maternal morbidity cases share many characteristics with maternal deaths and can directly inform about obstacles that had to be overcome after the acute complication, hence providing valuable information on obstetric care.<sup>3</sup>

Maternal near miss is a relatively recent concept and there has been no consensus about the most appropriate defining criteria. Three approaches based on different indicators have been proposed to identify maternal near miss:

1. Organ dysfunction;
2. Presence of conditions or complications such as pre-eclampsia, uterine rupture or severe sepsis; and
3. Level of care complexity such as blood transfusion or intensive care unit(ICU) admission.<sup>4,5</sup>

In order to provide insight into the quality of maternal care in Kamla Nehru Hospital, this study was conducted to determine the prevalence and nature of near miss obstetric cases and maternal deaths.

**MATERIAL AND METHODS:**

**Setting:** This prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Kamla Nehru State Hospital for Mother and Child, Indira Gandhi Medical College, Shimla from 1<sup>st</sup> April 2012 to 31<sup>st</sup> March 2013 to identify women with severe complications of pregnancy leading to MNM and MD.

**Inclusion Criteria:** The inclusion criteria of the study were divided in clinical, laboratory and management based criteria.

**1. Clinical criteria:**

- A. Acute cyanosis.
- B. Gaspings.
- C. Respiratory rate >40 or < 6 per min.
- D. Shock: haemorrhagic or neurogenic (persistent severe hypotension with systolic blood pressure <90mm Hg for > 60 minutes and pulse rate of >120 despite of aggressive fluid replacement of >2 litres).
- E. Oliguria (urine output <30ml/hr for 4 hrs or <400ml/24 hrs) non-responsive to fluids or diuretics.
- F. Clotting failure.
- G. Loss of consciousness lasting >12 hours(Coma Glasgow Scale <10)
- H. Stroke or total paralysis.
- I. Severe pre-eclampsia (blood pressure of 170/110 mmHg twice; proteinuria of 5 grams or more in 24 hours; and HELLP syndrome or pulmonary oedema or jaundice) or Eclampsia (Generalized fits without previous h/o epilepsy) or uncontrollable fits due to any other reasons.

**2. Laboratory based criteria:**

- A. Oxygen saturation <90% for > 60 min.
- B. Creatinine>3.5mg/dl.
- C. Bilirubin >6.0 mg/dl.
- D. Acute thrombocytopenia (<50, 000 platelets).
- E. Unconsciousness with the presence of Glucose and ketoacids in urine.
- F. Sepsis or severe systemic infection-fever (>38°C), a confirmed or suspected infection (e.g. chorioamnionitis, septic abortion, endometritis, pneumonia), and at least one of the following: HR >90, RR >20, leucopenia (WBC <4000), leukocytosis (WBC >12 000).

**3. Management based criteria**

- A. Use of continuous vasoactive drugs.
- B. Hysterectomy following infection or hemorrhage or ruptured uterus.
- C. Transfusion of >5 units red cell or component therapy.
- D. Intubation and ventilation for >60 minutes not related to anesthesia.
- E. Dialysis for acute renal failure.
- F. Cardio-pulmonary resuscitation.
- G. Admission to intensive care unit.

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All women fulfilling any one of the above criteria were included in the study irrespective of their being booked, un-booked or referred cases. For each case, data was collected on following variables: maternal age, parity, gestational age or postpartum day when near miss happened, previous deliveries, place of the complication (home, private doctor, primary health center, or tertiary center), type of delivery (vaginal or C- section), duration of total hospital stay, fetal outcomes, any medical disorder, ICU admissions.

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0.  $P < 0.05$  was considered statistically significant.

**RESULTS:** There were total 6970 patients who were admitted to labour room during this study period. There were 140 maternal near miss cases and maternal near miss ratio was 23.3 per 1000 live births. Sixteen maternal deaths occurred during this period, resulting in maternal mortality rate of 266 per 100, 000 live births. Maternal near miss: mortality ratio was 8.75. The live births during this period were 6008 in number.

The demographic characteristics of the women under study were: the mean age for women (in years) in MNM group and maternal death group was  $26.62 \pm 5.63SD$  and  $23.87 \pm 4.24SD$  respectively. Out of total 156 cases, 125 cases (80.1%) were from rural background and maximum number of cases i.e. 95 (60.9%) were of Class III (middle lower) according to modified Kuppuswamy classification. 96.1% of subjects in study group were literate and rest were illiterate. In MNM, 49.3% were un-booked at the time of admission and in maternal deaths, 88% of cases were un-booked. 50% of women in the study were primiparous.

