Original Article

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Maternal Near Miss Events in Tertiary Care Hospital: A Retrospective Observational Study

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: Over the years, continuous efforts have been made for improving reproductive health status of women. In India, Ministry of Health and Family Welfare (MoHFW) has set Maternal Near Miss (MNM) review operational guidelines.

Aim: To analyse the incidence and causes of MNM cases in tertiary care hospital.

Materials and Methods: This retrospective observational study was undertaken at a tertiary care hospital from January 2010 to September 2018. MNM cases were identified according to the criteria given by MoHFW, MNM review operational guidelines. Following parameters (variables) were noted viz., age, parity, obstetric haemorrhage, severe anaemia, sepsis, therapeutic interventions, etc., and were analysed. Quantitative data was analysed by calculating means, ratios and proportions, using Statistical Package for the Social Science (SPSS) software (version 21.0).

Results: There were total 36,366 deliveries during the study period. A total of 315 Maternal Near Miss (MNM) cases were noted. Hypertensive disorders n=133 (42.22%) in pregnancy was the leading cause of MNM events at the hospital. This was followed by obstetric haemorrhage n=97 (30.79%), and severe anaemia constituting n=36 (11.42%), and sepsis n=30 (9.52%). Mortality index was highest in the sepsis group n=5 (14.28%) followed by severe anaemia n=3 (7.69%).

Conclusion: Hypertensive disorders were most common cause of near miss cases followed by obstetric haemorrhage. Sepsis was most common cause of maternal mortality. Early identification of hypertensive disorders in pregnancy, obstetric haemorrhage, severe anaemia and sepsis; and prompt treatment of these causes may help in reducing near miss and maternal mortality.

Keywords: Hypertensive disorders in pregnancy, Maternal mortality, Sepsis

INTRODUCTION

There have been constant efforts globally to improve reproductive health status of women, over decades. The Millennium Developmental Goal aimed to pull down the Maternal Mortality Rate (MMR) by three quarters and achieve universal access to reproductive health, between year 1990 to year 2015) [1]. India's progress towards achieving this goal has been rather slow. In year 1990, MMR in India was 570 per one lakh live birth [2].

MMR in India has reduced by 26.9% since year 2013. The MMR decreased from 167 in 2011-2013 to 130 in 2014-2016 and 122 in 2015-2017 [3]. Across the globe, the maternal mortality ratio has also decreased by 38% from 342 deaths to 211 deaths per 1 lakh live births, from year 2000 to 2017 [4]. Over the years, efforts have been directed to formulate strategies for uplifting the health status of women in India. Maternal mortality ratio reflects overall health status of women in society.

Maternal mortality ratio is widely used as key indicator of the social, economic and health development and to assess maternal deaths in population [5]. However, maternal mortality ratio in itself is insufficient to probe into pregnant women's health status. Since, there is decline in absolute number of maternal deaths; it has become less reliable to measure the efficacy of health care system [6]. There are far many pregnant women who survive the acute obstetric event despite being critically ill, and escape maternal mortality.

Severe Acute Maternal Morbidity (SAMM) or MNM is defined as "A woman who nearly died but survived a complication that occurred during pregnancy, child birth or within 42 days of termination of pregnancy" [7].

Recently, SAMM is widely used to evaluate the quality of obstetric care; the woman receives, in a given particular health facility [8]. The advantage of using MNM cases as health indicator, is that they out number maternal deaths to a large extent and the surviving pregnant women are available for interrogation and interviewing for the quality of care received by them [9].

In India, MoHFW has set maternal the near miss review operational guidelines in 2014 [10]. This guideline has formulated identification criteria for near miss based on three parameters, which include clinical findings, investigations and intervention done for MNM events. Many studies in developing countries have used WHO criteria for MNM [11]. There are few Indian studies on near miss events, using MoHFW criteria [12]. This study primarily attempts to analyse the incidence and causes of MNM cases in the tertiary care hospital. Calculation of maternal mortality index, and other relevant indices were secondary objective.

MATERIALS AND METHODS

This retrospective observational study was undertaken at a tertiary care hospital. The data for the study was collected for the period from January 2010 to September 2018. Prior permission from Ethical Committee was taken before the study. The data were collected from the delivery register in labor ward, Intensive Care Unit (ICU), operation theater and medical records of patients in records department.

