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Original Article

Study of Who Maternal Near Miss Using Organ Dysfunction to Predict Maternal Outcome

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ABSTRACT

Background and Aims: The objective of this study was to determine maternal near miss frequency and maternal near miss to mortality ratio by using organ dysfunction criteria to analyze the trends of maternal near miss and to compare the nature of near miss events with that of maternal mortality.

Methodology: The study was conducted during July 2021 – December 2021 on all the maternal near miss cases who were admitted in Sultania Zanana Hospital. The cases of "near miss" were compared to maternal death using organ dysfunction.

Results: During our study period, total number of obstetric admissions were 8667 out of which maternal near miss cases were 500 and so incidence of maternal near miss was 5.76%. Cardiovascular (30.38%) and Respiratory organ dysfunction (33.87%) were maximum which were responsible for maternal near miss. The maternal near miss: mortality ratio was 7.8.

Conclusion: In this study, we used WHO criteria which cover almost all possible organ systems which can be affected secondary to any pregnancy-related complications. The WHO criteria for maternal near miss showed to be able to identify all cases of death and almost all cases of organ failure. Therefore, they allow evaluation of the severity of the complication and consequently enable clinicians to build a plan of care or to provide an early transfer for appropriate reference centers.

Key Words: *WHO Maternal near miss, organ dysfunction, maternal mortality*

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INTRODUCTION

Maternal mortality (MM) is frequently described as "Just the Tip of The Iceberg" alluding that there is a vast base to the iceberg in the form of maternal near miss (MNM) i.e., maternal morbidity which has remained largely undescribed. [1]

Maternal near miss (MNM) is a condition in which a woman nearly dies from complications of pregnancy or child-birth within 42 days of termination of the pregnancy regardless of location or duration, but survives either due to the care she receives or due to chance. Maternal near miss is more valuable indicator for analysis of obstetric care than maternal mortality[2].

WHO has published 25 clinical, laboratory and management-based markers for organ dysfunction called the WHO near miss criteria (WHO NM criteria) to identify Maternal Near Miss. The total number of criteria present in a woman is the "maternal severity score" (MSS).

The most vital purpose of the near-miss approach is to improve clinical practice and reduce preventable morbidity and mortality through the use of best evidence-based practice[3].

METHODOLOGY

It is an observational study that was conducted in obstetric patients fulfilling the near miss criteria admitted in Sultania Zanana Hospital, Bhopal for a period of 18 months. All near miss patients were analysed using organ dysfunction crtieria and followed up till final outcome (near miss or death). The maternal as well as fetal outcome were studied in such patients. The patterns of maternal near miss and also the nature of near miss events with that of maternal mortality were studied.

