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Original Article

Obstetrics and Gynaecology Section

Clinical Profile and Outcomes of Severe Acute Maternal Morbidities in a Tertiary Care Centre, Bangalore, India: A Descriptive Study

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ABSTRACT

Introduction: Many complications can occur during pregnancy, delivery, and the immediate post-partum period that necessitate admission to the Intensive Care Unit (ICU). As maternal mortality is declining in many areas of the developing world, studying it alone may not be sufficient to provide information on the quality of care given. Therefore, the emphasis is more on Severe Acute Maternal Morbidity (SAMM) or Maternal Near Miss (MNM), which has emerged as a promising alternative to maternal mortality reviews. This approach has an advantage over maternal mortality as it draws attention to the reproductive health of surviving women.

Aim: To determine the clinical profile, predisposing clinical conditions, and outcomes of SAMM.

Materials and Methods: A descriptive study was conducted at Bangalore Baptist Hospital, Bangalore, Karnataka, India, from November 2020 to June 2022. Data were collected on all pregnant women and postpartum women up to 42 days after delivery who were admitted to the high-risk labour room, High Dependency Unit (HDU), and ICU. A total of 191 patients were enrolled, and various variables were studied, including demographic details, gestational age, co-morbidities, intensive care management, and neonatal outcomes. Women with Life-Threatening Conditions (WLTC), SAMM, and Maternal Deaths (MD) were noted, and using these parameters, the Severe Maternal Outcome Ratio (SMOR), MNM incidence ratio, and mortality index were calculated.

Results: Among the 191 women with life-threatening conditions, 187 had SAMM, and four patients succumbed to death. The majority of SAMM cases were due to obstetric haemorrhage, observed in 73 patients (46.2%). This was followed by hypertensive disorders in pregnancy, seen in 65 patients (41.1%), and sepsis, seen in 15 patients (15.24%). The SMOR was calculated to be 44.05%. The MNM ratio was 43.13%, and the MNM mortality ratio was 46.75:1. A mortality index of 20.94% was reported in the study. Out of 155 births, 128 were live births, 14 were intrauterine deaths, 10 were fresh still-births, and three were early neonatal deaths.

Conclusion: Screening for high-risk pregnancies and timely detection of severe maternal morbidity are important steps toward promoting safe obstetric care. A multi-disciplinary team with good ICU care and availability of blood and blood products will help decrease maternal mortality.

Keywords: Hypertensive disorders, Obstetric haemorrhage, Sepsis

INTRODUCTION

The definition of SAMM or MNM by the World Health Organisation (WHO) is "A woman who nearly died but survived a complication that occurred during pregnancy, childbirth, and within 42 days of termination of pregnancy" [1]. According to this definition, if a mother experiences medical morbidity within 42 days after childbirth due to complications arising directly or indirectly from childbirth, it is considered SAMM [2].

Globally, maternal mortality has decreased by 34% from 2000 to 2020, from 342 deaths to 223 deaths per 100,000 live births, according to United Nations inter-agency estimates. This reduction falls short of the 6.4% annual rate needed to achieve the Sustainable Development Goal (SDG) of 70 maternal deaths per 100,000 live births by 2030 [3]. In India, the Maternal Mortality Rate (MMR) decreased to 97 in 2018-2020 from 113 in 2016-18, 122 in 2015-17, and 130 in 2014-2016, according to the Sample Registration System's special bulletin on maternal mortality in India 2018-20, with the highest MMR recorded in Assam [4].

Death reviews and inquiries are conducted worldwide to reduce maternal mortality rates and improve the quality of care. However, many morbidities go unreported, causing a burden on patients and their families [5]. Early treatment can lead to the recovery of obstetric patients. Good ICU care with monitoring can save young and productive lives. In developing countries like India, access to this level of care is limited in many places, with a lack of proper ICU facilities. As a result, many patients are referred from different clinics. The causes of near misses reflect the causes of maternal deaths, all of which are studied in detail in this research to determine the number of SAMM cases, the most common causes, and maternal and neonatal outcomes.

