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Original Research Article

Maternal near miss and maternal mortality in a tertiary care centre of North Karnataka: a retrospective study

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ABSTRACT

Background: Maternal near-miss cases and maternal deaths serve as crucial indicators of obstetric care quality. Analysis of these cases in tertiary care settings provides valuable insights for improving maternal healthcare services. Objective of this study was to analyze the prevalence, causes, and outcomes of maternal near-miss cases and maternal deaths in a tertiary care center in North Karnataka.

Methods: This retrospective observational study was conducted at Karnataka Medical College and Research Institute, Hubli, during 2023. The study population comprised all pregnant women who were admitted to the Department of Obstetrics and Gynecology at KMCRI during 2023. The identification and classification of maternal near-miss cases were conducted in accordance with the Ministry of Health and Family Welfare (MoHFW), Government of India guidelines. Data was collected from multiple hospital records and analyzed using SPSS version 22.

Results: Among 11,658 live births, 113 maternal near-miss cases and 51 maternal deaths were recorded (maternal mortality ratio: 437.46 per 100,000 live births). The majority of cases occurred in the 20-25 years age group (near-miss: 43.4%, deaths: 54.9%). Primigravidae constituted 48.7% of near-miss cases and 43.1% of deaths. Most cases were referrals (near-miss: 76.1%, deaths: 70.6%) and booked outside the institution (near-miss: 94.7%, deaths: 82.4%). Hypertensive disorders were the leading cause of near-miss events (65.5%), and maternal deaths were also primarily attributed to hypertensive complications (31.4%), acute kidney injury (23.5%), and sepsis (19.6%). Mechanical ventilation was required in 90.2% of maternal deaths and 53.1% of near-miss cases.

Conclusions: The high proportion of referred cases and unstable presentations emphasizes the need to strengthen peripheral healthcare facilities and referral systems. Early recognition of complications, timely referral, and improved antenatal care at primary healthcare levels are crucial for reducing maternal morbidity and mortality.

Keywords: Maternal mortality, Pregnancy complications, Tertiary care centers. Near miss, Treatment outcome

INTRODUCTION

Maternal mortality remains a critical public health challenge globally, particularly in developing countries. Despite significant advancements in healthcare services, maternal deaths continue to be a significant indicator of the quality of obstetric care and overall health system effectiveness. India, contributing to approximately 15% of global maternal deaths, faces substantial challenges in achieving optimal maternal health outcomes.[1]

A woman who survives life threatening conditions during pregnancy, abortion, and childbirth or within 42 days of pregnancy termination, irrespective of receiving emergency medical/surgical interventions, is called maternal near miss.[2] While maternal mortality has traditionally been the key indicator for maternal health, the study of maternal near-miss cases provides additional crucial insights into health system responsiveness and quality of care.[3]

Near-miss cases share many characteristics with maternal deaths and can provide comprehensive information about the factors that contribute to both maternal mortality and severe morbidity. These cases occur more frequently than maternal deaths, allowing for more robust statistical analysis and the identification of care patterns that can prevent progression to fatal outcomes.[4]

Karnataka, particularly its northern region, presents unique challenges in maternal healthcare delivery due to its diverse socio-economic landscape and varying levels of healthcare accessibility.[5] While the state has made significant progress in reducing maternal mortality over the past decade, disparities in healthcare access and quality persist, especially in rural and semi-urban areas.[6]

The analysis of both maternal near-miss cases and maternal deaths in tertiary care centers is particularly valuable as these institutions often serve as final referral points for complicated cases. Understanding the patterns, contributing factors, and outcomes in these settings can provide crucial insights for improving maternal healthcare services at all levels.[7]

The near-miss approach aids in assessing and enhancing the quality of care in the healthcare system by identifying patterns of severe maternal morbidity and mortality, evaluating the strengths and weaknesses of the referral system, and examining available clinical interventions, with the goal of finding ways to make improvements.[15]

This study aims to analyse the prevalence, causes, and outcomes of maternal near-miss cases and maternal deaths in a tertiary care center in North Karnataka, with the objective of identifying critical gaps in care and developing targeted interventions for improving maternal health outcomes.

METHODS

This retrospective observational study was conducted at Karnataka Medical College and Research Centre (KMCRI), Hubli, a tertiary care center in North Karnataka. The study period was extended throughout the year 2023 to analyse both maternal near-miss cases and maternal deaths that occurred during this timeframe.

The study population comprised all pregnant women who were admitted to the Department of Obstetrics and Gynecology at KMCRI during 2023. The identification and classification of maternal near-miss cases were conducted in accordance with the Ministry of Health and Family Welfare (MoHFW), Government of India guidelines. As per these guidelines, near-miss cases were identified based on three categories of criteria: clinical criteria, laboratory-based criteria, and management-based criteria.