MNM cases were identified according to the criteria given by MoHFW, MNM review operational guidelines [8], which includes three criteria viz., clinical findings, investigations and interventions (requiring minimum one from each category) or any single criteria which signified maternal cardiorespiratory collapse.

Inclusion criteria: All critically ill pregnant women admitted to labour ward for delivery, labouring women, postnatal women, postabortal women were segregated into MNM, based on criteria given by Ministry of Health, operational guidelines. These operational

guidelines have further divided these criteria into causes directly related to pregnancy, pre-existing causes before pregnancy and accidental and incidental causes.

Exclusion criteria: All uneventful pregnancies, abortions, deliveries and postnatal patients up to 42 days of delivery.

The clinical findings, investigations and interventions were broadly divided in 3 categories which included:

- Pregnancy specific obstetric and medical disorders
- Pre-existing disorders aggravated during pregnancy
- Accidental and incidental causes in pregnancy.

Causes of MNM cases were analysed and divided into hypertensive disorders in pregnancy, haemorrhage, sepsis, severe anaemia, postpartum collapse, liver dysfunction, cardiac dysfunction, respiratory dysfunctions, endocrinological dysfunctions and renal dysfunctions. This covered both direct and indirect causes of MNM events and also includes conditions pre-existing before pregnancy.

This study took place in a tertiary care hospital, with 24 hour emergency obstetric care as well as round the clock functional blood bank. The hospital also gets referrals from peripheral areas, Primary Health Care centers (PHC) and Community Health Care centers (CHC). Patient characteristics with reference to age, parity, gestational age, mode of delivery, Antenatal Care (ANC) registration status of patients were studied.

STATISTICAL ANALYSIS

Entry of data was done in Microsoft Excel sheet. Quantitative data was analysed by calculating means, ratios and proportions, using SPSS software (Version 21.0). The following are formulae for calculation of various ratio.

- MNM incidence ratio (number of MNM cases per 1000 live births)
- MNM to mortality ratio (number of MNM cases for every single Maternal death)
- Mortality index (number of Maternal deaths divided by total number of cases with severe Maternal outcome)(MI=MD/MNM+MD)

Severe Maternal outcome (SMO) is defined [13] as, Total number of cases including MNM and Maternal deaths (SMO=MNM+MD).

RESULTS

There were total 36,366 deliveries over the duration of study period. Total number of live births were 34,908. A total of 18 maternal deaths during these years and 315 MNM cases were observed. Majority of the patients were in the age group of 20 to 30 years (58.41%). However, young primigravida (<20 years) also contributed to almost 25% of total Near Miss cases. Multigravida was more in number as compared to primigravida (64.76%). Out of 204 multigravida patients, 28 patients were grand multipara (parity ≥4) that is 13.72%. Most of the near miss maternal morbidity occurred in the third trimester (60%) [Table/Fig-1].

Seventy six patients in this study required blood and blood related products, out of which eleven patients received massive blood transfusion (≥5 Packed Cell Volume (PCV), or whole blood) (14.4%). Out of 315 near miss patients, 270 (85.71%) patients had registered themselves either at our hospital or at PHC, CHC, private hospital. A total of 45 (14.28%) patients were unregistered and mostly included multigravida. A total of 91 patients were referred from outside places including PHCs, CHCs, private hospitals and rural hospitals.

MNM cases analysis into following causes is shown in [Table/Fig-2]. Hypertensive disorders in pregnancy were the leading cause of MNM events comprising of 42.22% of MNM cases. This was followed by obstetric haemorrhage (30.79%), while the third cause was severe maternal anaemia constituting 11.42%.

Of the total cases, eight patients required bilateral internal iliac artery ligation and seven patients required obstetric hysterectomy.