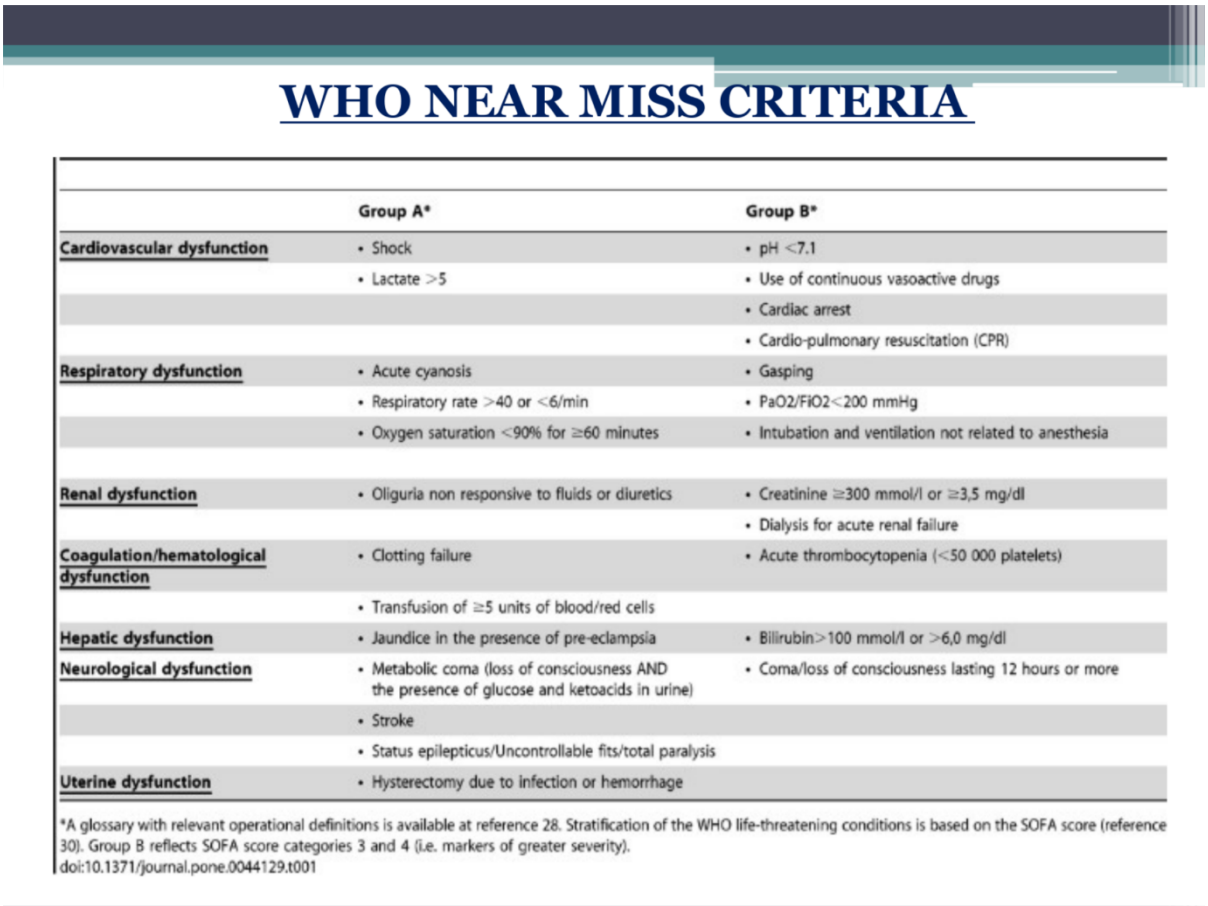
Inclusion Criteria

- All morbid patients (near miss obstetric patients) getting admitted in Sultania zanana hospital for a period of 18 months were studied.

- Willing to give written consent to participate in the study (in case of minor <18 years parents/guardians should be willing to give written informed consent).

Exclusion Criteria:
- All patients who are not fulfilling the near miss criteria
- Those who are not willing to give written informed consent.

Statistical Analysis Plan:
- Continuous variables were summarized using descriptive statistics such as mean, standard deviation, median, minimum and maximum. Categorical variables will be summarized for the study cohort.
- Subject disposition, demographic and baseline characteristics were summarized for the study cohort.
- MSI Calculator was used to calculate MSI and MSS.
- SPSS 20 and Medcalc 19.5 software's were used for statistical analysis.



WHO NEAR MISS CRITERIA

	Group A*	Group B*
Cardiovascular dysfunction	• Shock	• pH <7.1
	• Lactate >5	• Use of continuous vasoactive drugs
		• Cardiac arrest
		• Cardio-pulmonary resuscitation (CPR)
Respiratory dysfunction	• Acute cyanosis	• Gasping
	• Respiratory rate >40 or <6/min	• PaO2/FiO2<200 mmHg
	• Oxygen saturation <90% for ≥60 minutes	• Intubation and ventilation not related to anesthesia
Renal dysfunction	• Oliguria non responsive to fluids or diuretics	• Creatinine ≥300 mmol/l or ≥3,5 mg/dl
		• Dialysis for acute renal failure
Coagulation/hematological dysfunction	• Clotting failure	• Acute thrombocytopenia (<50 000 platelets)
	• Transfusion of ≥5 units of blood/red cells	
Hepatic dysfunction	• Jaundice in the presence of pre-eclampsia	• Bilirubin>100 mmol/l or >6,0 mg/dl
Neurological dysfunction	• Metabolic coma (loss of consciousness AND the presence of glucose and ketoacids in urine)	• Coma/loss of consciousness lasting 12 hours or more
	• Stroke	
	• Status epilepticus/Uncontrollable fits/total paralysis	
Uterine dysfunction	• Hysterectomy due to infection or hemorrhage	

*A glossary with relevant operational definitions is available at reference 28. Stratification of the WHO life-threatening conditions is based on the SOFA score (reference 30). Group B reflects SOFA score categories 3 and 4 (i.e. markers of greater severity).
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RESULTS:

TABLE 1: Incidence of maternal near miss patients among total number of obstetric admissions

Total number of obstetric admissions during the study period	Total maternal near miss cases among obstetric admission	Incidence of Maternal near miss
8667	500	5.76%

Total number of obstetric admissions in Sultania Zanana Hospital during study period were 8667. Total 500 maternal near miss cases were observed during the study period. Incidence of maternal near miss in our study during the study period was found to be 5.76%.

