Original Research Article

Analysis of Maternal Mortality in a Tertiary Care Hospital to Determine the Causes and Preventable Factors

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ABSTRACT

INTRODUCTION

The occurrence of maternal mortality is a significant indicator of a country's economic progress. The current study seeks to examine the causes of maternal deaths in a tertiary care hospital.

OBJECTIVES

To gather data and insights about the factors and issues contributing to maternal mortality in a tertiary care hospital in an urban setting, identify any potentially avoidable factors, and utilize the findings to prevent future maternal deaths.

METHODS

This was a 4 years retrospective study. The medical records of all maternal deaths occurring over a period of 4 years between January 2019 and November 2022 were reviewed and correlated with causes of death.

RESULTS

MMR in our study was 466.2/1 lakh live birth, most of the deaths(36.3%) were in the age group of 23-27 years, 61.3% cases were from rural areas, major immediate cause of death being sepsis (22.5%), major antecedent cause of death found was hypertensive disorders(27.4%) , 44.8% of deaths were between 24 hours- <7 days of admission.

CONCLUSION

A significant number of the deaths that have been observed could be prevented, indicating a large scope for improvement.

KEYWORDS

Maternal Mortality, Pregnancy, Urban, Tertiary Hospital, Cause of Death

INTRODUCTION

Maternal mortality is defined as the death of a woman from any cause related to or aggravated by pregnancy, but not from accidental or incidental causes, while she is pregnant or within 42 days of terminating pregnancy, regardless of the length of the pregnancy or the location of the pregnancy.[1]

The international definition of maternal mortality is the number of maternal deaths per 1,00,000 live births. India is one of the nations with an extremely high rate of maternal death. When it came to maternal mortality ratios, they were 2000 per 1,00,000 live births in 1938, 1000 per 1,00,000 live births in 1959, and 540 per 1,00,000 live births in 1999.[2]

The global MMR is supposed to drop to less than 70 per 1,00,000 live births by the year 2030, according to United Nation's Sustainable Development Goals. The maternal mortality ratio

(MMR) around the world slightly decreased from 227 deaths per 100,000 live births in 2015 to 223 in 2020. This number is still more than three times the goal of 70 set for 2030 – indicating that roughly 800 women lost their lives every day due to preventable complications during pregnancy and childbirth, or one death every two minutes.[3]

The current MMR for India for the year (2018–2020) is 97 per 1,00,000 live births, a declining trend from the previous year. With 69 per 1,00,000 live births, Karnataka has the highest rate in South India.[4] Pregnancy, despite being viewed as a natural and healthy condition, poses a significant risk of illness and even death at times.[5] The family, society, and country are all significantly impacted by the death of a mother. The surviving baby is deprived of the mother's affection. Minimizing maternal mortality is one of the MDGs' most significant objectives. To enable the implementation of corrective measures, the current study was carried out, to examine the causes of maternal deaths at a teaching hospital providing tertiary care.

Objectives of Study

1. To analyze causes of maternal mortality

2. To determine the preventable factors

3. To utilize this information in reducing maternal mortality

MATERIALS AND METHODS

Source of Data

Maternal mortality register in Department of OBG in Vani Vilas Hospital, BMCRI.

Methods of Collection of Data

Study Design

Retrospective study

Study Period

4 years (January 2019 to November 2022)

Place of Study

Vani Vilas Hospital, Bangalore Medical College and Research Institute, Bangalore

Sample Size

Based on the previous study conducted by **Jyotsana Lamba et al**, by considering the proportion of hemorrhage which is a major direct cause maternal mortality, the sample size is calculated as follows,

Formula

$$n = \frac{4pq}{d^2}$$

Where, n = sample size

p = proportion of hemorrhage causing maternal mortality = 22.2%

q = 100 - p = 100 – 22.2 = 77.8

d = Assuming precision is 6%

On substitution,

$$n = \frac{4 \times 22.2 \times 77.8}{(6)^2}$$

n = 191.9

Therefore, the sample size is approximately 192.

Inclusion Criteria

Death of any woman while being pregnant or within 42 completed days of termination of pregnancy

Exclusion Criteria

1. Accidental and incidental causes of death
2. Gynecological causes
3. Death with covid-19 infection

Methodology

Over the course of four years, from January 2019 to November 2022, a retrospective hospital-based study was conducted in the Obstetrics and Gynecology Department of Bangalore Medical College and Research Institute, a tertiary level health care facility in Bangalore,

Karnataka, India. The study was analyzed a total of 248 maternal deaths with respect to both the immediate and antecedent causes of death, with a focus on factors such as the patient's socio-demographic profile, parity, cause of death, and trimester of pregnancy at the time of death. These factors with the potential to affect maternal mortality such as delays in seeking medical attention, referrals, and treatment were also analyzed.