Sixty four percent of the cases were referred from other centers which became MNM or died. The most common indication of the referrals was eclampsia which accounted for 26% of cases followed by severe pre-eclampsia (18%). Most common period of gestation at the time of complication was  $28^{+1}$ -37 weeks which was seen in 38.5% of women.

Thirteen percent of cases became MNM in postpartum period i.e. after delivery to 6 weeks thereafter and 50% of maternal deaths occurred in this period. Maximum number of severe maternal outcomes i.e., 127 cases (81.4%) were having complication before admission which was statistically significant ( $p$  value = 0.000). Most common place of developing complication was home in 62% of cases and 20% developed complication after they were admitted in our center.

Out of 140 cases in MNM, 117 subjects were delivered and among 16 cases of maternal death, 11 were delivered and rest either had abortion or ectopic pregnancy. Fifty percent of women were delivered vaginally and 32% had caesarean section. In one case of MNM hysterotomy was done due to failed induction & induction was done with dinoprostone gel and misoprostol for eclampsia at POG  $27^{+3}$  weeks.

One case of MNM had manipulation at home at POG  $20^{+5}$  weeks who developed sepsis and total abdominal hysterectomy was done as products of conception were lying outside uterus after perforating uterine wall. One subject died due to diarrhoea at POG  $31^{+2}$  weeks & macerated fetus was extracted during post-mortem.

One case of maternal death had rupture uterus due to sepsis at POG 20 weeks and hysterectomy was done. Three cases died in antenatal period, out of these one had intrauterine death at POG  $24^{+6}$  weeks and died due to pulmonary embolism, one case died due to seizures not related to

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eclampsia at POG 33<sup>+1</sup>weeks and one case died due to acute respiratory distress syndrome due to scrub typhus at POG 20 weeks.

Salpingectomy was done for ruptured ectopic who were in shock in 10 cases and no death occurred due to ectopic pregnancy. Hysterectomy was done in eleven cases and two women died, common indication for hysterectomy being atonic PPH (4 cases) and adherent placenta (4 cases).

In two subjects (1.4%) of MNM, haemostatic stitch (b-lynch, Cho stitch) application was done for atonic uterus. In three cases of MNM, surgical drainage was done (1.drainage of pus in septic abortion, 2.drainage of broad ligament hematoma, 3.drainage of vulval hematoma). Manual removal of placenta was done in one MNM case (0.7%) that was referred after delivery with retained placenta and postpartum haemorrhage.

Examination under anaesthesia was done in three cases of MNM – 1) uterine tamponade using a condom catheter was done for atonic uterus, 2) ligation of left gastroepiploic artery done which was found to be bleeding after caesarean section, 3) for atonic PPH in which uterus was found to be retracted on exploration.

There were 72.7% of live births out of total 143 births in study population In MNM cases, there were 97 live births, 19 stillbirths and 14 abortions.

In maternal death cases, 7 were live births, followed by 4 stillbirths and 2 cases of abortions. 43% of neonates were admitted in neonatal intensive care unit (NICU) and 15% of neonates were expired at the time of discharge.

Out of total subjects, 9.6% received more than 5 units of blood or component therapy. Vasoactive drugs were used in 8 cases of MNM and 9 cases of maternal death. Nine cases were admitted to intensive care unit out of which five died. The mean duration of stay in the hospital was 9±5.98 days and maximum stay was of 30 days in a case of severe pre-eclampsia, in whom LSCS was done and baby was admitted in NICU.

According to Three Delays Model, levels of delay are defined as: Level I- delay in deciding to seek care; Level II –delay in reaching an adequate health facility; Level III- delay in receiving care at the facility. Most common level of delay was Level I (80.1%) in the study subjects (p value <0.001). Level II delay was in 23.7% of cases. Only one case had delay at Level III i.e. in receiving care at our institute. This case was referred in emergency with hydrocephalous and placenta accreta and emergency operation theatre was busy, this case landed up in emergency hysterectomy. (Table-1)

Direct causes contributed to 97.1% of MNM and 75% of maternal death cases. Most common causes were hypertensive disorders and severe haemorrhage. Hypertensive disorders were responsible for 50.6% cases of MNM and 31.2% cases of maternal deaths, mortality index being 6.5%. Mortality index refers to the number of maternal deaths divided by the number of women with life threatening conditions and expressed as percentage.