Table 2A: Frequency distribution of Causes of Maternal Near-Miss as per organ dysfunction

S.no.	Causes of Maternal near miss as per organ dysfunction	No.	%
1.	Cardiovascular dysfunction	243	30.38
2.	Coagulation dysfunction	174	21.75
3.	Hepatic dysfunction	39	4.88
4.	Respiratory dysfunction	271	33.87
5.	Neurological dysfunction	25	3.12
6.	Renal dysfunction	18	2.25
7.	Uterine dysfunction	30	3.75

TABLE2B: Frequency distribution of Causes of Maternal Near-Miss- multiple organ

Causes of Maternal near miss multiple organ wise	No.	%
Cardiovascular dysfunction	77	15.4
Cardiovascular dysfunction, coagulation dysfunction	67	13.4
Cardiovascular dysfunction, coagulation dysfunction, Hepatic dysfunction	11	2.2
Cardiovascular dysfunction, coagulation dysfunction, Respiratory dysfunction	32	6.4
Cardiovascular dysfunction, Respiratory dysfunction	27	5.4
Cardiovascular dysfunction, Respiratory dysfunction ,Uterine dysfunction	22	4.4
Cardiovascular dysfunction, Uterine dysfunction	7	1.4
Coagulation dysfunction	36	7.2
Coagulation dysfunction, Hepatic dysfunction	12	2.4
Coagulation dysfunction, Hepatic dysfunction, Respiratory dysfunction	04	0.8
Coagulation dysfunction, Respiratory dysfunction	12	2.4
Hepatic dysfunction, Neurological Dysfunction	12	2.4
Neurological dysfunction	01	0.2
Neurological dysfunction, renal dysfunction	05	1.0
Neurological dysfunction, Respiratory dysfunction	7	1.4
Respiratory dysfunction	155	31
Respiratory dysfunction, renal dysfunction	12	2.4
Uterine dysfunction	01	0.2
Total	500	100.0

TABLE2C: Frequency distribution of Causes of Maternal near miss as per WHO criteria

	MNM as per WHO Criteria	No.	%
CVS	Shock	194	38.80
	Lactate >5	4	0.80
	Use of continuous vasoactive drugs	40	8.00
	Cardiac arrest	5	1.00
CS	Acute thrombocytopenia 50 000 platelets	84	16.80
	Transfusion of>5 units of blood red cells	60	12.00
	Clotting failure	107	21.40
HS	Jaundice in the presence of pre-eclampsia	29	5.80
	Bilirubin >6 0 mg/dl	10	2.00
RS	Oliguria non responsive to fluids or diuretics	20	4.00
	Creatinine > 3.5mg/dl	20	4.00
NS	Status epilepticus Uncontrollable fits total paralysis	15	3.00
	Metabolic coma	10	2.00
ReS	Respiratory rate>40 or < 6 breaths per minute	217	43.40
	Oxygen saturation <90% for >60 minutes	198	39.60
	PaO2/FiO2<200 mmHg	15	3.00
US	Uterine dysfunction	30	6.00

Tables (2A, 2B &2C) depict various causes responsible for Maternal Near-Miss with multiple WHO criteria-group involvement, which were responsible for Maternal near miss. Among the WHO criteria, we observed 17. In CVS, shock (38%) was in majority followed by Use of continuous vasoactive drugs (8%), Cardiac arrest (5%) and Lactate >5 (0.8%) were observed. In coagulation dysfunction, clotting failure (21%) was in majority followed by Acute thrombocytopenia (16.8%) and Transfusion of>5 units of blood red cells (12%) were present. In hepatic dysfunction, Jaundice in the presence of pre-eclampsia (5%) was in majority whereas Bilirubin level >6.0 mg/dl was in 2%. In renal dysfunction, Oliguria non responsive to fluids or diuretics and Creatinine > 3.5mg/dl were in equally proportion (4%). In neurological system, Status epilepticus/Uncontrollable fits/total paralysis and metabolic coma were in 3% and 2% respectively. In respiratory dysfunction, Respiratory rate>40 or < 6 breaths per minute (43.4%) was present prominently whereas Oxygen saturation <90% for >60 minutes and PaO2/FiO2<200 mmHg was 39.6% and 3.0% respectively. Uterine dysfunction was observed in 6%.

