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Original Research Article

## Evaluation of associated risk factors of near miss obstetrics cases at B.P. Koirala Institute of Health Sciences, Dharan, Nepal

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### ABSTRACT

**Background:** In 2011, around 273,465 women died worldwide during pregnancy, childbirth or within 42 days after childbirth. Near-miss is recognized as the predictor of level of care and maternal death. The objective of the study was to evaluate the associated risk factors of near miss obstetric cases.

**Methods:** A prospective observational study was done from August 1, 2014 to July 30, 2015 in Department of Obstetrics and Gynecology at BPKIHS hospital, tertiary care hospital in Eastern Nepal, Dharan. Case eligible by 5 factor scoring system and WHO near miss criteria were evaluated. Risk factors included severe hemorrhage, hypertensive disorders, complication of abortion, ruptured uterus, medical/surgical condition and sepsis.

**Results:** A total of 9,727 delivery were attended during the study period from August 2014 to July 2014. There were 6307 (71.5%) vaginal delivery and 2777 (28.5%) caesarean section and 181 perinatal death with total of 9,546 livebirth. 162 near miss and 16 maternal death occurred during the study. Maternal near miss rate of 16.6 per 1000 live birth, Women with life-threatening conditions of 172, Severe maternal outcome ratio of 18.64, Maternal near-miss: mortality ratio: 10.1:1, Mortality index: 8.98%. Risk factors were obstetric hemorrhage 27.8%, abortion/ectopic 27.2%, eclampsia 16%, medical/surgical condition 14.8%, sepsis 13.6%, severe preeclampsia 11.1%, ruptured uterus 3.1%, and molar pregnancy 1.9% and cardiovascular and coagulation dysfunction as a major life-threatening condition and sepsis (25%) was the major cause of mortality.

**Conclusions:** Haemorrhage and hypertensive disorders are the leading causes of near miss event. Evaluation of associated risk factor can be potential tool for reduction of maternal morbidity and mortality.

**Keywords:** Abortion, Eclampsia, Five factor scoring system, Hemorrhage, Maternal mortality, Near miss

### INTRODUCTION

Worldwide, more than half a million women between age 15-49 die each year from the complication of pregnancy and childbirth.<sup>1</sup> Near misses have emerged as a useful complement to the investigation of maternal deaths.<sup>2</sup>

Near miss is defined as “A woman who nearly died but survived a complication that occurred during pregnancy, childbirth, or within 42 days of termination pregnancy.<sup>2,3</sup> The patient survived either by chance or because of hospital care she received.” Currently we have high pregnancy related mortality ratio (247 deaths due to any

causes in pregnancy up to six weeks after pregnancy event per 100 thousand live births) and maternal mortality ratio (229 deaths due to pregnancy and childbirth related cause per 100 thousand live births) which constitutes 11% of deaths of women of reproductive age group.

Various associated risk factors contribute to near miss events. Commonly seen in our context are: Antepartum/Postpartum hemorrhage, complication of abortion, ruptured ectopic and ruptured uterus, Hypertension complicating pregnancy: severe preeclampsia, eclampsia, sepsis or severe systemic

infection, provision of standard care: oxytocin infusion, provision of MgSO<sub>4</sub>, provision of antibiotics during caesarian, associated medical and surgical complication, presence of contributory factors: HIV, anemia, previous lower segment caesarian section, prolonged / obstructed labor .

In spite of the evidence-informed process that led the development of the WHO criteria for identifying women with life-threatening conditions, an actual validation of such criteria is required. In low-resource settings like in Nepal, application of these organ-failure based criteria that require relatively sophisticated laboratory and clinical monitoring can underestimate the occurrence of maternal near miss. Therefore, these criteria and the suggested WHO approach may not be able to identify maternal near miss across all settings appropriately. The threshold of five units of blood for identification of MNM according to WHO criteria led to underreporting of MNM in a low resource setting.<sup>4</sup> Five factor scoring system uses 3 units of threshold of blood with specificity of 93.9%.<sup>5</sup>

The objective of this study was to evaluate the associated risk factors and determinants of near miss obstetric cases at B.P. Koirala institute of health sciences, a tertiary hospital in eastern Nepal, Dharan.