The clinical criteria included severe maternal complications such as severe postpartum hemorrhage, severe pre-eclampsia, eclampsia, sepsis or severe systemic infection, ruptured uterus, and severe complications of abortion. Laboratory-based parameters encompassed severe acute thrombocytopenia (<50,000 platelets), severe acute hypoxemia (oxygen saturation <90% for ≥60 minutes), and severe acute kidney injury (creatinine ≥3.5 mg/dl). Management-based criteria included cases requiring intensive care unit admission, interventional radiology, laparotomy (excluding caesarean section), or the use of blood products for resuscitation.

The research team systematically reviewed multiple sources of medical records including admission registers, labour room records, intensive care unit records, operation theatre registers, and discharge summaries. A structured data collection format was utilized to gather comprehensive information about each case. The collected data included demographic details (age, socioeconomic status, residence), obstetric parameters (parity, gestational age, mode of delivery), nature of complications, interventions performed, and final outcomes.

For maternal deaths, detailed information was collected regarding the primary cause of death, contributing factors, admission to death interval, and the sequence of events leading to death. Cases were classified as direct obstetric deaths (resulting from obstetric complications) or indirect obstetric deaths (resulting from pre-existing conditions or conditions developed during pregnancy).

Statistical analysis was performed using SPSS version 22. Quality assurance measures were implemented throughout the data collection process. All collected data underwent verification by senior obstetricians, and any discrepancies were resolved through consensus after reviewing the original medical records. Regular audits of the data collection process were conducted to ensure completeness and accuracy of the information gathered.

The study was conducted after obtaining necessary approval from the Institutional Ethics Committee of KMCRI. All procedures followed were in accordance with the ethical standards of the institutional research committee and with the Helsinki Declaration of 1975, as revised in 2013. Patient confidentiality was maintained by coding all patient identifiers during data collection and analysis.

RESULTS

In our study, in the year 2023, there were total 113 maternal near miss cases and 51 maternal deaths. Total number of live births in the year was 11658. Maternal mortality ratio was found to be 437.46 per 1 lakh live births.

In our study, majority of both maternal near-miss cases and deaths occurred in the 20-25 years age group (43.4% and 54.9% respectively). Primigravidae constituted the largest proportion of cases in both groups (48.7% of near-miss

cases and 43.1% of deaths). Hindu women represented the majority of cases in both categories (77.9% and 78.4% respectively), reflecting the regional demographic distribution. (Table 1).

Table 1: Socio-demographic characteristics of study participants.

Variable		Maternal near miss (n=113)	Maternal deaths (n=51)
		N (%)	N (%)
Age (in years)	<20	11 (9.7)	1 (2)
	20-25	49 (43.4)	28 (54.9)
	26-30	38 (33.6)	12 (23.5)
	31-35	12 (10.6)	8 (15.7)
	>36	3 (2.7)	2 (3.9)
Parity	Primi	55 (48.7)	22 (43.1)
	Para 2	29 (25.7)	11 (21.6)
	Para 3	18 (15.9)	15 (29.4)
	Para ≥4	11 (9.7)	3 (5.9)
Religion	Hindu	88 (77.9)	40 (78.4)
	Muslim	25 (22.1)	11 (21.6)
	Christian	0	0

Table 2: Clinical characteristics of study participants.

Clinical characteristics		Maternal near miss	Maternal deaths
		N (%)	N (%)
Antenatal care	Booked at KMCRI	6 (5.3)	9 (17.6)
	Booked outside	107 (94.7)	42 (82.4)
Referral status	referred	86 (76.1)	36 (70.6)
	Not-referred	27 (23.9)	15 (29.4)
Condition at admission	Stable	76 (67.3)	21 (41.2)
	Unstable	37 (32.7)	30 (58.8)
Mode of delivery	Early pregnancy	5 (4.4)	4 (7.8)
	Antenatal	1 (0.9)	6 (11.8)
	LSCS	85 (75.2)	27 (52.9)
	Vaginal delivery	22 (19.5)	14 (27.5)

A striking finding was that the majority of cases were booked outside KMCRI (94.7% of near-miss cases and 82.4% of deaths) and were referrals from other centers (76.1% and 70.6% respectively). The condition of patients at admission showed that 32.7% of near-miss cases and 58.8% of maternal deaths were unstable at presentation. LSCS was the predominant mode of delivery in both groups, though with a higher percentage in near-miss cases (75.2%) compared to maternal deaths (52.9%) (Table 2).

Hypertensive disorders emerged as the leading condition in near-miss events (65.5%), followed by hemorrhage (26.5%). Hypertensive disorders (31.4%), AKI (23.5%), and sepsis (19.6%) were the leading causes of maternal deaths. Some conditions like amniotic fluid embolism and COVID-related pneumonia were exclusively seen in maternal deaths, while certain complications like CNS and renal issues were seen in near-miss cases. Pulmonary edema and PPCM were significant contributors in both maternal near miss and maternal death cases (Table 3).

