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**ORIGINAL ARTICLE**

# A study of Severe Acute Maternal Morbidity and mortality cases in a tertiary health care centre in the public sector

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## ABSTRACT:

**Background:** Severe Acute Maternal Morbidity or maternal near miss is a direct predictor of the quality of healthcare services in the obstetrics sector of the country. It indirectly depicts the efficiency of the decentralised healthcare infrastructure and diagnostics. Monitoring these cases of near misses and an in-depth analysis is supported by the Government of India and World Health Organization (WHO) for refining and improving the quality of health care provided to mothers by implementing new strategies and approaches.

**Objectives:** To assess and conduct a causal analysis of maternal near-miss cases and compare these with the maternal mortality cases.

**Methods:** It was a prospective observational study, conducted over one year at a final referral centre catering to 11 districts around central and northern Karnataka, which sees about 1000 deliveries per month and around 60 maternal mortality cases in its ICU each year of which 95% are referred cases. The study population comprised all the cases who fulfilled the operational guidelines prescribed by the National Health Mission, Government of India. Demographic data, Events that lead to the near-miss status of the patient, and interventions done were thoroughly studied here.

**Results:** Maternal Near Miss Incidence Ratio = Maternal Near Miss/1000 Live Births. The MNMIR was 44.8/1000 live births. Maternal Near Miss to Mortality Ratio was 8.06:1. Mortality Index = MD/MNM+MD X 100 = 11.04%

**Conclusion:** Pregnancy-specific primary causes for maternal near-miss events included hypertension in pregnancy and its associated complications, obstetric haemorrhage-antepartum or postpartum, anaemia, or a pre-existing illness that exacerbates in the eventual

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course of pregnancy. Their early identification, appropriate treatment and filling of the gap in the three delays of healthcare are essential to decrease maternal morbidity and mortality.

**Key words:** morbidity, mortality, pregnancy

## INTRODUCTION:

A maternal near-miss (MNM) case is defined as "a woman who almost died but survived complication(s) that occurred within 42 days of the pregnancy's termination or during the delivery or the pregnancy itself (antenatally)." [1] Decreasing maternal mortality has been propagated and is a practice essential component of the Millennium development goal. [2, 3] Though we are seeing a substantial decrease in the maternal mortality rate every progressing year, the target is not yet achieved. [4] Every day, roughly around 800 women perish from preventable causes related to pregnancy and childbirth worldwide. [5] In addition to this, more than 50 million women enter the arena of various morbidities every year. [6]

The maternal mortality ratio (MMR) in India decreased from 130 per 100,000 live births in SRS 2014–16 to 122 in SRS 2015–17 and to 113 per 100,000 live births in SRS 2016–18, according to the Sample Registration System (SRS) report from the Registrar General of India (RGI). India's MMR fell by 8.8% to 103 in 2017–19 from 113 in 2016–18, based on the most recent information provided by BYJU'S. The MMR declined from 130 per lakh live births in 2014–16 to 97 per lakh in 2018–20, according to the Press Information Bureau. [7, 8, 9] But this Maternal Mortality is just the tip of the iceberg, the real problem estimate can only be understood by the submerged base and body of the iceberg that is the near-miss cases. These cases act as proxy indicators and give a surrogate picture of the real causality of maternal illnesses. [10] Epidemiologists and caregivers have long used maternal death as a gauge of maternal health at all scales, from the local level to the national level. The total number of maternal fatalities in a region or a community, however, may be lower with consistently falling national statistics and the examination of a smaller sample size of maternal fatalities might not reveal the real inadequacies in the health care delivery system. Therefore, examining the near-miss instances/cases with a bigger sample size will help to fill in the gaps more successfully and implement the changes required to improve maternal care and services. This study deals with the causal analysis and in-depth review of the maternal near-miss cases in Karnataka Institute of Medical Sciences Hubli, which is a final referral centre to 11 districts around central and northern Karnataka, which sees about 1000 deliveries per month and around 60 maternal mortality cases in its ICU of which 95% are referred cases. Present study was carried out with the objective to assess and conduct a causal analysis of maternal near-miss cases and compare these with maternal mortality cases.