Second common cause was severe haemorrhage in abortions, ectopic pregnancies, antepartum and postpartum haemorrhage groups. It was responsible for 38.6% cases of MNM and 12.5% cases of maternal deaths. Mortality index for haemorrhage was 3.5%. Sepsis had highest mortality index of 57.1%.

Dystocia included obstructed labour and rupture uterus, which was responsible for 4 (2.9%) cases of MNM and one (6.3%) case of maternal death. Mortality index for dystocia was 20%.

Indirect causes were responsible for 4 cases of MNM and 4 maternal death cases. There were two cases with jaundice in MNM group and in one case there was broad ligament hematoma which

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was drained after re-exploration. One MNM case was due to intraperitoneal bleeding due to active bleeding of left gastroepiploic artery after caesarean section. There were 4 cases with indirect causes in maternal death. One case was due to sudden arrest due to pulmonary embolism in a subject with intrauterine death (POG-24+6weeks) and one subject had hypovolumic shock due to diarrhoea at POG 31+2 weeks.

One maternal death was due to aspiration pneumonia in a case of fever with seizures at POG 33+1 weeks and one case was due to Eisenmenger syndrome in a subject with Ventricular Septal Defect on first postoperative day of emergency LSCS. Overall, mortality index was 10.25%.

**DISCUSSION:** This is the first attempt to document both maternal mortality and maternal near miss in Shimla. Hypertensive disorders and haemorrhage were the leading cause of maternal near miss which accounted for 89.3% of cases. Hypertensive disorders were the main cause of maternal mortality (31.2%) and sepsis had highest mortality index (57.1%). According to a recently reported review by the WHO about maternal morbidity and mortality, the prevalence of near miss mothers ranges between 0.4% to 8%.<sup>6</sup>In the present study, prevalence of maternal near miss is 2.3%.

The MNMR described in this study (23.3 per 1000 live births) is within the wide range of ratios reported in studies from other developing countries (12.3-82.3 per 1000 LB).<sup>7</sup> This study shows MNMMR (maternal near miss: mortality ratio) of 8.75. This ratio reflects that overall standard of obstetric care is slightly better than studies from other developing countries reported (4.29 in Liberia,<sup>1</sup> 5.84 in Pakistan,<sup>8</sup> 6.75 in Tanzania<sup>9</sup>) but still far from 26.7 ratio reported in Bolivia, South America.<sup>10</sup> (Table 5).

Our study identified near miss cases based on a set of clinical criteria, laboratory markers and management based criteria. The clinical criteria had a better applicability as it is easy to interpret and enable us to assess both complication rates and quality of care. The criterion of ICU admission is underestimated as mostly <10% of cases in low resource settings receive intensive care. In our study it was 5.8%.

Hypertensive disorders make up almost 50% of cases of MNM and most of them developed before arrival to the hospital. This exposes a weakness in early detecting pre-eclampsia which may be due to poor follow up and antenatal care at peripheral level. Out of various types of obstetric haemorrhages, postpartum haemorrhage (PPH) constituted the greatest danger to the affected women. PPH accounted for 15% of MNM and 13% of maternal deaths.

One of the critical defects is the delay in referrals to higher levels of care. Majority of women with MNM (64%) were referred from other centers in critical condition. This may be attributed to scarcity of referral system in many parts of our country and due to ignorance and non-utilization of existing health care facilities. Another obstacle in proper timely referral is the first level delay.

It was evident that women and family members prolonged the decision to seek professional care from the hospital. Much of the decision making among families is complex and includes family dynamics, gender inequalities, economics, culture and politics. This first level delay was also seen in other studies (Lori etal<sup>1</sup> and Jithesh<sup>11</sup>).

**CONCLUSION:** The present study has tried to understand the causes responsible for maternal mortality and morbidity. Main causes were: 1) Lack of decision making for seeking care (Level I delay), 2) Lack of awareness and formal education about free facilities available all over the

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Himachal, 3) Fear of hospital services, 4) Poor quality of antenatal care at peripheral level and 5) Lack of roads connectivity.

Suggested health system actions include improving quality of antenatal care at peripheral level, by making EmOC centers functional and effective, training MBBS doctors in emergency obstetric care and developing a well-defined referral protocol to ensure prompt initiation of treatment and avoidance of unnecessary delays.

As main cause of MNM and maternal death in present study was severe pre-eclampsia due to uncontrolled blood pressure. Management protocols are to be strictly followed for hypertensive disorders. Obstetric units should practice drills on management regularly. Moreover, sepsis had maximum mortality index. Promotion and practice of clean child birth practices is required to bring down the sepsis rate and related morbidity and mortality.

