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Original Research Article

Record based study to determine the MMR and causes of maternal mortality: an experience from a tertiary care center in central India

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ABSTRACT

Background: A mother is the backbone of any family and so it is of paramount importance to ensure her good health. Maternal mortality ratio (MMR) serves as an indicator of the nation's healthcare system. This study aimed to evaluate the causes of maternal mortality and study implementable methods to reduce maternal deaths.
Methods: A retrospective descriptive study of one year from May 2023 to April 2024 at a tertiary care centre in central India to evaluate the causes, demographic and obstetric characteristics of maternal deaths.
Results: There were 43 maternal deaths and 3196 live births in the study period. MMR at our center was 1345 per 100 000 live births. Unbooked cases accounted for the majority (83.7%). Obstetric hemorrhage (25.6%) and hypertensive disorders (25.6%) were the predominant causes of maternal deaths. The general condition on admission was poor in majority (65.1%) cases and anemia was widely prevalent (60.5%).
Conclusions: The MMR at our center was significantly higher than the national data. Majority of the deaths can be avoided with timely intervention and proper referral. Early diagnosis and treatment of hypertensive disorders and Correction of anemia in early pregnancy can help reduce maternal mortality.

Keywords: Eclampsia, Healthcare, Hemorrhage, Maternal mortality, Maternal mortality ratio, Tertiary care center

INTRODUCTION

Maternal mortality is defined as the death of a pregnant woman or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.[1]

Maternal mortality remains a critical public health issue, reflecting broader disparities in health care access and quality worldwide. Maternal mortality ratio (MMR) serves as a stark indicator of the overall health system's functionality and the societal value placed on women's health. Despite global advancements in medical technology and healthcare practices, maternal mortality rates remain alarmingly high in many regions, particularly in low-income and developing countries.

As per the special bulletin on MMR released by the Registrar General of India (RGI), the maternal mortality ratio (MMR) of India in 2018-20 stands at 97/lakh live births.[2] Government schemes such as "janani shishu suraksha karyakram" and "janani suraksha yojana" have greatly helped in improving maternal health, along with the recent initiatives like surakshit matritva aashwasan' (SUMAN). Pradhan mantri surakshit matritva abhiyan (PMSMA) is another initiative to identify high-risk pregnancies and facilitate their appropriate management.[2]

As per report by UNICEF, the major complications that account for nearly two-thirds of all maternal deaths are

severe bleeding (mostly bleeding after childbirth), infections (usually after childbirth), high blood pressure during pregnancy (pre-eclampsia and eclampsia), complications from delivery and unsafe abortions.[3]

Keeping all this in view, our study was conducted to find out the MMR, causes of maternal mortality and implementable ways to reduce it in a tertiary care center in Uttar Pradesh.

Objective

To study causes of maternal mortality and factors contributing to it. To calculate the maternal mortality ratio in our set up. To study implementable methods to reduce maternal mortality.

METHODS

This was a retrospective descriptive study of one year from 1st May 2023 to 30th April 2024, conducted in MLB medical college, Jhansi, Uttar Pradesh; a tertiary care center in central India. Detailed retrospective reviews of records were undertaken from the patient case sheets and maternal death review forms of 43 maternal mortalities in the department of obstetrics and gynecology.

The study population included women who delivered in or outside the hospital as well as referred from other centers, who were admitted for pregnancy related complications and expired during management. The study also included the mortalities during early pregnancy and its related complications. The study excluded the patients who were "dead on arrival" during pregnancy or puerperium. The death of antenatal or postnatal cases due to violence, incidental or accidental cause was also excluded, as these cases are not included in the definition of maternal mortality.

Data retrieved from case notes included duration of hospital stay, delivery to death interval, outcome of pregnancy, blood investigations, direct and indirect cause of death. Total number of live births and number of maternal mortalities during this period was noted.

Study variables

Demographic characteristics: age, parity.

Obstetric characteristics: referral status, booking status, status at the time of admission and at the time of death (antenatal/ postnatal), condition of women at presentation, mode and outcome of delivery, presence of anemia, hypertensive disorders, deranged liver function tests, deranged kidney function tests, deranged serum TSH at time of admission.

Variables related to maternal mortality: maternal mortality ratio, cause of mortality (direct and indirect), duration between onset of complications to admission, duration of hospital stay, delivery to death interval,

Data collection tool

The data were collected from the maternal death review (MDR) form designed by the Government of India.

Statistical analysis

The data were entered in a Microsoft Excel sheet and descriptive statistics like frequency and percentage were calculated and presented in tables. The characteristics of the study population were presented using percentage and absolute numbers. Prevalence of maternal death and number of live births during the study period was represented as absolute numbers. MMR was calculated as the number of deaths due to maternal causes per 100,000 live births within the study period at our center.