Table 3: Causes of morbidity of the study participants.

Morbidity	Maternal near miss	Maternal deaths
	N (%)	N (%)
Haemorrhage	30 (26.5)	6 (11.8)
Sepsis	6 (5.3)	10 (19.6)
Hypertensive	74 (65.5)	16 (31.4)
Amniotic fluid embolis	0	2 (3.9)
AFLP	0	0
Cardiac disease	1 (0.9)	3 (5.9)
Pulmonary embolism	0	0
Pneumonia/COVID	0	4 (7.8)
Others	4 (3.5)	9 (17.6)
CNS	3 (2.7)	0
Renal	1 (0.9)	0
PPCM	19 (16.8)	10 (19.6)
AKI	10 (8.8)	12 (23.5)
DIC	2 (1.8)	7 (13.7)
HELLP	9 (8)	3 (5.9)
Pulmonary EDEMA	25 (22.1)	1 (2)
CVT	6 (5.3)	5 (9.8)
MODS	13 (11.5)	9 (17.6)

Table 4: Details of interventions among the study participants.

Interventions	Maternal near miss	Maternal deaths
	N (%)	N (%)
Laparotomy	11 (9.7)	7 (13.7)
Hysterectomy	18 (15.9)	7 (13.7)
Internal iliac artery ligation	26 (23)	5 (9.8)
Mechanical ventilation	60 (53.1)	46 (90.2)
Ionotropes	25 (22.1)	39 (76.5)
Blood transfusion	67 (59.3)	32 (62.7)
Dialysis	10 (8.8)	6 (11.8)

The intervention patterns showed significant differences between the groups. While blood transfusion was commonly required in both groups (59.3% of near-miss cases and 62.7% of deaths), mechanical ventilation showed a marked difference (53.1% in near-miss vs 90.2% in deaths). Similarly, ionotrope usage was significantly higher in maternal deaths (76.5%) compared to near-miss

cases (22.1%), indicating the severity of cases that progressed to mortality (Table 4).

Severe maternal outcome ratio (SMOR) referred to the number of women with life-threatening conditions (MNM+MD) per 1000 live births (LB) (SMOR=[MNM+MD]/LB). MNM ratio (MNMR) referred to the number of maternal near-miss cases per 1000 live births (MNMR=MNM/LB). Maternal near-miss mortality ratio (MNM:MD) referred to the ratio of MNM cases to MD. Mortality index (MI) referred to the number of maternal deaths divided by the number of women with life-threatening conditions expressed as a percentage (MI=MD/[MNM+MD]).

In our study, SMOR was found to be 14.07 per 1000 live births, MNMR was 9.69 per 1000 live births, MNM: MD was 2.22:1 and Mortality index was 31.1%. This indicates that 14 women per 1000 live births had life-threatening conditions and for every maternal death there were 2.22 near miss cases. Of all women who developed life-threatening conditions, 31.1% died.

DISCUSSION

Karnataka Medical College and Research Institute, Hubballi is a tertiary care centre of North Karnataka. It has delivery rate of around 10,000-12,000 per year. The Institute/ Hospital gets a large number of referrals from PHCs, CHCs, and private hospitals in Dharwad district as well as from hospitals and medical college of other districts like Haveri, Gadag, Koppal, Davangeri, Bagalkot, Belagavi, Uttar Kannada etc. Being a tertiary care centre and a referral hospital, most of the women getting admitted have risk factors and many are in a critical state. Our study provides significant insights into maternal near-miss cases and maternal deaths at a tertiary care center in North Karnataka.

In our study the ratio of 1:2.2 i.e. 1 maternal death per 2.2 Near Miss were noted. This is due to the available facilities in our institution. The hospital runs 1 Obstetric ICU and Obstetric HDU, one blood bank and Emergency operation theatres round the clock to provide emergency obstetric services and critical care to the patients. Also, availability of super speciality units like cardiology, neurology, nephrology, neurosurgery etc.

The cases will be referred from PHC's, CHC's, Taluka and District hospitals. Around 55-60% of the referrals will be unjustifiable and due to the various reasons like non availability of blood and blood products, non-availability of NICU care or OT facilities, non-availability of Cardiologist, Neurologist, Nephrologist, and for ICU care. majority of patients were referred for better management of labour ,previous caesarean section, hypertensive disorder of pregnancy, antepartum haemorrhage (APH), postpartum haemorrhage and anaemia .Other common causes were obstructed labour, failure to progress, premature rupture of membrane (PROM), intrauterine death (IUD), post term, fetal distress, hand prolapse, cord prolapse, twins, pre term, mal presentation, cephalopelvic disproportion (CPD), intrauterine growth retardation (IUGR), respiratory distress, heart disease, no specific cause mentioned in few cases.