## MATERIALS AND METHODS:

This study was a prospective observational study done in the Department of Obstetrics and Gynaecology, Karnataka Institute of Medical Sciences and Research Hospital, a tertiary referral centre. It has a 25-bed Intensive Care Unit with 25 Ventilators, a 24-bed High Dependency Unit, a 24-hour blood bank Facility and 24-hour superspecialist services in the public sector. The Patient population base it serves is 11 districts in the vicinity. It is the ultimate referral centre for many near-miss cases; hence the data and caseload are subjected to Berkson bias due to referrals.

The study population included all the cases with near-miss events that fulfilled the criteria of operational guidelines for maternal near-miss events, admitted to KIMS between 1st October

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2022 to 1st October 2023 for one year. Those with severe co-morbid conditions, those who were not able to participate in the study were excluded. Written informed consent was taken from all the eligible study subjects. Institutional Ethics Committee approval was obtained before the start of the study.

Their demographic data, events that lead to the near-miss status of the patient, and interventions done were thoroughly studied and analysed. Over this 1-year duration, we admitted and treated 572 cases of near misses and during this course, we had 71 mortality cases.

**Statistical analysis:** SPSS version 27 (2021) was used for analysis of the data. Student T-test and Chi-square tests were applied according to the variables.

**RESULTS:**

During the study period of 12 months, there were 12,943 deliveries in the hospital out of which 12,767 were live births. There were 572 cases of near-miss or severe acute maternal morbidity and 71 maternal mortalities. Total admissions were 13,499 in the antenatal wards, Obstetrics ICU and Labour room combined. Out of the total admitted patients, 6.9% required ICU care. The indices of Severe acute maternal Morbidity were: 1. Maternal Near Miss Incidence Ratio= Maternal Near Miss/1000 Live Births. This MNMIR was 44.8/1000 live births. 2. The maternal Near Miss to Mortality Ratio was 8.06:1 3. Mortality Index = MD/MNM+MD X 100 = 11.04% The patients were from 11 different adjacent districts which were referred to here for further management. Their demographic characteristics are described in Table 1. In most of the near-miss cases, patients were below 25 years. 51.1% were primipara and their Gestational age was late preterm to term. Notably, 400 cases out of the 572 were booked cases with at least 1-2 antenatal visits. This itself indicates the unpredictability of the disease onset in the antenatal period.

**Table 1: Demographic Data of the Study Population**

| Characteristic | | Maternal Mortality (n=71) (%) | Maternal Near-miss (n=572) (%) | P value |
|---|---|---|---|---|
| Age (years) | 16 – 25 | 35 (49.3%) | 316 (55.3%) | 0.021 |
| | 26-35 | 33 (46.5%) | 252 (44%) | |
| | 36-45 | 3 (4.2%) | 4 (0.7%) | |
| Parity | Primi | 31 (43.6%) | 280 (48.9%) | 0.238 |
| | Multi | 40 (56.4%) | 292 (51.1%) | |
| Gestational age (weeks) | Up to 30 | 9 (12.7%) | 73 (12.8%) | 0.167 |
| | > 30 | 62 (87.3%) | 499 (87.2%) | |
| Average distance travelled to reach present hospital (km) | < 20 | 29 (40.8%) | 260 (45.4%) | 0.757 |
| | 20-50 | 16 (22.6%) | 116 (20.3%) | |
| | > 50 | 26 (36.6%) | 196 (34.3%) | |
| Registration status | Booked | 49 (69%) | 400 (69.9%) | 0.9828 |
| | Unbooked | 22 (31%) | 172 (30.1%) | |

**Table 2: Education, Employment and Socioeconomic Status of the Family**

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| Characteristic | | Maternal Mortality (n=71) (%) | Maternal Near-miss (n=572) (%) | P value |
|---|---|---|---|---|
| Mother's education | Illiterate | 39 (54.9%) | 68 (11.9%) | < 0.0001 |
| | Literate | 32 (45.1%) | 504 (88.1%) | |
| Mother's employment | Unemployed | 42 (59.1%) | 388 (67.8%) | < 0.0001 |
| | Employed | 29 (40.9%) | 184 (32.2%) | |
| Husband's education | Illiterate | 11 (15.5%) | 12 (2.1%) | < 0.0001 |
| | Literate | 60 (84.5%) | 560 (97.9%) | |
| Socio-economic status | Class I to III | 8 (11.3%) | 312 (54.5%) | < 0.0001 |
| | Class IV & V | 63 (88.7%) | 260 (45.5%) | |

Table 2 shows the education, employment and socio-economic status of the family members of the discussed cases. We can infer that most of the cases had only primary schooling and 67.8% of these patients were homemakers and did not earn. Women not earning takes away their autonomy in decision-making- it is a well-known fact. It is thought-provoking that if at all these women had employment, could it be better in terms of early healthcare attention seeking?