MATERIALS AND METHODS

A descriptive study was conducted at Bangalore Baptist Hospital, Bangalore, India, from November 2020 to June 2022. The study received approval from the ethical committee (BBH/IRB/2021/10). Upon stabilising the patient, informed consent was obtained from the relative or legal representative. All pregnant women, regardless of their gestational age, and postnatal women up to 42 days after delivery who were critically ill and experienced a near-miss event before or after admission to the hospital, formed the study population.

Sample size calculation: Based on a study conducted in Ghana [6], which reported pre-eclampsia as the most common clinical

presentation of SAMM (41.5%), a sample size of 191 was calculated with an error margin of 7%.

Inclusion criteria: All pregnant women and post-natal women upto 42 days after delivery who were admitted to the High-risk labour room, ICU, or HDU were included.

Exclusion criteria: Pregnant women who were brought in dead and post-natal women beyond 42 days were excluded from the study.

Procedure

A total of 191 patients were enrolled, and data were collected on various variables, including demographic details, gestational age, co-morbidities, mode of delivery and management, and neonatal outcomes. Women with Life-Threatening Conditions (WLTC), SAMM, and Maternal Deaths (MD) were recorded, and the following indices were calculated based on these parameters:

1. Severe Maternal Outcome Ratio (SMOR)=(SAMM+MD) per 1000 live births.
2. Maternal near miss ratio=SAMM per 1000 live births.
3. Mortality index=MD/(SAMM+MD).

Data were collected using a semi-structured questionnaire that included information such as name, age, hospital number, booked status, unbooked status, migrated patient status, type of delivery (normal vaginal, elective, or emergency caesarean section), need for other surgeries, adverse effects leading to SAMM, duration of hospital stay, and maternal and neonatal outcomes.

STATISTICAL ANALYSIS

The data were entered into a Microsoft excel datasheet and analysed using Statistical Package for Social Sciences (SPSS) version 22.0 software. Categorical data were represented in the form of frequencies and proportions, while continuous data were presented as mean and standard deviation.

RESULTS

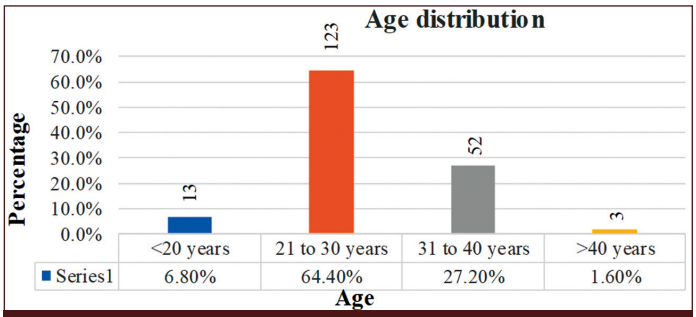
Total of 191 patients were included in the study. The total number of deliveries during the study period was 4167. The total number of live births was 4335. The total number of SAMM/MNM patients was 187, and the total number of MDs was four. Out of the four deaths, two cases were due to sepsis and its complications, one case was due to hypertensive disorders in pregnancy, and one case was due to severe Coronavirus Disease-2019 (COVID-19) illness.

1. Severe Maternal Outcome Ratio (SMOR)=(SAMM+MD) per 1000 live births=44.05%.
2. Maternal near-miss incidence ratio=SAMM per 1000 live births=43.13%.
3. Maternal near-miss mortality ratio=46.75:1.
4. Mortality index=MD/(SAMM+MD)=20.94%.