RESULTS

In the study period of one year, 43 maternal deaths occurred and there were 3196 live births in the same period. Hence, the maternal mortality ratio at our center was estimated as 1345 per 100 000 live births.

Table 1: Distribution of age, parity, booking status, referral status.

Characteristics	Frequency (%)
Age (years)	
<20	1 (2.3)
20-30	39 (90.7)
31-40	3 (7)
Parity	
Primi	16 (37.2)
Multi	27 (62.8)
Referral status	
Yes	25 (58)
No	18 (42)
Booking status	
Yes	7 (16.3)
No	36 (83.7)

As seen in Table 1, maternal deaths were more common (90.7%) among women belonging to the age group of 20-30 years, deaths in teenage pregnancies was 2.3%, while 7% of women who died were between 31-40 years of age. Majority of deaths belonged to the multiparous (62.8%) group. Unbooked cases accounted for the majority (83.7%) and 58% cases were referred from other centers.

Patients were more commonly (81.4%) admitted as antenatal cases at the time of admission and 2.3% cases (n=1) were patients with incomplete abortion; however, the majority (88.4%) of maternal deaths were in the postpartum period. Almost two-third of the women (62.8%) sought medical care more than 24 hours after

developing complications and only 14% women came to hospital with regular obstetric complaints like labor pains with no complications. More than half (53.5%) of the patients had a hospital stay of more than 24 hours, while the delivery to death interval was less than 24 hours in majority (55.3%) cases (Table 2).

Table 2: Correlation between period of admission and death, Duration between onset of complications, admission, delivery and death.

Characteristics	Frequency (%)
Status at the time of admission	
Antenatal	35 (81.4)
Postnatal	7 (16.3)
Incomplete abortion	1 (2.3)
Status at the time of death	
Antenatal	5 (11.6)
Postnatal	38 (88.4)
Duration of hospital stay	
<24 hours	20 (46.5)
>24 hours	23 (53.5)
Delivery to death interval	
<24 hours	21 (55.3)
>24 hours	17 (44.7)
Duration between onset of complications and admission	
0 hours	6 (14)
<24 hours	10 (23.2)
>24 hours	27 (62.8)

Table 3: Mode and outcome of delivery, condition of patient on admission.

Characteristics	Frequency (%)
Mode of delivery	
Undelivered	5 (11.9)
Caesarean section	23 (54.8)
Vaginal delivery	14 (33.3)
Outcome of delivery	
Live birth	27 (73)
Still birth	10 (27)
General condition on admission	
Stable	15 (34.9)
Poor	28 (65.1)
Shock on admission	
Yes	12 (27.9)
No	31 (72.1)
Anemia on admission	
Yes	26 (60.5)
No	17 (39.5)
Hypertensive disorder	
Yes	17 (39.5)
No	26 (60.5)

As depicted in Table 3, the majority (54.8%) of patients had a caesarean section, while 33.3% were vaginally delivered and 11.9% were undelivered. Three-fourth (73%) of women had a live birth. The general condition on admission was poor in majority (65.1%) cases and 27.9% cases presented to the hospital in shock. Anemia was widely prevalent (60.5%), whereas hypertensive disorders were present in 39.5% of cases (Table 3).

Table 4: Direct and indirect causes of maternal death.

Characteristics	Frequency (%)
Direct: obstetric hemorrhage	11 (25.6)
PPH	3 (7)
Placenta previa, PAS	3 (7)
Abruptio placentae	1 (2.3)
Ruptured uterus	4 (9.3)
Direct: hypertensive disorders	11 (25.6)
Eclampsia	5 (11.6)
Severe preeclampsia	4 (9.3)
HELLP	2 (4.7)
Direct: pregnancy related infection	3 (7)
Direct: abortive outcomes	1 (2.3)
Direct: embolism	4 (9.3)
Direct: peripartum cardiomyopathy	3 (7)
Indirect: very severe anemia	3 (7)
Indirect: cardiac disorder	1 (2.3)
Indirect: liver disorder	2 (4.7)
Indirect: neurological disorder	1 (2.3)
Indirect: hypersensitivity reaction to blood/drugs	3 (7)

Table 5: Relevant blood investigations on admission.

