

Review of Maternal Mortality at a Tertiary Care Hospital: What Have we Achieved?

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Abstract

Background Mothers are the nurturing pillar of the family. When a woman dies or becomes ill, either during or after giving birth, the consequences have the potential to affect not only the woman herself, but her family, society and the nation as well.

Objectives The study was designed to evaluate the maternal mortality ratio in a tertiary care hospital, assess the demographic profile, causes of maternal mortality, type

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of delay, and to suggest remedial measures for improvement.

Methods A retrospective study was done from Jan 2013 to Dec 2016 at a tertiary care hospital in New Delhi. The medical records of all maternal deaths over a period of 4 years were reviewed and analyzed.

Results The Maternal mortality ratio in the study period was 361.71/100,000 live births. The number of maternal death was 364. Unbooked cases accounted for the majority, i.e., 322, booked being 29 and registered 13. Two hundred and eleven cases were referred from other centers. Maximum deaths occurred between 21 and 30 years (73.07%). Anemia was widely prevalent. Most maternal deaths were due to direct causes like hypertensive disorders (28.02%), pregnancy-related infections (20.87%), and hemorrhage (12.36%). Among indirect causes, anemia, hepatitis, heart disease and respiratory illness accounted for 15.93, 11.53, 3.29 and 5.49%, respectively. Type I delay was most common (64.28%).

Conclusion Strengthening of the peripheral centers, hiring competent staffs and adequate blood bank facilities together with reference linkages must be done. Auditing the causes for maternal mortality is extremely helpful to identify the preventable causes and delays.

Keywords Maternal mortality review · Maternal death · Direct causes · Indirect causes · Tertiary care hospital

Introduction

According to the WHO, “A maternal death is defined as death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by pregnancy or its management but not from accidental or incidental causes” (ICD-10) [1]. Maternal death has serious implications on the family, the society and the nation.

United Nation report card on Millennium Development Goal-5 concluded that the progress shown by the South Asian countries including India which accounts for 25% of all maternal deaths in the world is not impressive [2]. The UN Millennium Development Goals called for reducing MMR by 75 per cent between 1990 and 2015 [2]. For India, this implies that it should have achieved the target of reducing maternal deaths to 109 by 2015. However, it even failed to achieve its target of 140, by the year 2015, and has an MMR of 167.

Direct obstetric causes like hypertensive disorders, pregnancy-related infections, abortion, hemorrhage and medical causes like hepatitis, heart disease, respiratory diseases are still the common causes of maternal deaths in our country. Since these causes are largely preventable by

early detection of risk factors and early intervention, their analysis can help to reduce the maternal mortality. The trends in causes of maternal mortality and institutional mortality rates in our center differ from those obtained in other studies in India; it is attributed to ours being a tertiary medical college hospital situated in New Delhi, where large number of patients are referred from neighboring states and NCR region.

Keeping all this in view, this study was done to analyze maternal mortality ratio in a tertiary care center and its epidemiological aspects.

Aims and Objectives

1. To determine the Maternal Mortality ratio at the Tertiary care Hospital for a period of 4 years.
2. To identify the causes and factors leading to Maternal Mortality.
3. To suggest measures to be taken to strengthen the existing health infrastructure to reduce maternal mortality.

Materials and Methods

This was a retrospective study carried out in the Department of Obstetrics and Gynecology at Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, which is a tertiary care center of North India. It has an annual delivery rate of around 25–27,000 and gets a large number of referrals from PHCs, CHCs, and maternity homes as well as from hospitals and medical college of Delhi NCR and adjoining states like UP, Haryana, Uttarakhand. The hospital runs 3 ICU's and 1 Obstetric HDU, one blood bank and 2 emergency operation theatres round the clock to provide emergency obstetric services and critical care to their patients. The female deaths which met the WHO Criteria for Maternal Death [1] were included in this study.