TABLE**3: Maternal near miss to mortality ratio**

Total number of maternal near miss cases observed in the study	Total number of maternal deaths	Maternal near miss to mortality ratio obtained in the study
500	64	7.8

Table4: Relationship between maternal deaths and severity markers (WHO criteria) -Cardiovascular dysfunction

Cardiovascular dysfunction	**Maternal Death**			
		Yes	**No**	
Shock	Yes	35	29	64 (12.8%)
	No	159	277	436 (87.2%)
Lactate.5	Yes	4	60	64 (12.8%)
	No	0	436	436 (87.2%)
Use of continuous vasoactive drugs	Yes	10	54	64 (12.8%)
	No	30	406	436 (87.2%)
Cardiac arrest	Yes	0	64	64 (12.8%)
	No	5	431	436 (87.2%)
Cardio pulmonary resuscitation CPR	Yes	64	0	64 (12.8%)
	No	436	0	436 (87.2%)

Table 5: Relationship between maternal deaths and severity markers (WHO criteria) - Respiratory dysfunction

Respiratory dysfunction	**Maternal Death**			
		Yes	**No**	
RS Respiratory rate 40 or 60 min	Yes	30	34	64 (12.8%)
	No	253	183	436 (87.2%)
RS Oxygen saturation 90% for $60 minutes	Yes	39	25	64 (12.8%)
	No	263	173	436 (87.2%)
RS Intubation and ventilation not related to anesthesia	Yes	0	64	64 (12.8%)
	No	0	436	436 (87.2%)
RS PaO2 FiO2 200 mmHg	Yes	59	5	64 (12.8%)
	No	426	10	436 (87.2%)

Table 6: Relationship between maternal deaths and severity markers (WHO criteria) - Renal dysfunction

Renal dysfunction	**Maternal Death**			
		Yes	No	
RS Oliguria non responsive to fluids or diuretics	Yes	5	59	64 (12.8%)
	No	15	421	436 (87.2%)
RS Creatinine $300 mmol l or$ 3 5 mg d	Yes	5	59	64 (12.8%)
	No	15	421	436 (87.2%)
RS Dialysis for acute renal failure	Yes	0	64	64 (12.8%)
	No	0	436	436 (87.2%)

Table 7: Relationship between maternal deaths and severity markers (WHO criteria) - Coagulation/hematological dysfunction

Coagulation/hematological dysfunction	Maternal Death			
		Yes	No	
CS Acute thrombocytopenia 50 000 platelets	Yes	29	35	64 (12.8%)
	No	55	381	436 (87.2%)
CS Transfusion of $ 5 units of blood red cells	Yes	20	44	64 (12.8%)
	No	40	396	436 (87.2%)
CS Clotting failure	Yes	19	45	64 (12.8%)
	No	88	348	436 (87.2%)

Table 8: Relationship between maternal deaths and severity markers (WHO criteria) - Hepatic dysfunction

Hepatic dysfunction	Maternal Death			
		Yes	**No**	
HS Jaundice in the presence of pre eclampsia	Yes	9	55	64 (12.8%)
	No	20	416	436 (87.2%)
HS Bilirubin. 100 mmol l or.6 0 mgd	Yes	5	59	64 (12.8%)
	No	5	431	436 (87.2%)

Table 9: Relationship between maternal deaths and severity markers (WHO criteria) - Neurological dysfunction

Neurological dysfunction	Maternal Death			
		Yes	**No**	
NS Status epilepticus Uncontrollable fits total paralysis	Yes	59	5	64 (12.8%)
	No	426	10	436 (87.2%)
NS Metabolic coma	Yes	59	5	64 (12.8%)
	No	431	5	436 (87.2%)

Table 10: Relationship between maternal deaths and severity markers (WHO criteria) - Uterine dysfunction

Uterine dysfunction	Maternal Death			
		Yes	**No**	
Hysterectomy due to infection or hemorrhage	Yes	59	5	64 (12.8%)
	No	411	25	436 (87.2%)

DISCUSSION

During our study period, 500 patients were maternal near miss, and 64 were maternal deaths.

INCIDENCE OF MATERNAL NEAR MISS

TABLE 11: Showing incidence of maternal near miss compared with other authors

During our study period, total number of obstetric admissions were 8667 out of which maternal near miss cases were 500 and so incidence of maternal near miss was 5.76%. Our results were in accordance with the results reported by Owolabi et al [8] (7.2%). Slightly higher pooled incidence was reported by Oppong et al [5] (34.2%) and by Yemane et al [4] (24.85%).