Characteristics	Frequency (%)
Deranged LFT	
Yes	27 (62.8)
No	16 (37.2)
Deranged KFT	
Yes	15 (34.9)
No	28 (65.1)
Deranged serum TSH	
Yes	13 (30.2)
No	30 (69.8)

Obstetric hemorrhage and hypertensive disorders of pregnancy were the predominant causes of maternal deaths, each contributed to one-fourth (25.6%, n=11/43) of maternal deaths. Obstetric hemorrhage includes PPH (7%), placenta previa and placenta accreta spectrum (7%), abruptio placentae (2.3%) and ruptured uterus (9.3%). Hypertensive disorders include eclampsia (11.6%), severe preeclampsia (9.3%) and HELLP (4.7%). Pregnancy related infections leading to sepsis was seen in 7% of the deaths and deaths caused by abortive outcome, which was due to septic abortion in our study, was found to be in 2.3% (n=1) cases. 9.3% and 7% deaths occurred due to pulmonary embolism and peripartum cardiomyopathy, respectively. Indirect causes contributed to 23.3% deaths which were very severe anemia (7%), liver disorder

(4.3%), cardiac disorder (2.3%), neurological disorder (2.3%) and reaction to drugs/blood transfusion (7%) (Table 4).

On admission, deranged liver function tests were seen in almost two-third (62.8%) cases and deranged kidney function tests were seen in 34.9% cases. Thyroid dysfunction was found in 30.2% cases (Table 5).

DISCUSSION

Maternal mortality is widely accepted as a crucial yardstick of a nation's health and socioeconomic development. Maternal mortality ratio in India in 2018-20 according to Registrar General of India (RGI) was 97 per lakh live births.[2] However, MMR in our study was 1345 per lakh live births, which is alarmingly high in comparison to our country's data. The reason for this could be that our center is a tertiary care hospital and referral center for various hospitals in the whole of Bundelkhand region. The total population of Bundelkhand region is 18.3 million and 79.1% of the population lives in rural areas.[4] Another study in Uttar Pradesh by Malik et al showed a high MMR of 1178 due to more referred cases (83%) with most referred in critical condition.[5] In our study, the majority of patients were unbooked (83.7%) and 58% were referred. Often these women were referred when they developed life-threatening complications. 65.1% of women presented in poor general condition and 27.9% women were in shock at the time of admission. Majority of these deaths could have been prevented by timely and early access to proper health care services. Similar to this, a study conducted in Nepal, by Sitaula et al showed that 29.6% women presented in a state of shock.[6]

In our study, 62.8% women sought medical care more than 24 hours after developing complications which shows that crucial time was lost before admission to our hospital. 46.5% women died within 24 hours of admission. Similar result on maternal deaths within 24 hours was obtained in a study by Mittal et al (45.05%) and Sitaula et al (32%).[6,7]

Most (90.7%) deaths occurred in age group of 20-30 years which is consistent with study by Mittal et al showing 73% deaths occurring in mothers of age group 20-30 years.[7] The maternal deaths were more common in multiparous (62.8%) group and 88.4% deaths occurred in postpartum period. This was also seen in a study conducted by Rehman et al, they found multigravidae constituted 58.2% of deaths and most deaths (72.5%) had happened in post-natal period.[8] This indicates a need for proper family planning methods to ensure adequate spacing between pregnancies and to avoid too many and unwanted pregnancies.

Majority (60.5%) women were found to be anemic. Similar results were seen in a study by Malik et al in which 71.02% women were anemic.[5] Multiple pregnancies with short inter-conception period along with poverty and nutritional deficiencies contribute to anemia. Despite many initiatives by the government, anemia is still widely prevalent in pregnant females. In our study, thyroid dysfunction was seen in 30.2% women on admission. In a study by Kumari et al, prevalence of thyroid dysfunction among pregnant women was found to be 21.1%.[9] Many studies such as a study by Hajifoghaha et al have shown positive correlation between thyroid dysfunction and preeclampsia.[10] Hence, thyroid dysfunction may be a contributing factor to maternal deaths due to hypertensive disorders.

In our study, the major cause of maternal death was obstetric hemorrhage (25.6%) and hypertensive disorders of pregnancy (25.6%). In a study by Sharma et al, major cause of death was hypertensive toxaemia (21.4%), while haemorrhage caused 11.9% of the total deaths.[11] In another study by Hansda et al, hypertensive disorders (26.86%) and haemorrhage (21.64%) were the major causes of maternal deaths.[12] Anemia, liver disorder and cardiac disorder accounted for 7%, 4.7%, 2.3% of maternal deaths, respectively. These are similar to other studies.[12]

CONCLUSION

The MMR at our centre was significantly higher than the national data. Majority of the deaths can be avoided with timely intervention and proper referral. Some recommendations which can help to prevent maternal deaths are as follows: i) early diagnosis and treatment of hypertensive disorders. Establishment of separate eclampsia units at PHCs and CHCs may be helpful to prevent eclampsia-related maternal deaths; ii) correction of anemia in early pregnancy and availability of blood and blood products at primary and secondary health care centres; iii) thyroid function tests should be done at all public health centers during antenatal check-ups; iv) at least one antenatal visit to a tertiary center should be done to screen for underlying comorbidities during the antenatal period; v) lab services should be expanded; vi) high risk patients should be timely referred; vii) awareness programs regarding the high risks in pregnancy should be done at grassroot level.

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