The result thus generated is utilized in reducing maternal mortality. The ethical committee of the institute approved the study. Results will be analyzed by using percentage and proportion.

Figure 1 : Flow Chart
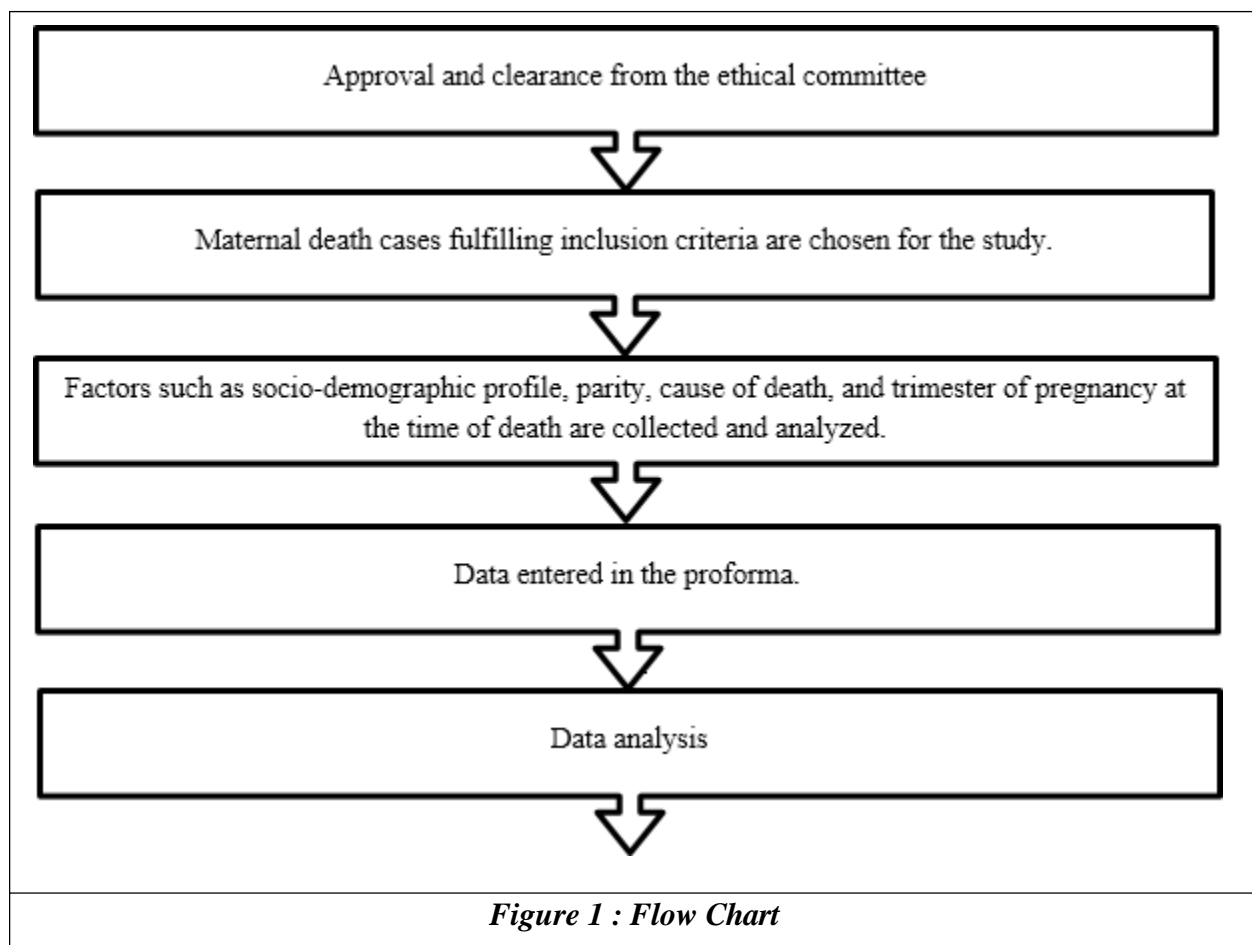
Outcome Measures

1. To analyze the factors and causes of maternal mortality
2. To assess any delay in seeking medical attention, or delay in referral, or delay in treatment And utilize the knowledge in preventing further maternal mortalities

Statistical Analysis

- Kolmogorov-Smirnov test was used to determine the normality of the data.

- Continuous variables are expressed in terms of MEAN + SD.