**Table 3: Modes of termination of pregnancy**

| Modes of termination of pregnancy | Maternal Mortality (n=71) (%) | Maternal Near-miss (n=572) (%) | P value |
|---|---|---|---|
| Vaginal delivery | 24 (33.8%) | 136 (23.8%) | 0.0896 |
| Other modes | 47 (66.2%) | 436 (76.2%) | |

Other modes include LSCS, hysterotomy, laparotomy, abortion

Vaginal delivery was more common in those with maternal mortality in 33.8% of the cases compared to 23.8% in those with near-miss. (Table 3)

**Table 4: Causal Analysis of Mortality and Near Miss Cases according to Operational Guidelines on Maternal Near Miss Review**

| Causes | Maternal Mortality (n=71) (%) | Maternal Near-miss (n=572) (%) | P value |
|---|---|---|---|
| Hemorrhage | 16 (22.5%) | 187 (32.7%) | < 0.001 |
| Hypertension | 42 (59.1%) | 279 (48.8%) | < 0.001 |
| Sepsis | 15 (21.1%) | 67 (11.7%) | 0.039 |
| Maternal sudden collapse | 5 (7.1%) | 3 (0.5%) | < 0.001 |
| Cardiac dysfunction | 9 (12.7%) | 127 (22.2%) | 0.087 |
| Rupture uterus | 1 (1.4%) | 6 (1.1%) | 0.74 |
| Severe anemia | 17 (23.9%) | 68 (11.9%) | 0.0082 |
| Neurological dysfunction | 13 (14.3%) | 19 (3.3%) | < 0.001 |

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| | | | |
|---|---|---|---|
| Renal dysfunction | 17 (23.9%) | 31 (5.4%) | < 0.001 |

Hypertensive disorders in pregnancy and the associated complications (48.77%) were the predominant cause of maternal near miss and mortality (59.1%) followed by anaemia, postpartum haemorrhage and sepsis. Table 4 gives the in-detail causal analysis of the maternal mortality causes and the maternal near-miss causes. These are mutually inclusive since one patient had multiple overlapping entities.

**Table 5: Direct cause of Maternal Mortality.**

| Cause | Number | % |
|---|---|---|
| Hemorrhage | 9 | 12.7 |
| Sepsis | 15 | 21.1 |
| Cardiac arrest | 4 | 5.6 |
| CVA | 4 | 5.6 |
| PPCM with acute LV failure | 2 | 2.9 |
| Amniotic fluid embolism | 4 | 5.6 |
| Pulmonary thromboembolism | 6 | 8.5 |
| ARDS | 1 | 1.4 |
| Uremic encephalopathy | 1 | 1.4 |
| Pulmonary edema | 9 | 12.7 |
| DIC | 8 | 11.3 |
| HELLP | 8 | 11.3 |

The direct causes of maternal mortality are described in Table 5. It is notable here that, even though hypertensive disorders in pregnancy and haemorrhage were the predominant causes of maternal morbidity and near miss, most of the mortalities were due to sepsis. Of these 15 cases 14 cases were referred from other districts. Sepsis, which is a preventable cause needs to be efficiently diminished. 4 patients had sudden cardiac arrest, 4 patients had intracranial haemorrhage, and 2 patients died due to Peripartum cardiomyopathy. 9 patients developed pulmonary edema and 8 patients had Disseminated Intravascular Coagulation.