The details of all the maternal deaths from January 2013 to December 2016 were collected from the individual case sheets and facility-based maternal death review forms. These forms were filled by the treating doctor and reviewed by the supervising Faculty within 24 h of the death of the women. The maternal death was then analyzed and audited weekly, followed by a monthly meeting in the department by the Senior Faculty members. This was later followed by a quarterly meet in the Hospital, with experts from different fields of Medicine and also a quarterly meet in the district and the state. These data were analyzed with respect to the following parameters: age, parity,

socioeconomic status, residence, booking status, condition of admission, prevalence of anemia, admission death interval, causes of death and type of delays identified. Total 364 maternal deaths were carefully studied and analyzed.

Maternal mortality ratio for the study period was calculated using the formula:

$$\text{MMR} = \frac{\text{Total no of maternal deaths} \times 100,000}{\text{Total no of live births}}$$

Types of delay according to Maternal Death Review form is summarized as follows:

- Type I delay—delay in decision making to seek help
- Type II delay—delay in transport due to unavailability of vehicles and delay in referral
- Type III—delay in treatment at institutional level

Results

During the study period January 2013 to December 2016, there were 100,631 live births and 364 maternal deaths. The MMR in the study period was 361.71/100,000 live births (Table 1).

The demographic profile and epidemiological characteristics of maternal deaths are shown in Table 2.

It was observed that majority of the women who died (73.07%) were in the prime reproductive years (21–30 years). Teenage pregnancy attributed to 3.29% ($n = 12$) of maternal deaths. More than two-third (70.32%) of the women were multipara (56.59%) and grandmultipara (13.73). Nearly two-thirds of the women (68.68%) belonged to lower socioeconomic strata. Majority of the women resided outside Delhi (51.38%). Most of these women were unbooked, an alarmingly 88.46%. Out of these unbooked cases, 64.9% women were referred from other centers. Many of these women were in critical (94, 29.12%) and serious (102, 31.67%) conditions, respectively.

Type I (64.28%) and type II (34.06%) delay were the most common delays identified (Table 3).

According to the WHO Application of ICD-10 to deaths during pregnancy, childbirth and puerperium [4], the causes of maternal deaths were categorized and it has been shown in Table 4.

Table 1 Year-wise maternal mortality ratio

Year	Total live births	Maternal deaths	MMR/1,00,000 live births
2013	23,973	86	358.73
2014	24,515	67	273.30
2015	25,575	95	371.45
2016	26,568	116	436.61

Table 2 Sociodemographic characteristics of Maternal Death

Socio-demographic character	No. of women (%)
Age	
≤ 20 years	46 (12.63%)
20–30 years	266 (73.07%)
31–40 years	46 (12.63%)
> 40 years	06 (1.64%)
Parity	
Primi	108 (29.67%)
Multipara	206 (56.59%)
Grandmultipara	50 (13.73%)
Socioeconomic status	
Lower class	250 (68.68%)
Middle class	108 (29.67%)
Upper class	06 (1.64%)
Residence	
Delhi	177 (48.62%)
Outside Delhi	187 (51.38%)
Booking status	
Unbooked	322 (88.46%)
Booked	29 (7.96%)
Registered	13 (3.54%)
Status on admission (AHA) [3]	
Good	19 (5.21%)
Fair	54 (14.83%)
Serious	171 (46.97%)
Critical	120 (32.96%)
Prevalence of Anemia	
Severe (< 7 gm%)	133 (36.53%)
Moderate (7–9.9 gm%)	129 (35.43%)
Mild/no (≥ 10 gm%)	102 (28.02%)
Referral	
Referral	211 (57.96%)
No referral	153 (42.03%)
Duration of hospital stay	
≤ 24 h	164 (45.05%)
24–48 h	72 (19.78%)
> 48 h	128 (35.16%)

Table 3 Type of delays identified contributing to maternal deaths

Type of delay	No. of women (%)
Type I	234 (64.28%)
Type II	124 (34.06%)
Type III	6 (1.64%)

Discussion

Maternal mortality Ratio is a measure of Quality of Health care services available in a country. According to the latest report (RGI-SRS), MMR in India has registered a decline