- Categorical variables are expressed in frequency (n) and percentage (%)

- There are 248 participants in this study (n=248)

RESULTS

MMR of our study was 466.2/1,00,000 live birth. The mean age of maternal deaths was 25.7 years. The maximum age seen was 40 years and minimum being 17 years. The maximum age interval observed was between 23 years to 27 years which is 36.3%. The second maximum being 18 to 22 years of age which is 29.4%.

Among total population studied 61.3% were from rural population. 100% of the patients were referred. Primi gravida constituted 20.6% of deaths. Primi para constituted 44.7% of deaths, multi para were remaining 34.7% of deaths. Total antenatal deaths were seen in 16.1%. Total postnatal deaths were seen in 83.9%. Details as explained in table 1.

	Socio-Demographic Features	**Number**	**Percentage**
Age (Years)	<18	2	0.8
	18-22	73	29.4
	23-27	90	36.3
	28-32	59	23.8
	33-37	20	8.1
	>38	04	1.6
Residence	Urban	96	38.7
	Rural	152	61.3
Socio-Economic Status	Upper	00	00
	Upper Middle	02	0.8%

	Lower Middle	12	4.8%
	Upper Lower	46	18.5
	Lower	188	75.8%
Parity	0	51	20.6
	1	111	44.7
	2	57	23
	3	22	8.9
	4	6	2.4
	5	1	0.4
Delivery Status	Post-Natal Deaths	208	83.9
	Ante-Natal Deaths	40	16.1
Table 1: Illustrates socio-demographic data			

Causes	Number	Percentage
Sepsis	56	22.5
Pulmonary Embolism	47	18.9
Hemorrhagic Shock	40	16.1
Cerebral Cause	31	12.5
Cardiogenic Shock	25	10.08
DIC	15	6.04
Eclampsia	11	4.4
ARDS	8	3.2
Amniotic Fluid Embolism	6	2.4
Hepatic Causes	6	2.4
HIE	4	1.6
Table 2: Llustrates the Immediate cause of death		

The major immediate cause for death in this study was sepsis which was seen in 56 cases (22.5%), the second major cause being pulmonary embolism in 47 cases (18.9%), followed by hemorrhagic shock in 40 cases (16.1%)

Causes	Number	Percentage
Hypertensive Disorders	68	27.4
Eclampsia	36	14.5
PPH	25	10.08
Cardiac Causes	19	7.6
Hepatic Causes	19	7.6
Anemia	15	6.04
Sepsis	14	5.6
Cerebral Causes	13	5.2
Pulmonary Causes	10	4.03
Uterine Rupture/Perforation	9	3.6
Dengue Hemorrhagic Fever	7	2.8
Placenta Previa	6	2.4
Ruptured Ectopic	5	2.01
Uterine Inversion	1	0.4
Nephrotic Syndrome	1	0.4
Table 3: Illustrates the Antecedent cause of death		

The major antecedent cause for death in this study was hypertensive disorder of pregnancy as seen in 68 cases (27.4%). The next major antecedent cause was eclampsia in 36 cases (14.5%), post partum hemorrhage in 25 cases (10.08%), cardiac and hepatic causes 19 cases each(7.6%), anemia in 15 cases (6.04%), uterine rupture/perforation seen in 9 cases (3.6%), dengue hemorrhagic fever in 7cases (2.8%), uterine inversion leading to death seen in 1case(0.4%) Among the infective pathology H1N1 infection was present in 2 cases, pulmonary tuberculosis seen in 2 cases, cholera seen in 1 case.

Time	Number	Percentage
< 6 hours	27	10.9
6-24 hours	64	25.8
24 hours - 7days	111	44.8
> 7days	46	18.5
Table 4: Illustrates the Time interval between admisssion to death		

Admission to death interval analysis as illustrated in table-4, showed death of 27 cases (10.9%) at <6 hours, 64 cases (25.8%) at 6 hours – 24 hours, 111 cases (44.8%) at 24 hours to 7 days, 46 cases (18.5%) at >7 days interval.

DISCUSSION

Death of mother is a tragic event. In practical life, it has a severe impact on the family, community and eventually, the nation. In the present study, there were 248 maternal deaths amongst 53,191 deliveries during the study period of 4years, giving a MMR of 466.2 per 1,00,000 live births. Vani vilas hospital, Bangalore; receives complex cases from rural areas as it is both a teaching institution and a tertiary care center. The mortality ratio at the hospital has been impacted by the admissions of critically ill patients referred from surrounding areas, similar to other teaching institutions in India.

Similarly in a study conducted by Abhilasha Nair and Mohan K Doibale[6] on maternal mortality in a tertiary care hospital in a Maharashtra district, the average MMR over a three-year period (January 2012 to December 2014) was found to be 410/1,00,000 live births.