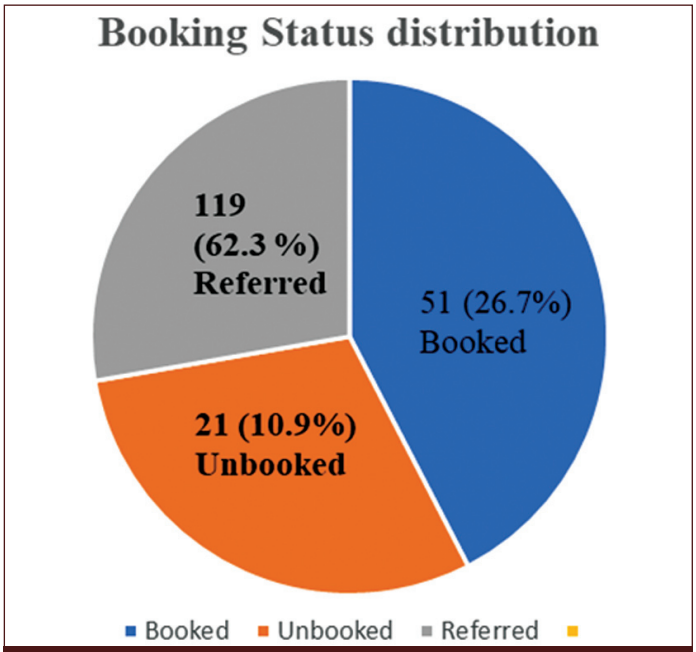
Most of the cases occurred in the maternal age group of 21-30 years [Table/Fig-1]. The total number of ANC check-ups for patients who were either booked in our hospital or referred from an outside hospital was 170. Unbooked patients were 21 (who presented for the first time in our hospital) [Table/Fig-2].

Among the patients, about 22.5% are post-natal, and 21.5% of the women are from the gestational age of 28 to 33+6 weeks [Table/Fig-3].

Out of a total of 158 obstetric morbidities, there are a total of 73 obstetric haemorrhages (post-partum haemorrhage, abnormal placentation, abruptio placenta, ectopic pregnancy, incomplete abortion), which account for 46.2% of the causes of obstetric morbidity [Table/Fig-4].



[Table/Fig-1]: Bar diagram showing age distribution of subjects [N=191].



[Table/Fig-2]: Pie diagram showing booking status distribution [N=191].

	Count	%
<12 weeks	30	15.7%
12 weeks to 19+6 weeks	7	3.7%
20 weeks to 27+6 weeks	14	7.3%
28 weeks to 33+6 weeks	41	21.5%
34 weeks to 36+6 weeks	27	14.1%
37 weeks to 41+6 weeks	29	15.2%
Postnatal period	43	22.5%
Total	148 (ANC)+43 (PNC)=191	100%

[Table/Fig-3]: Gestational age distribution (N=191).

		Count	%
Pre-eclampsia		41	25.95%
HELLP (Haemolysis, elevated liver enzymes, low platelets)		6	3.8%
Antepartum eclampsia		10	6.33%
Postpartum eclampsia		7	4.43%
Intrapartum eclampsia		1	0.63%
Puerperal sepsis		7	4.43%
Acute Fatty Liver of Pregnancy (AFLP)		1	0.63%
Postpartum Haemorrhage (N =14)	Atonic	9	5.7%
	Traumatic	2	1.27%
	Tissue (Retained products)	3	1.9%

Abnormal placentation (N=15)	Placenta Previa	11	6.96%
	Accreta	1	0.63%
	Increta	1	0.63%
	Percreta	2	1.27%
Abruptio placenta		19	12.03%
Ectopic pregnancy (n =18)	Ruptured tubal	13	8.23%
	Unruptured tubal	3	1.9%
	Caesarean scar ectopic	2	1.27%
Incomplete abortion		7	4.43%
Peripartum cardiomyopathy		4	2.53%
Postop caesarean complications		3	1.9%
Molar pregnancy		1	0.63%
Intra Hepatic Cholestasis of Pregnancy (IHCP)		3	1.9%
Hyperemesis gravidarum		1	0.63%
	Total	158	

[Table/Fig-4]: Obstetric morbidity among subjects (n=158).

Among the medical morbidities, haemorrhagic shock with complications was the highest, accounting for 13 out of 74 cases, i.e., 17.6% [Table/Fig-5].