## METHODS

This was a Prospective Observational Study done over 11 months from August 1, 2014 to June 30, 2015 in the Department of Obstetrics and Gynecology at BPKIHS hospital, tertiary care hospital in Eastern Nepal, Dharan.

Among the patient admitted under the care of department of obstetrics and gynecology, potentially all life-threatening conditions were assessed, and those cases which met WHO criteria for near miss were given score as per Five factor scoring system and score of equal or more than 8 were enrolled in the study. Sample was taken on the basis of fulfillment of criteria.

**Table 1: Five factor scoring system.**

Factors	Score
Organ –system failure	5
ICU admission	4
Transfusion>3 units,	3
Extended intubation (>12 hour),	2
Surgical intervention (hysterectomy, relaparotomy)	1

### **Organ system failure (WHO: near-miss criteria)**

#### *Cardiovascular dysfunction*

- Shock,
- Cardiac arrest (absence of pulse/ heart beat and loss of consciousness),

- Use of continuous vasoactive drugs,
- Cardiopulmonary resuscitation,
- Severe hypoperfusion (lactate >5 mmol/l or >45 mg/dl), severe acidosis (pH <7.1)

#### *Respiratory dysfunction*

- Acute cyanosis,
- Gaspings,
- Severe tachypnea (respiratory rate >40 breaths per minute),
- Severe bradypnea (respiratory rate <6 breaths per minute),
- Intubation and ventilation not related to anesthesia,
- severe hypoxemia (O<sub>2</sub> saturation <90% for ≥60 minutes or PAO<sub>2</sub>/FiO<sub>2</sub> <200)

#### *Renal dysfunction*

- Oliguria non-responsive to fluids or diuretics, dialysis for acute renal failure,
- Severe acute azotemia (creatinine >300 μmol/ml or >3.5 mg/dl)

#### *Coagulation/haematological dysfunction*

- Failure to form clots,
- Massive transfusion of blood or red cells (>5 units),
- Severe acute thrombocytopenia (<50 000 platelets/ml)

#### *Hepatic dysfunction*

- Jaundice in the presence of pre-eclampsia,
- Severe acute hyperbilirubinemia (bilirubin >100 μmol/l or >6.0 mg/dl)

#### *Neurological dysfunction*

- Prolonged unconsciousness (lasting >12 hours)/coma (including metabolic coma),
- Stroke,
- Uncontrollable fits/status epilepticus,
- Total paralysis

#### *Uterine dysfunction*

- Uterine hemorrhage or infection leading to hysterectomy

Women with complication beyond 42 days of childbirth and non pregnant women with complications were excluded.

Data was entered into a computer database using Microsoft Excel spreadsheet and statistical analysis was performed. Results were presented as frequencies, percentages and descriptive statistics.

Primary outcomes were to evaluate of the associated risk factors of the near miss events.

Secondary outcome was to calculate:

- MNM incidence ratio = maternal near miss cases per 1,000 livebirths (LB). MNMIR=MNM/LB.
- Maternal near miss: mortality ratio= Proportion between maternal near miss cases and maternal deaths. Higher ratio indicates better care.
- Mortality index=Number of maternal deaths divided by the number of women with life threatening conditions, expressed as a percentage.
- Severe maternal outcome ratio (SMOR)=The number of women with life-threatening conditions (MNM + MD) per 1000 live births (LB).

