Maternal Near Miss Indicators and Analysis of Maternal Near Miss Cases in a Tertiary Care Center over a Period of One Year

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Abstract:

Background: The World Health Organization (WHO) defines the criterion of severe maternal morbidity or Maternal Near Miss (MNM) as a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within six weeks after pregnancy. Having in thought the diversity in distribution of MNM cases among several states in India, there was a curious insight to conduct a survey pertaining to the prevalence/incidence of MNM cases, to study the criteria used for identification, to tabulate and analyse the causes of MNM cases and to decode the various contributory factors such as personal/family, socio economical and administrative problems responsible for the occurrence of MNM cases in a tertiary care center.

Aims: 1) To calculate the incidence of MNM cases in the tertiary care hospital. 2) To derive the indicators pertaining to maternal nearmiss for the institution. 3) To analyse the causes contributing to MNM with respect to age, parity and timing of delivery in the hospital.

Settings and Design: This study was carried out in the dept of Obstetrics and Gynecology of Govt. Karur Medical College Hospital in Karur district of Tamilnadu, India, from Jan 2023 to Dec 2023 as a research work.

Materials and Methods: A Maternal Near Miss Register, which is already maintained is utilised for the purpose of collection of data. In this register, all the details pertaining to the near miss cases are entered precisely and accurately so as to provide all necessary information for the study. At the end of the year, the register is consolidated and the same process performed for the entire year. Number of Live birth and maternal mortality were obtained to calculate the Near Miss Indicators, and the results are published in the form of this article.

Results and Conclusion: The study reveals that there were a total of 76 MNM cases identified in the tertiary care center over a period of 12 months from January to December of 2023. On deriving at the MNM Incidence ratio, live births being 3936 births, the ratio tends to be 19.3 per 1000 live births. Also, the MNM Mortality ratio as calculated, maternal mortality for the year being 3 cases, the ratio tends to be 25.3 : 1. Formulating the causes for MNM, Haemorrhage is the leading cause, followed by Eclampsia, in similarity with the worldwide statistics. This institution handles a load of MNM cases, and provides lifesaving care.

Keywords: Maternal near miss, Mortality, Indicators.

Introduction

The World Health Organization (WHO) defines the criterion of severe maternal morbidity or Maternal Near Miss (MNM) as a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within six weeks after pregnancy [2].

MNM is gaining more importance as maternal mortality ratio (MMR) for 2018-2020 in India is reduced to 97/100,000 live births (LB) as compared to 130/100,000 live births in 2014-16, declining by 33 points. Kerala is the only state to achieve a maternal mortality rate less than 1 (0.9). The other well performing states in that order are Maharashtra (1.8), Telengana (2.3), Andhra Pradesh (2.4) amd Tamilnadu (2.7). Ministry of Health and Family Welfare, Government of India (GOI), released MNM guidelines in December 2014 [1,2,8].

Having in thought the diversity in distribution of MNM cases among several states in India, there was a curious insight to conduct a survey pertaining to the prevalence/incidence of MNM cases, to study the criteria used for identification2, to tabulate and analyse the causes of MNM cases and

to decode the various contributory factors such as personal/family, socio economical and administrative problems responsible for the occurrence of MNM cases in a tertiary care center. The results from this study by any means shall pave a way towards identifying the modifiable factors, and to recommend corrective actions, if there are any, to be taken.

Aims and Objectives

1. To calculate the incidence of MNM cases in the tertiary care hospital
2. To derive the indicators pertaining to maternal nearmiss for the institution.
3. To analyse the causes contributing to MNM with respect to age, parity and timing of delivery in the hospital.

Review of Literature

The "Operational Guidelines for Maternal Near Miss Review" released by Ministry of Health and Family Welfare (MoHFW), Govt of India in December 2014 defines maternal near miss and criteria for MNM and various indicators of MNM and register for documentation and notification of MNM[8]. This study utilizes the register maintained in the institution as per MoHFW guidelines for streamlining and analysis of MNM cases.