Table 4 Causes of maternal deaths according to WHO ICD-10

Groups according to ICD-10 code [4]	Type and group	No. of maternal deaths (%)
1	Direct: Pregnancies with abortive outcome	10 (2.74%)
2	Direct: Hypertensive disorders	102 (28.02%)
3	Direct: Obstetric hemorrhage	45 (12.36%)
4	Direct: Pregnancy related infections	76 (20.87%)
5	Direct: Other obstetric complications	
	Obstructed labor	08 (2.19%)
6	Direct: Unanticipated complications of management (e.g., pulmonary embolism)	13 (3.57%)
7	Indirect: Non obstetric complications	
	Anemia	58 (15.93)
	Heart disease (with or without pre existing hypertension)	12 (3.29%)
	Gastrointestinal complications	55 (15.10%)
	Respiratory diseases/ARDS/TB	20 (5.49%)
	Neoplasm	02 (0.54%)
	Infections, not direct result of pregnancy	02 (0.54%)
	Epilepsy	02 (0.54%)
8	Unspecified: unknown/undetermined	03 (0.82%)
9	Coincidental causes	0

from 212 in the period 2007–2009 to 167 in 2011–2013. Hence, the rate of decline between 2007–2009 and 2011–2013 was 5.7%. If the MMR had declined with the same pace, then India would have achieved an MMR of 140 per 100,000 live births. However, based on the World Health Statistics (WHS) 2016, the MMR of India is still 174/100,000 live births. This works out to losing nearly five mothers every hour. India accounts for around 17% of the burden of global maternal deaths.

The maternal mortality ratio in the study period was 361.71/100,000 live births being 358.73, 273.30, 371.45 and 436.61 in the year 2013, 2014, 2015 and 2016, respectively. MMR in our study still remains quite high, more than our national average and has also shown an alarmingly increasing trend against a falling trend in the country. It can be explained by the fact that our health facility is a referral/tertiary care hospital for various hospitals in and around Delhi. Majority of the patients were unbooked (322, 88.46%) and most of them referred from other public/private facility across the state and neighboring states. Most of these women presented to us in serious (31.67%) or critical condition (29.12%) often with multiple complications and expired within 24 h of admission to the hospital (45.05%). Similar results on death within 24 h were shown in studies by Jadhav et al. [5] (46.83%) and Rajeshwari et al. [6] (48.2%).

A total of 211 (57.96%) patients were referred from other health care facility, 62 (29.38%) without adequate life support measures, further aggravating their moribund

state. Often the women were referred to hospital when they developed life-threatening complication. Some of these patients were referred to our facility after being previously referred from 1 or 2 facilities. Many of these patients could have been saved by timely and early access to health care services. The most common delays identified in this study were Type I and Type II delays. No ANC and delay in deciding to seek care (234, 64.28%) and delay in reaching tertiary care center (124, 34.06%) were the major factors responsible for high maternal mortality. Another Indian study by Khandale et al. [7] also reported a high type I (85.89%) and type II delay (10.25%).

Social factors do seem to play in this scenario, with poor status of women especially in lower socioeconomic status, social and cultural inhibitions and lack of awareness leading to delay in the women or her family seeking timely help. Also, lack of availability of blood and blood components/blood bank, emergency obstetric care facility, trained manpower, ICU facility at various centers across the state and neighboring states has been identified. This often leads to patient being referred from one facility to the other without receiving appropriate medical care. No proper referral linkages also lead to delay in a women receiving access to a referral centre.

Our study showed mortality rate of 358.73–436.61 per 100,000 live births; however, Sundari et al. [8] reported mortality rate as 559–802/1,00,000 live births due to large number of referral cases.

Most of the women in our study were in the age group of 21–30 years (73.07%). Teenage pregnancy resulting in maternal death was seen in 12 (3.29%) cases. The main causative factors were septic abortion (41.66%), pre-eclampsia and eclampsia (33.33%), sepsis (23.91%), and anemia (16.66%). UN statistics division reported teenage pregnancy in India as 86/1000 (1995–2010), which is very high as compared 49 globally and 53 in less developed countries. Teenage pregnancy drastically augments the risks for pregnant women and the children they bear. This high number of teenage pregnancy is probably because of early age of marriage of girls, especially in lower socioeconomic strata and social taboo of the society to premarital sex. Often, due to this social phobia, many girls land up with quacks for illegal abortions, instead of accessing proper Health services.