**RESULTS**

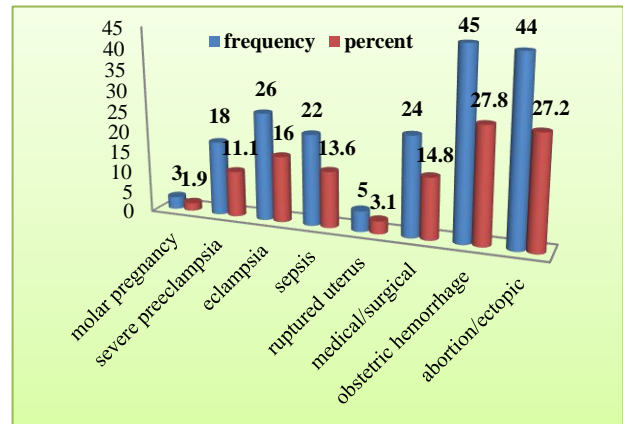
A total of 9,727 deliveries were attended during the study period of 11 months from August 1, 2014 to June 30, 2015.

**Table 2: Secondary outcomes.**

Maternal near miss indicator	Indices	Range
Maternal near miss	162	0-46
Live Birth, LB	9,546	618-21543
Maternal death	16	0-9
Severe maternal outcome rate	18.64	2-16
Near-Miss Rate, NMR	16.6	1.4-16
Mortality Index, MI	0.089	0-0.45
Near-miss per maternal death	10.1 :1	0-12:1
Maternal mortality ratio, MMR	167	0-200

There were 6307 vaginal delivery (71.5%) and 2777 (28.5%) caesarean section and 181 perinatal death with total of 9,546 live birth. Total of 162 near miss were identified and 16 maternal death occurred during the study.

The study showed maternal near miss rate of 16.6 per 1000 livebirth and maternal mortality rate of 167 per 100000 livebirth. Women with life-threatening conditions (WLTC) of 172, Severe maternal outcome ratio of 18.64 per 1000 livebirth, Maternal near-miss mortality ratio (MNM: 1 MD) 10.1:1, Mortality index (MI) of 8.98%.



**Figure 1: Prevalence of risk factors.**

The study showed 27.8% had obstetric hemorrhage as the leading risk factor for the near miss, 27.2% was due to complication of abortion/ectopic, 27.1% of near miss was due to hypertensive disorder of pregnancy (eclampsia and preeclampsia), 14.8% with medical/surgical condition, followed by sepsis 13.6%, then ruptured uterus 3.1%, and least with molar pregnancy, i. e. 1.9%.

**Table 3: Organ dysfunction.**

Risk factor (no.)	Organ dysfunction (%)						
	Cardiovascular	Respiratory	Renal	Coagulation	Hepatic	Neurologic	Uterine
Molar pregnancy (3)	1 (33.3)	1 (33.3)	-	1 (33.3)	-	-	-
Severepreeclamsia (18)	8 (44.4)	8 (44.4)	3 (16.7)	3 (16.7)	-	-	-
Eclampsia (26)	5 (19.2)	12 (46.2)	9 (34.6)	4 (15.4)	3 (11.5)	2 (7.7)	-
Sepsis (22)	11 (50)	8 (36.4)	6 (27.3)	3 (13.6)	3 (13.6)	-	-
Ruptured uterus (5)	1 (20)	1 (20)	-	-	-	-	5 (100)
Surgical/medical (24)	9 (37.5)	4 (16.7)	-	13 (54.2)	3 (12.5)	-	-
Obstetric hemorrhage (24)	30 (66.7)	2 (4.4)	4 (8.9)	16 (35.6)	2 (4.4)	-	6 (13.3)
Ruptured ectopics (44)	28 (63.6)	5 (11.4)	3 (6.8)	11 (25)	1 (2.3)	-	-

Majority of risk factors had cardiovascular dysfunction as leading life-threatening condition. Hypertensive disorder had cardiovascular and respiratory dysfunction as a leading life-threatening condition. Among hemorrhagic

patient cardiovascular dysfunction was followed by coagulation dysfunction.

80% of the near miss patients were referred from other health facility likewise 16.7% had laparotomy within 3

hours of arrival, similarly who came themselves were 9.9% and 9.3% had delivery or abortion before arrival to the hospital.

Table 4 shows nearly 81% of near miss patient were referred from other health facilities and only 9.9% had arrived at the hospital without referral. Rest occurred during their stay at this hospital.