In the present study, the mean age of maternal deaths was 25.7 years. Maximum deaths (36.3%) were in the age group of 23-27 years, followed by (29.4%) deaths in 18-22 years. Teenage deaths were 2 i.e; 0.8%, deaths above 33 years was 9.7%. Which is similar to that reported by the other studies, Kaur et al[7] revealed that 51.8% of deaths in 20-30 years, 19.6% in teenage pregnancies and 23.3% in >30 years. And study by Vidyadhara et al[8] at tertiary hospital of Ahmedabad showed maximum deaths (55.27%) were in the age group of 19-24 years, followed

by (15.79%) deaths in <19 years and over the age of 30 years. Dogra et al[9] revealed that 48% deaths in 20–25 years while 10.3% in >30 years.

The decrease in the mortality rate among women under the age of 19 might be attributed in part to the liberalization of the MTP Act. This has led to an increase in young women seeking assistance from specialized physicians for lawful abortion procedures, consequently lowering the occurrence of illegal abortions and the resulting fatalities linked to their complications.

100% of the cases in the study were referred cases.

About 154 cases (62.1%) cases were from rural area while 94 cases (37.9%) were from urbal area, similarly a study conducted by Bhaskar et al[10] on maternal mortality at a tertiary care hospital, showed 69.16% of death of patients from rural areas.

Primi gravida constituited 20.6% of deaths. Primi para constituited 44.7% of deaths, multi para were remaining 34.7% of deaths. Agarwal et al [17][11] reported that high deaths among multiparas (43%) than the primiparas (25%); Thomas et al [20][12] showed that primigravida contributing to 29.2% and multigravida 50.8% of deaths.

In the present study among the immediate cause; sepsis stands the majority (22.5%), pulmonary embolism (18.9%), hemorrhagic shock (APH, PPH, Abortion related) - 16.1%, cerebral causes (CVA, IVH, CVT)-12.5%

And among antecedent causes; Hypertensive disorders and eclampsia constituted (27.4% and 14.5%), PPH (10.08%), followed by cardiac causes (RHD, CHD, CCF) and hepatic causes (hepatitis, AFLP, ALD)- 7.6% each and anemia - 6.04% cases

Uterine rupture/perforation seen in 9 cases (3.6%), dengue hemorrhagic fever in 7 cases (2.8%), uterine inversion leading to death seen in 1 case (0.4%)

Among the infective pathology H1N1 infection was present in 2 cases, pulmonary tuberculosis seen in 2 cases, cholera seen in 1 case.

Similarly in study by Vidhyadhar et al,[8] Common direct causes were- hemorrhage (21.05%), eclampsia and pulmonary embolism (10.52%) and sepsis (7.89%). Indirect causes were; hepatitis (21.05%), heart disease (13.15%), and anemia (2.63%).

A study by Sengupta et al,[13] noticed that among the direct causes; hemorrhage (12.40%) and sepsis (17.82%) and among the indirect causes; hepatitis (29.93%) followed by anemia (17.82%) stood the major.

Bera et al[14] revealed that among the direct causes, hemorrhage contributed in 23.8% and sepsis for 16.4% deaths and among the indirect causes, jaundice resulted (19.9%), followed by anaemia and heart disease, with 5.9% and 3.4% deaths respectively.

Admission to death interval analysis showed death of 27 cases (10.9%) at <6 hours, 64 cases (25.8%) at 6 hours – 24 hours, 111 cases (44.8%) at 24 hours to 7 days, 46 cases (18.5%) at >7 days interval. The shortest admission to death interval was 30 minutes seen in 3 cases with immediate cause of death being- hemorrhagic shock secondary to traumatic PPH, cardiac arrest and pulmonary embolism in patient with HELLP syndrome.

The longest admission to death interval was 27 days seen in case of acute fulminant hepattis with immediate cause of death being Hepatic encephalopathy with MODS

In a 10 years retrospective study conducted by Shobha et al,[15] showed 59.01% women died within a week of admission to the hospital, in which 21.31% women died in less than 24 hours of admission. Twenty five 40.98% women died after a week of admission to hospital.

CONCLUSION

Our study's MMR surpasses the national averages, also sepsis stands the major immediate cause and hypertensive disorders stands the major antecedent cause of death. This could be prevented by training local health system more efficiently in peripheral regions which helps in early identification of any high risk and early referral. This also requires sufficient antenatal, intrapartum, post partum care.

Therefore with early referral, rapid and well-equipped transport services, sufficient availability of blood and its components, and the promotion of overall safe motherhood, many deaths could have been prevented.

Every maternal death should be analyzed through a maternal death audit, whether it is at the community level through verbal autopsy or at the institutional level. This analysis will assist in pinpointing the factors and shortcomings in the healthcare delivery system that could be linked to pregnancy-related deaths.

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