The predominant age group affected in our study was 20-25 years, comprising 43.4% of near-miss cases and 54.9% of maternal deaths. This finding aligns with a study by Verma et al.9 This could be attributed to the early marriage, early child bearing practices still prevalent in North Karnataka. In this study by Verma et al both morbidity (28%) and mortality (37%) were maximum in the age group of 20-24 years and maternal near-miss was higher (76.92%) in multigravida patients.[9] Higher morbidity was seen in the cases with one previous lower segment caesarean section (LSCS) (13%) and mortality was higher in both previous one and previous two LSCS cases (7%). In our study primigravidae constituted the largest proportion of cases (48.7% of near-miss and 43.1% of deaths). This highlights the particular vulnerability of first-time mothers and emphasizes the need for special attention to this group during antenatal care.

A striking finding in our study was the high proportion of cases booked outside our institution (94.7% of near-miss cases and 82.4% of deaths) and referred from other centers (76.1% and 70.6% respectively). This is very similar to the findings of Pratima et al where 94.22% of deaths, Khandale et al 88.46%, Verma A et al.[9-11] 100% deaths were of cases not booked at the tertiary hospital but booked outside. The high referral rate might indicate both the tertiary nature of our facility and potential delays in recognizing complications at primary healthcare levels.

The high proportion of referred cases in our study, with 76.1% of near-miss and 70.6% of maternal deaths coming from other facilities, suggests significant gaps in the quality and timeliness of primary care. Many of these referred patients did not receive adequate initial treatment, including proper medication dosages, appropriate complication assessment, and prompt referral, leading to delayed presentation and increased morbidity by the time they reached our tertiary center. This highlights the critical need to strengthen primary healthcare services, ensure proper antenatal and intrapartum care, and empower healthcare personnel at the peripheral level to recognize complications early, provide initial stabilization, and refer patients in a timely manner. Reducing unjustified referrals and improving the management of patients at the district hospital level could significantly reduce maternal mortality by preventing the "missing of the golden hour" and decreasing the burden on tertiary care facilities, thereby enhancing the quality of care provided to individual patients.

Hypertensive disorders emerged as the leading cause of near-miss events (65.5%) in our study, followed by hemorrhage (26.5%). This differs from studies by Rathod et al where amongst near-miss cases, haemorrhage

(26.70%), anaemia (24.84%), hepatitis (16.77%) and PIH (11.80%) were leading causes, while causes for maternal mortality were PIH (27.27%), haemorrhage (19.79%), sepsis (18.18%), anaemia (16.16%) and hepatitis (16.66%).[12] In a study by Verma et al septicaemia was the commonest (59.61%) in the near-miss group and cardiovascular causes and septicaemia were the commonest in the mortality group.[9] The higher prevalence of hypertensive disorders in our study population warrants further investigation and may suggest regional variations in disease patterns.

Our study revealed high rates of mechanical ventilation (90.2%) and inotrope usage (76.5%) in maternal deaths, significantly higher than those reported by Harde M et al (42.6% and 6.6% respectively).[13] This difference might reflect both the severity of cases reaching our center and the availability of intensive care facilities.

The rate of obstetric hysterectomy in our study (15.9% in near-miss cases) is comparable to findings by Sharma S et al who reported 16.7% in their analysis of near-miss cases.[14] However, our internal iliac artery ligation rate (23%) which is higher than most reported studies, like in Sharma et al it was 13.2% possibly indicating a more aggressive approach to controlling hemorrhage. In a study by Verma et al the MMR was 623/1lakh (0.623%) during the study period, MNMR was 12/1000 LB, with 18/1000 LB (1.82%) of severe maternal outcome ratio (SMOR).[9] These findings were comparable to our study.

CONCLUSION

The study reveals a significant maternal mortality ratio of 437.46 per 100,000 live births at our tertiary care center in 2023, with 113 near-miss cases and 51 maternal deaths among 11,658 live births. Hypertensive disorders emerged as the predominant cause of maternal near-miss events (65.5%), while a combination of hypertensive complications (31.4%), acute kidney injury (23.5%), and sepsis (19.6%) were the leading causes of maternal deaths. The high proportion of referred cases (76.1% in near-miss and 70.6% in deaths) and the significant number of patients who arrived in unstable condition (58.8% of maternal deaths) highlights the critical need to strengthen peripheral healthcare facilities and referral systems.

The study emphasizes the importance of early recognition of complications, timely referral, and the need for improved antenatal care at primary healthcare levels. Implementation of these measures, along with enhanced emergency obstetric care facilities at district hospitals, could significantly reduce maternal morbidity and mortality in the region.

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