Table 5 shows 51.1% of obstetrics hemorrhagic cases were admitted to ICU, likewise, 95.6% of them received blood products and 71.1% of obstetrics hemorrhagic women were referred from other health facilities.

**Table 4: Condition at arrival in the facility and the referral process (N=162).**

Determination	Frequency
Delivery or abortion occurred before arrival	15 (9.3%)
Laparotomy within 3 hours of arrival	27 (16.7%)
Woman referred from other health facility	131 (80.9%)
Self	16 (9.9%)

**Table 5: Obstetric hemorrhage and its intervention (N=45).**

Obstetric hemorrhage patients	Percentage
ICU admission	51.1
Use of blood products	95.6
Women referred from other health facility	71.1

**Table 6: Prevention of near miss obstetric hemorrhage (N=45).**

Prevention	Frequency	Percentage
Oxytocin	38	84.4
Other Uterotonic	10	22.2
Active management	20	44.4

**Table 7: Treatment of near miss obstetric hemorrhage (N=45).**

Treatment	Frequency	Percentage
Oxytocin	30	66.7
Ergometrine	8	17.8
Misoprostol	25	55.6
Tranexamic Acid	24	53.3
Removal of retained products	7	15.6
Balloon or condom tamponade	1	2.2
Hysterectomy	7	15.6
Other uterotonics	8	17.8

From the Table 6, we observe that 84.4% received Oxytocin for the prevention of obstetric hemorrhage, 22.2% received other uterotonic like methergin,

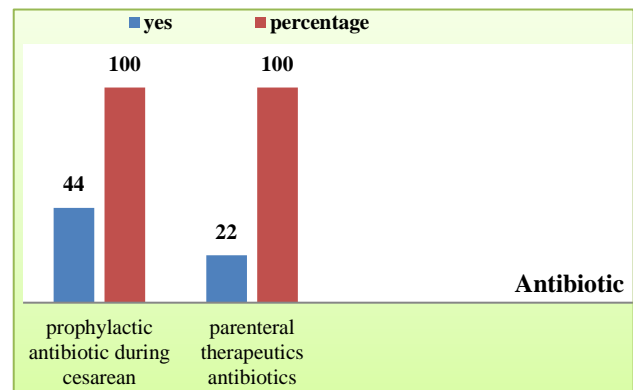
misoprostol for the prevention and 44.4% had active management of third stage of labor.

Oxytocin was the major uterotonic used for the treatment of obstetric hemorrhage in 66.6% of cases, followed by misoprostol, 55.6% and tranexamic acid, 53.3%. 7 patient underwent hysterectomy after failed medical management. One patient (2.2%) received balloon/condom tamponade for the treatment of obstetric hemorrhage and 17.8% had other uterotonics as a treatment.

**Table 8: Anticonvulsant magnesium sulfate (risk factor eclampsia).**

Anticonvulsant	Eclampsia frequency
Magnesium sulphate received	23 (92%)
Magnesium sulphate not received	2 (8%)
Total	25 (100%)

From the Table 8, it shows that 23 (92%) got anticonvulsant (magnesium sulphate) during their treatment and 2 (8%) did not have.



**Figure 2: Prevention and treatment of infection and sepsis.**

This study showed that 100% received prophylactic antibiotics before cesarean section and 100% received parenteral antibiotics therapeutically during the treatment of sepsis. This study had 44 (27%) caesarean section, curettage 26 (16%), laparotomy for ruptured ectopic 21 (13%), laparotomy for ruptured uterus were 5(3.1%). The entire patient had received antibiotic prophylactically before the surgical procedure.

**Table 9: Intensive care (N=162).**

Intensive care	Frequency
Use of blood products	110 (67.9%)
Dialysis	7 (4.3%)
Laparotomy	36 (22.2%)
Admission to ICU	116 (71.6%)

Total number of near miss patient using blood products were 110 i.e. (67.9%), and those who underwent dialysis were 7 i.e. (4.3%), likewise laparotomy was done for 36 i.e. (22.2%), and 116 i.e. (71.6%) had admission to ICU.