S.no.	Author	Incidence
1.	Yemane et al[4]	24.85%
2.	Oppong et al[5]	34.2%
3.	Chikadaya et al[6]	0.9%
5.	Dias et al[7]	10.21%
6.	Owolabi et al[8]	7.2 %

Table 12: showing comparison of frequency distribution of causes of maternal near miss as per organ dysfunction among various studies

S.no.	Authors	Organ dysfunction with %	
1.	Akker et al[9]	CVS Coagulation Hepatic Respiratory Neurological Renal Uterine	32% 4% 14% 16% 9% 1% 23%
2.	Shrestha et al[10]	CVS Coagulation Hepatic Respiratory Neurological Renal Uterine	5% 12.5% 2.5% 17.5% 27.5% 5% 10%
3.	Souza et al[11]	CVS Coagulation Respiratory	49.4% 27.5% 30.4%
4.	Chhabra et al[12]	Coagulation Respiratory Neurological Uterine	62% 22% 14% 22%
5.	Pandit et al[13]	Coagulation Respiratory Hepatic	72.4% 50% 41.4%

In our study, among organ specific criteria, cardiovascular (30.38%) and respiratory (33.87%) were in majority which were responsible for maternal near miss, followed by coagulation (21.75%), uterine (3.75%), hepatic (4.88%), neurological (3.12%), and renal dysfunction (2.25%). Partially similar to our findings, Pandit et al. [13] observed, hematological/coagulation (72.4%) followed by respiratory (50%) and hepatic (41.4%) dysfunction were the three most frequent organ dysfunctions seen in near miss patients, respectively.

Coagulation and hypertensive disorders were the most common disease conditions in both severe maternal morbidity and near-miss cases, in a study reported by Chhabra et al.[12] They reported coagulation dysfunction (62%) was the most common cause of maternal near miss followed by uterine (22%), respiratory (22%) and neurological dysfunction (14%) and are in partially line with our study. Similarly in other study, the three medical conditions that were most commonly responsible for near-miss events across all the cases were hypertensive disorders of pregnancy (472[53.4%]), severe anemia (185 [20.9%]), and postpartum hemorrhage (68 [7.7%]). In Other studies, maternal mortality and morbidity is mainly due to hypertension and hemorrhage.

Likewise Souza et al.[11] from their study concluded that CVS (49.4%), respiratory (30.4%) and coagulation (27.5%) disorders were the most frequent organ dysfunctions found in mothers with severe maternal outcome (NM and maternal deaths), similar to the observations of our study.[18] Overall it can be considered that cardiovascular and coagulation system dysfunction are the main cause of MNM.

The findings and related criteria to different studies are reported in these tables, who observed different causes of MNM which are partially similar to our findings.

Table 13: Comparison of subjects according to Maternal near miss to mortality ratio

S.No.	Author	Maternal near miss: Mortality ratio
1.	Herklots et al[14]	3.24
2.	Wasim et al[15]	10.25
3.	Teka et al[16]	6.08
4.	Mbachu et al[17]	11.4
5.	**Roopa et al[18]**	5.6

In present study, our maternal near miss: mortality ratio was 7.8, which was similar to Teka et al [16] (6.08) and Roopa et al [18] (5.6). Mbachu et al [17] (11.4) and Wasim et al [15] (10.25) reported slightly higher findings.

CONCLUSION

Countries with low income like India, despite an increase in institutional births and regular antenatal check-ups, suffer the greatest burden of maternal death and illness with many women receiving no prenatal care and this expose them to a number of obstetric problems.

And so, studying maternal near miss cases are being recognized as an important tool to examine the quality of obstetric care. WHO initiated this process where it agreed on a definition and also formulated a uniform case identification criterion to improve the quality of obstetric care.

Implementing maternal near miss concept practically provide important clues to improve maternal health and reduce maternal deaths and hence improve the quality of obstetric care.

Maternal near-miss instances can be identified using any WHO criteria of pregnancy-related life-threatening problems, as these problems are consistently connected with maternal mortality.

Most studies conducted in developed countries report similar maternal outcomes although the complications are less frequent and maternal death is rare. It is difficult to compare the occurrence of maternal outcomes reported in the developed countries to those in low and middle income or developing countries like India because of differences in criterion used to define near miss.

In this study, we used WHO criteria which cover almost all possible organ systems which can be affected secondary to any pregnancy-related complications. The WHO criteria for maternal near miss showed to be able to identify all cases of death and almost all cases of organ failure. Therefore, they allow evaluation of the severity of the complication and consequently enable clinicians to build a plan of care or to provide an early transfer for appropriate reference centers.

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