**Table 6: Life-Saving Interventions**

| Intervention | Maternal Mortality (n=71) (%) | Maternal Near-miss (n=572) (%) |
|---|---|---|
| Blood and Blood Products Transfusion (>90ml/kg body weight or >5 units of blood) | 61 (84.91%) | 212 (37.06%) |
| ICU admission requiring resuscitative (CAB) or cardiorespiratory support | 59 (83.09%) | 47 (66.19%) |
| Use of inotropes/vasopressors/cardiotonic | 11 (15.49%) | 2 (28.16%) |
| Haemodialysis / Renal Replacement Therapy | 1 (1.4%) | 61 (84.91%) |
| Emergency Laparotomy | 13 (18.30%) | 3 (4.22%) |
| Status Epilepticus | 503 (87.93%) | 167 (29.29%) |
| Mechanical Ventilation | 36 (6.29%) | 39 (6.81%) |

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| | | |
|---|---|---|
| Cardio-Pulmonary Resuscitation | 15 (2.62%) | 232 (40.55%) |
| Peripartum Hysterectomy | 21 (3.67%) | 29 (5.06%) |

Table 6 gives the life-saving interventions that were done in these near-miss and mortality cases. 503 cases out of the 572 near-miss cases and 59 out of 71 mortality cases required cardio-respiratory support. 37.06% cases of near-miss and 84.91% cases of maternal mortality had received transfusion of blood and blood products of a minimum of 4 units. 167 patients and 47 patients of near-miss and mortality respectively, were put on inotropic support. 36 cases in the near miss cases underwent haemodialysis and 11 of the mortality cases underwent dialysis. 232 patients in the near miss group and 61 cases in the mortality group were on Mechanical ventilators at some point of time during their stay in the hospital.

**Table 7: Maternal Healthcare services related characteristics: the delays in healthcare**

| Characteristic | | Maternal Mortality (n=71) (%) | Maternal Near-miss (n=572) (%) |
|---|---|---|---|
| First Delay (by self/ relatives) (Decision to seek medical care >24 hours) | Yes | 19 (26.8%) | 104 (18.2%) |
| | No | 52 (73.2%) | 468 (81.8%) |
| Second delay (transportation delay of > 60mins) | Yes | 18 (25.4%) | 117 (20.5%) |
| | No | 53 (74.7%) | 455 (79.6%) |
| Tertiary delay (Time to receive medical attention after reaching the hospital >60mins) | Yes | 6 (8.5%) | 64 (11.2%) |
| | No | 65 (91.6%) | 508 (88.8%) |

Table 7 depicts the maternal healthcare service-related characteristics of the admitted cases. Knowledge regarding the danger signs related to the specific condition is crucial for early diagnosis and treatment. It is noteworthy that even though 414 cases out of 572 cases of near misses and 45 out of 71 cases of maternal mortality are known, there were 104 and 19 cases of delayed decision-making to seek healthcare attention. It can be explained with the help of 3 delays. The first delay is caused by a lack of understanding/ knowledge which makes it take longer for the patient to access medical facilities. Lack of access to health care owing to transportation, cost, or socioeconomic concerns constitutes the second delay. The third delay is associated with failure to triage and give immediate care at the medical facility because of the serious condition's delayed diagnosis. The percentages and the actual number of delays that lead to the deficiencies have been projected in Table 7, which helps to understand the gaps that are present in the healthcare services system.

## DISCUSSION:

Maternal mortality comprises of a small sample size due to the radical approaches and betterment in the healthcare sector in present-day society. However, if one must analyse and understand the actual problems and the prevalence of morbidity in antenatal mothers, maternal near-miss cases need to be studied in detail. 572 cases of maternal near misses were studied and compared with maternal mortality in this study. Despite making outstanding progress in preventing maternal deaths, developing countries still need to improve their primary health care system at the grassroots level and strengthen their referral system including the

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transportation facilities. [11] Identification of the delays as mentioned in the above paragraphs like the primary, secondary and tertiary helps to fill the voids in the healthcare infirmaries and the entire systems. [12] The Maternal Near Miss to Mortality Ratio was 8.06:1 in our study. It is best understood when we state that for every 1 case of maternal death, 8 cases of similar almost-nearing-to death cases were saved. In a study conducted by Chandrakanta Prasad in Lady Hardinge Medical College [13], the maternal near-miss ratio was 4.3:1. The Maternal near-miss ratio in our study is of decent standard owing to the caseload our medical college bears.