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Level of delay	Total (N=156)		MNM (n=140)		MD (n=16)	
	No.	%	No.	%	No.	%
No. delay	24	15.4	20	14.3	4	25
I	125	80.1	113	80.7	12	75
II	37	23.7	33	23.6	4	25
III	1	0.6	1	0.7	0	0

**TABLE 1: COMPARISON OF LEVEL OF DELAY**

Diagnosis	MNM N (%)	MD N (%)	Mortality Index (%)	P value
<b>Direct causes</b>	136(97.1%)	12(75%)	8.1	
A. Hypertensive disorders	71(50.6%)	5(31.2%)	6.5	0.140
B. Severe haemorrhage	54(38.6%)	2(12.5%)	3.5	0.074
C. Sepsis	3(2.1%)	4(25%)	57.1	0.002*
D. Dystocia	4(2.9%)	1(6.3%)	20	0.422
E. Severe anaemia	4(2.9%)	0	0	1.000
<b>Indirect causes</b>	4(2.9%)	4(25%)	50	0.004*
<b>Total</b>	<b>140</b>	<b>16</b>	<b>10.25</b>	

**TABLE 2: CAUSES OF MATERNAL NEAR MISS AND MATERNAL DEATH**

\*statistically significant

CRITERIA	Total (N=156)	MNM (N=140)	MD (N=16)	P value
Acute cyanosis	0	0	0	
Gaspings	3(1.9%)	0	3(18.8%)	0.000*
RR >40 or <6/min	6(3.8%)	2(1.4%)	4(25%)	0.001*
Shock	22(14.1%)	17(12.1%)	5(31.2%)	0.037*
Oliguria	0	0	0	
Clotting failure	3(1.9%)	2(1.4%)	1(6.3%)	0.278
GCS score <10	35(22.4%)	29(20.7%)	6(37.5%)	0.127
Stroke/paralysis	0	0	0	
Severe pre-eclampsia	35(22.4%)	34(24.3%)	1(6.3%)	0.123
Eclampsia/uncontrolled fits	37(23.7%)	34(24.3%)	3(18.8%)	0.763
HELLP syndrome	9(5.8%)	6(4.3%)	3(18.8%)	0.018*

**TABLE 3: APPLICABILITY OF MATERNAL NEAR MISS CRITERIA (CLINICAL)**

\*statistically significant

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CRITERIA	Total (N=156)	MNM (n=140)	MD (n=16)	P value
<b>Laboratory based</b>				
1.oxygen saturation<90%	19(12.1%)	13(9.3%)	6(37.5%)	0.005*
2.creatinine >3.5mg/dl	1(0.6%)	0	1(6.3%)	0.000*
3.bilirubin >6mg/dl	6(3.8%)	5(3.5%)	1(6.3%)	0.000*
4.platelets <50, 000	1(0.6%)	1(0.7%)	0	1.000
5.Sepsis	7(4.5%)	3(2.1%)	4(25%)	0.002*
<b>Management based</b>				
1.vasoactive drugs	17(10.9%)	8(5.7%)	9(56.3%)	0.000*
2.hysterectomy	11(7%)	9(6.9%)	2(12.5%)	0.313
3.>5 units of blood transfused	15(9.6%)	15(10.7%)	0	0.367
4.intubation & ventilation	9(5.8%)	4(2.8%)	5(31.3%)	0.000*
5.dialysis for renal failure	0	0	0	
6.CPR	16(10.3%)	0	16(100%)	0.000*
7.ICU admission	9(5.8%)	4(2.8%)	5(31.3%)	0.000*

**TABLE 4: APPLICABILITY OF MATERNAL NEAR MISS (LABORATORY AND MANAGEMENT BASED) CRITERIA**

\*statistically significant

Sl. No.	STUDY	SMOR	MNMR	MNMMR	MI
1.	Roost M etal (2009) <sup>10</sup>	51.8	49.9	26.7	3.6
2.	Lori JR etal (2011) <sup>1</sup>	52.5	42.6	4.29	18.9
3.	Siddiqui SA etal (2012) <sup>8</sup>	90	76	5.84	14.6
4.	Nelissen E etal(2013) <sup>9</sup>	27	23.6	6.75	12.9
5.	Present study	25.9	23.3	8.75	10.25

**TABLE 5: MATERNAL NEAR MISS INDICATORS**



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