Characteristics	Severe Acute Maternal Morbidity (SAMM)	Percentage distribution (%)
Age (years)		
<20	82	26.03
≥20 to <30	184	58.41
≥30 to <40	49	15.56
Parity		
Primigravida/primipara	111	35.24
Multigravida/multipara	204	64.76
Gestational age		
First trimester	81	25.71
Second trimester	28	8.89
Third trimester	189	60
Postnatal	17	5.40
ANC Booked/Unbooked case		
Booked case	270	85.71
Unbooked case	45	14.28
Referred cases	91	28.8
ICU admissions	223	70.79
Number of patients requiring blood transfusion and related products	76	24.12

[Table/Fig-1]: Showing characteristics of women with Maternal Near Miss (MNM) events.
ANC: Antenatal care

Causes	No of Maternal near miss cases (n=315)	Percentage of near miss cases (%)	Incidence of near miss cases/1000 live births
Hypertensive disorders of pregnancy	133 (total)	42.22	3.80
Eclampsia	42		
Severe preeclampsia	71		
HELLP	20		
Severe anaemia	36	11.42	1.03
Haemorrhage	97	30.79	2.77
Sepsis	30	9.52	0.85
Endocrinological dysfunction (GDM, thyroid disorders)	02	0.64	0.057
Cardiac dysfunction	08	2.54	0.22
Respiratory dysfunction	02	0.64	0.057
Liver dysfunction	07	2.22	0.20

[Table/Fig-2]: Causes of Maternal Near Miss (MNM) cases.
HELLP: Haemolysis, elevated liver enzymes, low platelet count; GDM: Gestational diabetes mellitus

Exploratory laparotomy was required for atonic Postpartum Hemorrhage (PPH) following cesarean section in two cases and following vaginal delivery in one case.

Most of the cases requiring internal iliac artery ligation and obstetric hysterectomy had underwent cesarean section (13 patients out of 15) and remaining two patients had vaginal deliveries. Amongst the seven patients, who required obstetric hysterectomy, two patients had uterine rupture, three patients had placenta previa, two patients required laparotomy for atonic PPH following cesarean section.

In the maternal mortality group, however, sepsis was the leading cause of maternal mortality. In patients with sepsis, four patients developed sepsis following cesarean section and one patient developed sepsis following normal vaginal delivery [Table/Fig-3].

Out of eighteen maternal deaths, eight patients were primigravida (44.4%) and ten were multigravida (55.5%). Young Primigravida (<20 years) (n=6) contributed to one-third of total maternal deaths. Remaining twelve patients were in the age group of 20-30 years.

Causes	Maternal near Miss	Maternal mortality	Mortality index
Severe anaemia	36	3	0.07
Hypertensive disorders in pregnancy	133	3	0.02
Sepsis	30	5	0.14
Respiratory dysfunction	02		
Cardiovascular dysfunction	8	1	0.07
Hepatic dysfunction	7	2	0.15
Neurological dysfunction	0	1 (Tubercular meningitis)	-
Infection	0	1 (Leptospirosis)	-
Haemorrhage	97	2	0.02

[Table/Fig-3]: Comparison of causes of near miss with maternal mortality; The documented and confirmed source of infection was diagnosed only in one case of Maternal Mortality (Leptospirosis). In case of MNM, no such infection was documented. For comparison purpose, we have mentioned "infection" as separate row. Hence Infection column against MNM is mentioned "0".

Mortality index was highest in the sepsis group (14.28%) followed by severe anaemia (7.69%).

The most common intervention was admission to ICU (223 patients) contributing nearly to 70.89%, followed by mechanical ventilation in 31 patients (9.8%) [Table/Fig-4].

Interventions	Number of interventions (%)
Ventilator support	31 (9.8)
Massive blood transfusion	11 (3.49)
ICU admission	
Obstetric ICU	167 (53.01)
Medical ICU	56 (17.77)
Obstetric hysterectomy	7 (2.22)
Use of vasopressors	28 (8.8)
Dialysis	4 (1.26)
Internal Iliac artery ligation	8 (2.53)
Laparotomy	3 (0.95)
Repair of genital injuries	12 (3.8)
Repair of bladder and bowel	3 (0.95)
Management of ketoacidosis	1 (0.31)

[Table/Fig-4]: Therapeutic Interventions in this study (n=315); {Note: Some patients received more than one intervention. Hence, sum total interventions exceed number of patient(n)}.

MNM to mortality ratio in our study was 17.5:1 [Table/Fig-5]. This means that for every single maternal death there were 17.5 MNM events. The mortality index was 5.7% in this study.

Variables	Values
Maternal near Miss incidence ratio	9.02/1000 live births
Maternal near Miss/mortality ratio	17.5: 1
Mortality index	5.7
Severe Maternal Outcome (SMO) ratio	9.53/1000 livebirths

[Table/Fig-5]: Near miss event indicators in our study.