World Health Organization Regional Office for Europe's "Conducting a Maternal Near-Miss Case Review Cycle at the Hospital Level" Manual with Practical Tools 2016 defines the relation between maternal mortality and MNM, rates of various countries and the role of MNM reviews in reducing and preventing maternal mortalities nation-wise, thereby throughout the world [2]. Ragini Kulkarni, Harshal Kshirsagar et al, in their article on "Maternal Nearmiss events in India", state that the incidence of MNM cases varied widely from 3.9 to 379.5 per 1000 live births and 7.6 to 60.4 per 1000 deliveries. MNM: Maternal death varied from 1.7:1 to 21.8:1 throughout India [3].Pragti Chhabra In the study "Maternal Near Miss: An indicator for Maternal Health and Maternal Care" states that

Haemorrhage, hypertensive disorders, sepsis and obstructed labour are the leading causes of maternal near miss in that order of decreasing frequency in developing countries like India, where Haemorrhage contributed to more than 30% of MNM cases [4].

Deepthi Gupta, Arnab Nandi, et al in their study " Incidence of maternal nearmiss and mortality cases in central India tertiary care centre and evaluation of various causes" have identified that among the causes of nearmiss, haemorrhage was the leading cause, followed by pre eclampsia and sepsis [5].

Materials and Methods

This study is conducted in a tertiary care hospital in Tamilnadu, in the district of Karur, at Government Karur Medical College Hospital, over a period of one year, from January 2023 to December 2023. A Maternal Near Miss Register, which is already maintained is utilised for the purpose of collection of data. In this register, all the details pertaining to the nearmiss cases are entered precisely and accurately so as to provide all necessary information for the study, including the name, age, address, contact number, area, RCH identification number, co morbidities, course in hospital, diagnosis, discharge and follow up.

WHO criteria is used for inclusion of cases in the study. At the time of discharge, every patient is informed about the use of data for study purpose, and consent is obtained. At the end of every month, the total number of nearmiss cases, break up of causes MNM review and audit meetings were conducted and documented.

At the end of the year, the register is consolidated and the same process performed for the entire year. Number of Live birth and maternal mortality were obtained to calculate the Near Miss Indicators, and the results are published in the form of this article. The cases identified as near miss were grouped according to the WHO near miss grouping as depicted in Fig 2.

BOX 40-e1 — The WHO Maternal Near-Miss Criteria

CLINICAL CRITERIA
- Acute cyanosis
- Gasping[a]
- Respiratory rate > 40 or < 6/min
- Shock[b]
- Oliguria nonresponsive to fluids or diuretics[c]
- Clotting failure[d]
- Loss of consciousness lasting ≥ 12 hours[e]
- Loss of consciousness *and* absence of pulse/heart beat
- Stroke[f]
- Uncontrollable fit/total paralysis[g]
- Jaundice in the presence of preeclampsia[h]

LABORATORY-BASED CRITERIA
- Oxygen saturation < 90% for ≥ 60 minutes
- PaO_2/FIO_2 < 200 mm Hg
- Creatinine ≥ 300 μmol/L or ≥ 3.5 mg/dL
- Bilirubin > 100 μmol/L or > 6.0 mg/dL
- pH < 7.1
- Lactate > 5
- Acute thrombocytopenia (< 50,000 platelets)
- Loss of consciousness *and* the presence of glucose and ketoacids in urine

MANAGEMENT-BASED CRITERIA
- Hysterectomy after infection or hemorrhage
- Use of continuous vasoactive drugs[i]
- Transfusion of ≥ 5 units of red blood cells
- Intubation and ventilation for ≥ 60 minutes not related to anesthesia
- Dialysis for acute renal failure
- Cardiopulmonary resuscitation

Figure 1: Who Nearmiss 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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Figure 2: Who Nearmiss Groups

Near Miss Indicators:

The following near miss indicators were calculated by using the equations mentioned against them [7]