We can observe from Table 1 which describes the demographic data, that most of the patients were from the younger age group, especially between 20 to 30 years. Among the maternal near-miss cases, the parity of the women did not differ significantly. These findings are in contrast to the findings of the study conducted at Lady Hardinge Medical College [13] in which multipara predominated. However, a greater number of multiparas succumbed to death due to the above-described reasons mainly haemorrhage, hypertension and sepsis being the prime contributors. Numerous socioeconomic factors have an impact on maternal health, which is an important component of public health. [14] The primary structural determinants that impact maternal health service usage and maternal mortality in India encompass economic standing, caste/ethnicity, education, gender, religion, and culture. The main intermediary elements consist of maternal health communication, women's exposure to the media, place of residency at the time of childbirth, and maternal health messages. The intermediary elements that contribute to the utilization of maternal health services or result in maternal fatalities are influenced by these structural factors. As can be seen from Table 1, 378 cases out of 572 cases of near-miss and 51 out of 71 cases of maternal mortality were from rural areas. The booking status of the pregnancy which is primarily influenced by the maternal and paternal education system is also high as depicted. Postpartum haemorrhage is sometimes an unpreventable entity, especially in multipara mothers, but 187 cases of it entering the criteria of near-miss events among 572 is alarming and warrants discussion. Postpartum haemorrhage of atonic type constituted the main reason for maternal near misses in a study conducted in Uttar Pradesh [15] Postpartum haemorrhage is a curtailable entity with adequate anaemia correction, optimizing the blood pressure in Hypertensive disorder of pregnancy cases and getting the Labour room ready during the delivery. Hypertensive disorders of pregnancy are the most common complication of pregnancy. In our study, there were 279 cases (48.77%) of maternal near misses and 42 cases (59.1%) of maternal mortality that had a diagnosis of HDP in any of the severity ranging from gestational hypertension to eclampsia. The preliminary evaluation of such cases should start with a proper recording of the Blood pressure with an appropriately calibrated instrument with the proper method of recording it by medical personnel. If a high BP reading is missed or recorded improperly, we can only imagine the delay in diagnosis and the morbid course of events that follow. There were 68 cases (11.88%) of maternal near–miss and 17 (23.9%) cases of maternal mortality that had uncorrected severe anaemia. It is to be recalled here that anaemia itself is a leading cause of PPH, abruption, and delayed healing among others. Therefore, more reforms must be made especially in the rural pockets to pick up these missed cases of uncorrected and under-corrected anaemia. From Table 5 we can see that Sepsis is the main cause of death among these 71 cases. The contribution of sepsis in pregnancy and puerperium – e.g., the ascending vaginal infections, urinary tract infections, and surgical site infections that lead to maternal mortality is around 11%. [16] Sepsis is almost always secondary to an underlying condition; therefore, we must identify and correct the issues accordingly.

Table 7 depicts the delays encountered while the patient obtains health care. The first delay is said to have incurred when the patient or her husband/ relatives decide to seek medical care

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after >24 hours of the preliminary event. It is most commonly due to a lack of knowledge and awareness about the disease-specific danger/ warning signs. There were 104 cases out of 572 that faced the primary delay. Only proper education by ASHA workers and counselling at the Primary Health Centre including the mass media propaganda can decrease this number. The second delay is encountered while transportation, i.e., here the travelling time takes >60 minutes. As we can see from Table 1, many cases had to travel >20 kilometres to reach the referral centre. So, decentralization of not only healthcare services but also healthcare workers would imbibe growth and provide a solution for this problem of second delay. The third delay is the one that patient faces due to improper triaging and waiting for >60 minutes in the triage area before they are assigned definitive management. From Table 7 we can note that this delay is smaller in number when compared to others. But never the less, even these numbers have to be curtailed.

## CONCLUSION:

Pregnancy-specific primary causes for maternal near-miss events include hypertension in pregnancy and its associated complications, obstetric haemorrhage- antepartum or postpartum, anaemia, or a pre-existing illness that exacerbates the eventual course of pregnancy. The earliest identification of these near-miss incidents according to WHO or the NIH operational guidelines, vigilant observations, health directions, prompt referral, and using a multidisciplinary approach with appropriate interventions, aid in lowering the morbidity and mortality rates among mothers.

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