	Count	%
1. Renal (AKI: Acute Kidney Injury on CKD: Chronic Kidney Disease, lupus nephritis, acute pyelonephritis, renal calculi, urosepsis, end stage renal disease)	9	12.2%
2. Pulmonary (pulmonary oedema, acute respiratory distress syndrome, pneumonia, pulmonary thromboembolism)	4	5.4%
3. Cardiac (Eisenmenger's, stress induced cardiomyopathy, acute pericarditis, severe PAH, rheumatic heart disease with severe MS, AS)	10	13.5%
4. Central Nervous System (CNS) (Acute CVA, CVT, Arnold Chiari, Aseptic Meningitis with Bilateral Papillitis, Brain Tuberculoma, SAH, Status Epilepticus)	10	13.5%
5. Hepatic (autoimmune hepatitis, viral hepatitis, hepatic encephalopathy)	3	4.1%
6. Shock- (Septic- 8, Haemorrhagic- 13, Cardiogenic- 1, Anaphylactic- 1)	23	31.1%
7. Poisoning (Ingestion of phenol)	1	1.4%
8. Gastro-intestinal (Ileocecal Tuberculosis, Peritonitis)	2	2.7%
9. Acute Myeloid Leukaemia (AML)	1	1.4%
10. Cholera	1	1.4%
11. Coronavirus Disease-2019 illness	9	12.2%
12. Dengue haemorrhagic fever	1	1.4%
	74	

[Table/Fig-5]: Medical morbidity among subjects (n=74).

As the majority of cases were antenatal, most of them were managed by termination of pregnancy. Among them, 52.4% account for caesarean section [Table/Fig-6]. Among the patients, the maximum number of patients (72.8%) stayed in the hospital for less than seven days [Table/Fig-7]. A total of 93.2% of cases treated in our hospital were stable at the time of discharge, and 2.1% were MDs [Table/Fig-8].

		Count	%
Mode of delivery and management	Emergency LSCS	83	43.5%
	Vaginal delivery (including preterm, instrumental, VBAC)	49	25.7%
	Elective LSCS	17	8.9%
	Laparotomy for ectopic pregnancy	18	9.4%
	Dilatation and curettage	8	4.2%
	Medical management (PPCM, sepsis, eclampsia, hyperemesis gravidarum)	8	4.2%
	Caesarean hysterectomy	4	2%
	Relaparotomy	3	1.6%
	Suction evacuation	1	0.5%
	Total	191	

[Table/Fig-6]: Mode of delivery and management.

		Count	%
Duration of hospital stay	<7 days	139	72.8%
	8 to 14 days	39	20.4%
	15 to 28 days	8	4.2%
	>28 days or 1 month	5	2.6%
	Total	191	100%

[Table/Fig-7]: Duration of hospital stay distribution.

		Count	%
Condition at discharge	Discharge Against Medical Advice (DAMA)	9	4.7 %
	Death	4	2.1 %
	Stable	178	93.2 %

[Table/Fig-8]: Condition of mother at discharge.

Out of 191 cases, 36 underwent termination of pregnancy (18 were ectopic, seven were incomplete abortions, four terminations were due to cardiac and renal disease, two were septic abortions, one was a molar pregnancy, and four cases were lost to follow-up after treating the cause, like dengue haemorrhagic fever, cholera, ingestion of phenol, acute pyelonephritis). Among 155 births, 128 were live births, and 14 were intrauterine deaths. Among three early neonatal deaths, only one was delivered in our hospital; the other two babies were delivered elsewhere [Table/Fig-9].

		Count	%
Neonatal outcome	Live	128	82.6%
	Intrauterine Death (IUD)	14	9%
	Fresh Still Birth (FSB)	10	6.5%
	Early Neonatal Death (END)	3	1.9%
	Total	155	100%

[Table/Fig-9]: Neonatal outcome.

DISCUSSION

In the present study, the majority (63.4%) were aged between 21 to 30 years, and the mean age of the study subjects was 25.57 years. Studies conducted by Sinha M et al., Mbachu II et al., and Vandana and Krishnaswamy P also found similar age groups for maternal morbidity, consistent with present study findings [7-9]. However, in the study by Mustafa Adelaja L and Olufemi Taiwo O., the mean age of the subjects was 30±2 years, which could be attributed to differences in social factors [10].

Research from many developing nations indicates that the majority of maternal near-miss incidents had already occurred before the

women arrived at the participating hospitals. For instance, in Bolivia, Mozambique, and Somalia, 74%, 70%, and 74.2% of near-miss cases, respectively, were in critical condition upon reaching the medical facilities, highlighting the importance of addressing pre-hospital barriers [11-13]. In the study conducted by Kamal S et al., maternal morbidity rates were significantly higher than our study findings, with 52% of cases being critical upon arrival at the hospital and 80% being unbooked cases [14].