1. Maternal near miss incidence ratio: (per 1000 live births)

Total no. of near miss cases x1000

Total live births

2. Maternal near miss- Mortality Ratio:

Total no. of near miss cases

Total no. of maternal mortalities

Statistical Analysis

1. Total no. of MNM cases : 76 cases
2. Month-wise distribution of MNM cases:

Table 1:

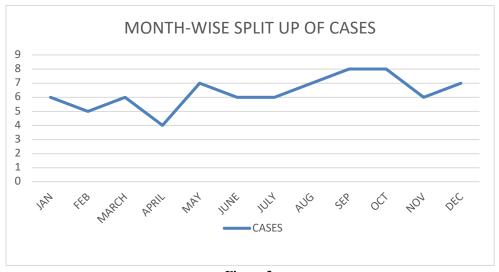| Month	No. Of Cases	Month	No. Of Cases
January	6	July	6
February	5	August	7
March	6	September	8
April	4	October	8
May	7	November	6
June	6	December	7
July	6	**Total**	**76**

Figure 3:

MNM Incidence Ratio:
MNM Incidence Ratio=

$$\text{MNM Incidence Ratio} = \frac{76}{3936} \times 1000 = 19.3 \text{ per 1000 live births}$$

MNM Mortality Ratio:

MNM Morality Ratio= 76/3 = 25.3

Table 2: Age distribution:

Age group(yrs)	No of cases
15-20	7
21-25	28
26-30	21
31-35	18
36-40	2
Total	**76**

The above table shows that the number of MNM cases in the age group of 21 to 25 years is significantly higher.

Table 3: Parity Distribution:

Parity	No of Cases
Para 1	18
Para 2	26
Para 3	29
Para 4 and more	3
TOTAL	**76**

The above table shows that there is a significant number of MNM cases in P2 and P3

Table 4: Socioeconomic Status

SES Class	No of Cases
I	0
II	0
III	6
IV	34
V	36
TOTAL	**76**

The above table shows that, in the institution, the MNM cases are cumulated in the lower SES groups.

Table 5: Geographic distribution

Area	No of Cases
Urban	34
Rural	42
Total	**76**

The above table shows that there is no significant difference in the incidence of MNM cases between urban and rural population.

Table 6: Association with Other Comorbidities:

Comorbidities	No. of cases
Obesity	12
Thyroid disorders	34
Anaemia	42
Thrombocytopenia	22
Diabetes	8
Hypertension	21
Heart disease	9
Tuberculosis	2
None	4

The above table shows that only 4 (significantly lower) of the MNM cases are without any comorbidities. And the most prevalent comorbidity being anaemia, and some of the MNM cases had multiple comorbidities.

Table 7: Timing of MNM with respect to admission:

Timing of MNM	No of Cases
At admission	27
After admission	49
Total	**76**

Significant number of cases became nearmiss after admission

Table 8: Timing of MNM with respect to Parturition

Timing of MNM	No of Cases
Antepartum	14
Intrapartum	40
Postpartum	22
TOTAL	**76**

Table 9: Causes of nearmiss Vs Parturition

Timing	Cause	No of cases	Total
Antepartum	AP Eclampsia	13	14
	Pulmomary edema	1	
Intrapartum	PPH	40	40
Postpartum	PP eclampsia	10	22
	Pulmonary edema	1	
	Secondary PPH	1	
	Sepsis	8	
	PPCM	2	
Total			76

Table 10: Causes of MNM

Causes	No of cases	Percentage
AP Eclampsia	13	18
Pulmomary edema	2	2
PPH	41	54
PP eclampsia	10	14
Sepsis	8	10
PPCM	2	2
Total	76	100

Table 11: Age Vs Causes

Age group(yrs)	Causes	No. cases	No of cases
15-20	AP eclampsia	4	7
	PPH	3	
21-25	AP Eclampsia	5	28
	PPCM	1	
	PPH	14	
	PP Eclampsia	2	
	Pulmonary edema	1	
	Sepsis	5	
26-30	AP Eclampsia	1	21
	Pulmonary edema	1	
	PP eclampsia	5	
	PPH	11	
	Sepsis	3	
31-35	AP Eclampsia	2	18
	PPH	12	
	PPCM	1	
	PP eclampsia	3	
36-40	AP eclampsia	1	2
	PPH	1	
Total		76	76

Discussion

The study reveals that there were a total of 76 MNM cases identified in the tertiary care center over a period of 12 months from January to December of 2023.