DISCUSSION

In recent years, MNM has been increasingly used as indicator of obstetric care. MNM cases significantly outnumber maternal mortality cases. Maternal mortality ratio has decreased globally and hence it may be a less reliable indicator for assessing the quality of care a woman receives. On the other hand, MNM cases, being in large numbers provide robust data for assessment of obstetric care.

Investigating and interviewing MNM cases is less traumatic than probing maternal deaths, for the health care workers. The following table [Table/Fig-6] shows brief review of Indian studies of MNM.

Other Indian Studies (Author) (Year of Publication) (n=sample size of the study)	Findings
Kumari S (2020) (n=31925) [12]	MNM incidence of 8 per 1,000 live births. MNM to mortality ratio was 1.9:1 Mortality Index was 34%
Tallapureddy S et al., (2017) (n=3900) [14]	MNM incidence ratio was 8.46/1000 live births. Leading cause of MNM was obstetric haemorrhage (43.7%) followed by hypertensive disorders (31.2%). The mortality index was 15.79%. MNM/Mortality ratio was 5.34:1
Purandare C et al., (2014) (n=27433) [15]	Number of MNM cases were 264. Incidence of MNM was 9.6/1000 live births. Leading cause of MNM was Obstetric haemorrhage.
Reena RP and Radha KR (2018) (n=3581) [9]	MNM incidence ratio was 9.27/1000 live births. Leading cause of MNM was severe pre-eclampsia (40.6%) followed by obstetric haemorrhage (21.81%).
Gupta S et al., (2015) (n=6892) [16]	MNM incidence ratio was 3.98/1000 live births. MNM to mortality ratio was 3.37:1. Leading cause of MNM was Obstetric haemorrhage. Most common cause for maternal mortality was hypertensive disorders. Mortality index was 22.8%
Roopa PS et al., (2013) (n=7390) [17]	MNM incidence ration was 17.8/1000 live births. MNM to mortality ratio was 5.6:1 and mortality index was 14.9%
Mansuri F, et al., (2019) (n=21491) [18]	MNM to mortality ratio was 3.13:1. Eclampsia and Preeclampsia were leading causes of MNM followed by postpartum haemorrhage
Jain U (2019) (n=13849) [19]	MNM Incidence 14.34%; Leading cause of MNM was Hypertensive disorders (30.18%) followed by obstetric haemorrhage (27.67%); Most common cause of mortality postpartum haemorrhage.
Manjunatha S et al., (2018) (n=3347) [20]	MNM Ratio 7.46/1000 Live births; and MNM to mortality ratio was 6.25:1 Sepsis and PPH were common causes of MNM.
Parmar NT et al., (2016) (n=1929) [21]	MNM Ratio 23.85/1000 Live births; Haemorrhagic disorders were common cause of MNM.

[Table/Fig-6]: Brief summary of Indian studies on MNM.

MNM incidence ratio in our study was 9.02/1000 live births which is similar to other studies in India [9,14]. MNM events as well as maternal deaths, below 20 years of age, in this study were almost equally distributed in both the groups, 26.03% and 27.7%, respectively.

Our study had hypertensive disease in pregnancy as leading cause of MNM. In few other studies also [9,14] hypertensive disease was leading cause of MNM. Haemorrhage and hypertensive disorders in pregnancy are also listed as other common causes of MNM, irrespective of the criteria used for identification of MNM [14-20,22].

Overall, mortality index was 5.7% in this study. Sepsis (14.28%) was the leading cause of maternal mortality followed by severe anaemia and hypertensive disorders in pregnancy. A study by Roopa PS et al., also has sepsis as leading cause of maternal mortality in their study [18]. The near miss to mortality ratio in our study was 17.5: 1 which is similar to other study [23], which has the ratio of 14.2:1

Limitation(s)

Relatively smaller sample size and study population from specific region around the hospital were limitations of the study. Larger study across different regions in India will help to identify specific causes of MNM in the given region(s).

CONCLUSION(S)

Sepsis was most common cause of maternal mortality whilst hypertensive disorders were leading cause of MNM. Prompt detection of these disorders can significantly improve maternal outcome.

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