In the present study, nearly 77.5% of the subjects were from ANC, and 22.5% were from PNC, which is consistent with the findings of the study by Sinha M et al., where 23% were from PNC and 76% were in ANC at the time of reporting [7].

In a study by Roopa PS et al., the number of women with near-miss outcomes at a gestational age of 28 weeks was 57.2% [15]. Another study by Shrestha N et al., reported that pregnant women with near-miss maternal morbidity accounted for 30.5% at gestational age less than 12 weeks, 16.6% at 13-28 weeks, and 27.7% at more than 28 weeks, with 25% of cases occurring in the postnatal period [16]. Various studies suggests that near-miss maternal morbidity can occur at any gestational age, but the majority are in the group with a gestational age greater than 28 weeks. In the present study, obstetric haemorrhage was found to be the most common cause of maternal morbidity, followed by hypertension. The causes of SAMM in other studies are outlined in [Table/Fig-10] [9,15,17-20].

Studies	Obstetric haemorrhages	Hypertensive disorders in pregnancy	Sepsis
Present study	46.2%	41.1%	15.24%
Roopa PS et al., [15]	44.2%	23.6%	16.3%
Bibi S et al., [17]	-	50%	17%
Vandana and Krishnaswamy P [9]	6 %	56%	6.4%
Waterstone M [18]	55.6 %	38.09%	2.9%
Zwart J et al., [19]	62.9%	8.69%	-
Siddiqui S et al., [20]	34.2%	29.1%	35%

[Table/Fig-10]: Comparison between the present study and other studies regarding outcomes of SAMM [9,15,17-20].

In some Indian studies by Khosla AH et al., the prevalence of near miss was 4.4% [21], and by Chhabra P, it was 3.3% [1]. Data on various studies regarding MMR, mortality index, and MNM to mortality ratio are outlined in [Table/Fig-11] [8,11,15,22,23].

Study	Maternal Near Miss (MNM) to mortality ratio	Mortality index	MMR
Present study	46.8:1	20.94%	92.3 per 1 lac live births
Roopa PS et al., [15]	5.6:1	14.9%	313 per 1 lac live births
Mbachu II et al., [8]	11.4:1	8.8%	1908 per 1 lac live births
Herklots T et al., [22]	1.3:1	6.03%	647 per 1 lac live births
Roost M et al., [11]	26.7:1	3.6%	187 per 1 lac live births
Mall A and Mansuri F, [23]	3.1:1	24.23%	367 per 1 lac live births

[Table/Fig-11]: Comparison of various studies regarding MMR, mortality index, MNM to mortality ratio [8,11,15,22,23].

To facilitate comparison over time and between nations, standardisation of inclusion criteria and case assessment techniques is necessary. Both inadequate prenatal care and delayed admission to the ICU might impact outcomes. Conducting an audit of SAMM patients can help us better understand the continuum from maternal illness to death.

MNM has gained attention as the rate has decreased in developed countries, and guidelines for categorising patients under this group have been provided by the World Health Organisation (WHO) working group. Evaluating healthcare facilities based on MNM has proven to be equally effective. Consequently, focus has shifted from maternal mortality to MNM.

Limitation(s)

The influence of socio-cultural factors among the subjects was not analysed to understand their impact on the onset of SAMM. A longer duration of study spanning over years and a multi-center study are required to gain a better understanding of SAMM.

CONCLUSION(S)

Obstetric haemorrhage, hypertensive disorders, and sepsis in pregnancy continue to be the most common causes of SAMM. Therefore, maternal morbidity and mortality can be reduced by ensuring adequate antenatal care, regular antenatal visits, institutional deliveries, post-natal care and follow-up, early detection and intervention, availability of a critical care team, and a multi-disciplinary team providing good ICU care. Screening for high-risk pregnancies and timely detection of severe maternal morbidity are important steps toward promoting safe obstetric care. Reviewing cases of severe maternal morbidity and mortality can help improve the quality of care.

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