Anemia was associated with 19.8% of near miss patient. 5.6% of near miss patient were associated with prolonged/ obstructed labor and 3.1% of near miss had previous cesarean section as associated factors, none of the patient had HIV as associated factors.

**Table 10: Associated factor (N=162).**

Associated factors	Frequency	Percentage
No associated condition	116	71.6
HIV	-	-
Anemia	32	19.8
Previous LSCS	5	3.1
Prolonged/obstructed labor	9	5.6

37% near miss pregnancy ended with vaginal delivery, 27% with caesarean section, likewise curettage 16%, laparotomy for ruptured ectopic 13%, laparotomy for ruptured uterus were 5% and the lowest was women discharged or still pregnant, i.e 3%.

**Table 11: End of pregnancy (N=162).**

End of pregnancy	Frequency
Vaginal delivery	61 (37%)
Cesarean section	44 (27%)
Curettage	26 (16%)
Laparotomy for ectopic pregnancy	21 (13%)
Laparotomy for ruptured uterus	5 (3%)
Women discharged or still pregnant	5 (3%)

## DISCUSSION

In 2011, around 273,465 women died worldwide during pregnancy, childbirth or within 42 days after childbirth.<sup>6</sup> the majority of these women die in low- income countries, and sub-Saharan Africa carries the highest burden, with a maternal mortality ratio (MMR) ranging between 169/100,000 live births in southern sub-Saharan Africa and 478/ 100,000 live births in west sub-Saharan Africa.<sup>6</sup>

The maternal mortality ratio (MMR) in Nepal decreased substantially between 1996 and 2006, from 539 to 281 deaths per 100,000 births (Ministry of Health and Population) [MOHP]. Improvements in maternal health services have been key in reducing the country's MMR. The health care services that a woman receives during pregnancy, childbirth, and the immediate postnatal period are important for the survival and well-being of both the mother and the child.

A total of 9,727 deliveries were attended during this study period from August 1, 2014, to June 30, 2015.

There were 6307 vaginal delivery (71.5%) and 2777 (28.5%) caesarean section and 181 perinatal death with a total of 9,546 live birth. Total of 162 near miss were identified and 16 maternal death occurred during the study. Maternal near miss rate (MNMR) of 16.6 per 1000 live birth and Maternal Mortality Rate (MMR) of 167 per 100000 live birth.

Studies done in the developing countries show the same trend of maternal near miss rate(MNMR) and vary from anywhere between 15–40/1000 live births.<sup>7</sup>

The maternal mortality ratio at our setup was 167/100000 live births. The Brazilian study showed a mortality rate of 260/100000 live births.<sup>8-10</sup> In other developing countries the maternal mortality ratios were in between 423/100000 live births to 324/100000 live births.<sup>11</sup>

In a prospective multicenter surveillance done in Kathmandu valley, there were 41,676 total live births, 157 maternal near-miss cases and 26 maternal deaths during a year of study in the 2012 at nine healthcare facilities with sentinel units with the near-miss rate of 3.8 per 1000 live births.<sup>12</sup> Near miss rate was low as compared to this study.

### Risk factors

This study showed obstetric hemorrhage as the leading risk factor for the near miss i.e. 27.8% followed by hypertensive disorder 27.6% (eclampsia and severe preeclampsia) followed by the complication of abortion/ectopic i.e. 27.2%. Majority of the hemorrhagic patient are postpartum hemorrhage patient attributed to lack of blood product in the periphery.