On deriving at the MNM Incidence ratio [7], live births being 3936 births, the ratio tends to be 19.3 per 1000 live births, which is on par with the Indian statistics (3.9 to 397.5)3 according to the article by Kulkarni et al., in their article "Maternal near-miss events in India". Also, the MNM Mortality ratio as calculated, maternal mortality for the year being 3

cases, the ratio tends to be 25.3:1, which is a very significantly higher ratio as compared to Indian standards as depicted by Kulkarni et al., [3] With the month-wise distribution of MNM cases, it was identified that there were highest cases (8) recorded in the months of September and October, whereas least number of cases (5) in the month of April. Comparing the age-wise distribution of MNM cases, the age group of 21 to 25 years records the highest variable; say 28 cases, followed by the next tier, 26 to 30 years, with 21 cases, and the least being 36 to 40 years, with only 2 MNM cases. And the number of MNM cases in teenage group, ie., 16

to 20 years were 7, which is high in proportion as compared to the less number of total cases in that age group. Even though the recording was 28 cases in the age group of 21 to 25 years, the proportion of MNM in that age group is less, as there were many live births in that group. This represents a paradoxical condition in the age wise distribution of MNM cases, and clearly indicates that the extremes of age is more prone for being MNM cases, owing to increasing obstetric complications [2].

As the socio-economic class gets lower, the number of MNM cases is in an increasing trend in this study, which is in line with study by Deepti Gupta et al, [5]. Also, with increase in parity, the number of MNM cases is in an increasing trend, again in accordance with the above study [5]. There was no significant difference in the incidence of MNM between mothers residing at urban and rural areas of the district.

While glancing through the association with other co morbidities, Anaemia was the highest associated, showing a direct as well as indirect association with MNM cases. Following anaemia were hypothyroidism and hypertensive disorders of pregnancy although their direct association is not significantly proven,

Regarding the timing of becoming MNM, 49 cases (67%) were not MNM at admission, but turned into a nearmiss case after admission in the center, whereas only 27 (33%) cases were already MNM at the time of admission. Again, 40 patients became MNM during labour, all were due to Postpartum Haemorrhage, 22 cases became MNM in postpartum period, causes being PP Eclampsia, Sepsis, PPCM, Pulmonary edema in decreasing order of frequency. During antepartum period, 14 mothers were MNM, and AP eclampsia contributed to (13 cases) 99.2%, and pulmonary edema (1 case) contributed to 0.8%.

Analysing the causes of MNM, in correlation with WHO criteria, Postpartum haemorrhage was the leading cause of MNM, almost 54% of all cases, followed by Eclampsia , AP and PP eclampsia surmounting to 32%, followed by Sepsis accounting to 10%, and Peripartum Cardiomyopathy and Pulmonary edema making up 2% each. The above observation goes in accordance with the study by Deepti Gupta et al, [5] and WHO manual 20162, and further other studies [1,3,4].

 Deciphering and cross analysing the age Vs causes of MNM, AP eclampsia and PPH were the only causes in the extreme age groups, whereas in the middle age groups, PPH was the leading cause, followed by Eclampsia and sepsis, just simulating the overall population.

Conclusion:

From all the observed and the derived values from this study, this institution handles a medium load of MNM cases, with MNM incidence of 19.3 per 1000 live births, and renders a critical and lifesaving care, which is depicted by the very high MNM Mortality ratio of 25.3 : 1. Also, formulating the causes for MNM, Haemorrhage is the leading cause, followed by Eclampsia, in similarity with the worldwide statistics.

As this institution is the only tertiary care center for the entire district, and handles most of the high-risk Obstetric cases, the statistics of this institution can be extrapolated and considered a near-equivalent statistics of the district.

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