A study by Shrestha et al in Kathmandu showed hemorrhage 41.66% and hypertensive disorder of the pregnancy 27.77% as leading risk factor for maternal near miss comparable with present study.<sup>9</sup>

A similar study done in Karnataka showed hemorrhage as the leading cause (44.2%), followed by hypertensive disorders (23.6%) and sepsis (16.3%).<sup>13</sup>

Another study in Ile Ife, Nigeria showed severe hemorrhage (41.3%), hypertensive disorders in pregnancy (37.3%), prolonged obstructed labor (23%), septicemia (8.6%) and severe anemia (4.6%) were the direct causes of near miss and this study showed the cause of risk factor comparable with present study.<sup>14</sup>

### Organ dysfunction

Those women who present with organ dysfunction are severely ill and are most likely to benefit from intensive monitoring and care in an ICU. Hence, a high proportion (e.g. Over 70%) of women with severe maternal outcomes are expected to be admitted to an ICU. In this study, Cardiovascular dysfunction i.e. 79 (48.8%) was the



leading life-threatening condition among near miss patients followed by Coagulation dysfunction i.e. 44 (27.2%), Respiratory dysfunction i.e. 39 (24.1%), Renal dysfunction 18 (11.1%), Hepatic dysfunction 8 (4.9%) and least followed by neurologic dysfunction i.e. 4 (2.5%).

Majority of near miss patient admitted in ICU had organ dysfunction, cardiorespiratory the leading organ dysfunction requiring ventilator support or continuous use of vasoactive drugs.

Coagulation dysfunctions were common among hemorrhagic patient owing to the transfusion of more than 5 pints of blood. Majority of the patient were postpartum hemorrhage, or ruptured ectopic pregnancy or incomplete abortion with severe blood loss or due to thrombocytopenia. Thrombocytopenia was either gestational or associated medical illness.

In a study done in Indonesia, vascular dysfunction was by far the most common organ dysfunction (77.7%), followed by cardiac (5.1%) and renal dysfunction (4.5%).<sup>15</sup>

Uterine dysfunction (27%) was the leading organ dysfunction followed by Hematologic. 22% followed by Cardiovascular 21% in a multicentre surveillance in Kathmandu.<sup>12</sup> Another study done in Kathmandu in 2008 showed vascular dysfunction 16% as a major dysfunction.<sup>9</sup>

#### **Standard of care and process indicator**

Oxytocin was the main uterotonic used both prophylactically and therapeutically. MgSO<sub>4</sub> was used in all cases of eclampsia. All laparotomies were performed within three hours of arrival. 88.2% of the hemorrhagic patient received Oxytocin as a treatment. 11.7% of the hemorrhagic patient received other than Oxytocin as a treatment adjusting remaining patient either aborted or delivered before arrival. 80% of the hemorrhagic patient received Oxytocin prophylactically. 17.3% received prophylactic antibiotics and 84% received parenteral antibiotics among the near miss patient.

Study done in Kathmandu showed Oxytocin administered in 86% (104 in 121) for prevention and 76% (92 in 121) for treatment of PPH.<sup>12</sup>

#### **Associated factors**

Anemia was associated with 19.8% of near miss patient. 5.6% of near miss patient were associated with prolonged/ obstructed labor and 3.1% of near miss had a previous cesarean section as associated factors, none of the patients had HIV as associated factors.

In African countries, anemia was one of the associated factors in near miss event, and anemia was likely due to

the prevalence of malaria. In present context, anemia was likely due to nutritional or secondary to blood loss following antepartum /postpartum hemorrhage or due to the complication of ectopic or abortion.

Limitation of study was that the study was a prospective observational study done for a period of 11 months. The risk factors were predefined by WHO and were evaluated. Had the study been comparative case control study then risk factors of near miss could have been correctly identified in our setup. Although this study did not specifically address avoidable factors, it has nevertheless raised awareness of the shortcoming of the management of serious maternal illnesses.

#### **CONCLUSION**

Any pregnant woman can develop life threatening complications with little or no advance warning. All women need access to quality maternal health services that can diagnose and manage life-threatening complications. This study highlights obstetric hemorrhage as the most common serious obstetric complication leading to near-miss event followed by hypertension during pregnancy. Evaluation of associated risk factor can be the potential tool for reduction of maternal morbidity and mortality in Nepal.

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