In our study, multipara and grandmultipara comprised 56.59 and 13.73% of maternal mortality, respectively, reflecting the need to strengthen family planning services so that every pregnancy is wanted and planned. In grandmultipara group, 20% deaths were due to hypertensive disorders, anemia and respiratory diseases each, followed by sepsis (16%), hemorrhage (10%) and obstructed labor (10%). Repeated pregnancies within a short span of life along with poverty, poor hygiene and nutritional deficiency are the major causes for anemia in grandmultipara women. Also, grandmultipara needs to be monitored carefully for hypertension. But unfortunately in India, due to negligence they present to hospital only at a late stage when complications develop.

In our study, 69.81% of maternal deaths were due to direct obstetric causes: hypertensive disorders (28.02%), pregnancy-related infections/sepsis (20.87%), hemorrhage (12.36%), and abortion (2.74%). A study done by Khandale et al. [7] reported eclampsia and pre-eclampsia (28.19%), and hemorrhage (10.25%) which is similar to our results.

In this study, the most common cause of maternal death was hypertensive disorders of pregnancy, followed by sepsis. As per WHO (2007 and 2010) 25% of all maternal deaths worldwide are due to hemorrhage. In our study, obstetric hemorrhage contributed to only 12.36% of cases, much lower than other Indian studies (Murthy et al. [9] 26.66%, Rajeshwari et al. [6] 35.5%, Montgomery et al. [10] 27%). This is probably, because our center runs blood bank facilities round the clock with availability of various blood components. Anemia was a significant co-morbid factor (71.97%) and an indirect cause of maternal mortality in 15.93% which is comparable to study done by Khandale et al. [7] (14.10%). This also correlates with poor antenatal coverage and unmet dietary requirements of women, especially from poor socioeconomic status.

Globally, direct obstetric causes and indirect causes have been implicated in 73 and 27.5%, respectively [11]. In

our study, medical causes attributed to 25.5% of the total maternal deaths. Heart disease, gastrointestinal complications including hepatitis, ARDS/TB/Respiratory illness, neoplasm, dengue, epilepsy accounted for 3.29, 15.10, 5.49, and 0.54% each, respectively. Rajeshwari et al. [6] and Khandale et al. [7] also reported medical causes in 20.6 and 19.22%, respectively.

Conclusion

Most of the maternal deaths in this study were observed in women from rural areas who were less educated, with no antenatal coverage and belonged to lower socioeconomic status. Maternal death is an avoidable tragedy and most of the causative factors can be prevented to a large extent, only if antenatal women seek and receive good antenatal care to correct anemia, sensitized about family planning, identify complications early and are timely referred to an appropriate facility.

From this study, we conclude that the following measures may help reduce the National MMR to achieve the desired MMR of 100 by the year 2020.

1. Ensuring 100% antenatal coverage.
2. Dietary supplementation, oral iron supplementation for correction of anemia.
3. Early identification and management of pre-eclampsia.
4. Promotion of clean delivery practices and improving sanitation.
5. Provision of safe abortion services.
6. Treatment of medical conditions, e.g., hypertension, diabetes, tuberculosis, etc.
7. Strengthening of existing Emergency obstetric care (EmOC) facilities by training and up gradation of medical and paramedical staff and improving infrastructure facilities.
8. Promoting institutional deliveries.
9. Promotion of family planning services and spacing of births.
10. Maternal death review and audit.
11. Appropriate referral linkages with stress on early referral, easy transport and with adequate life support measures.
12. Sex education to teenagers.

Compliance with Ethical Standards

Conflict of interest Pratima Mittal, Garima Kapoor, Nikita Kumari, Bindu Bajaj declare that they have no conflict of interest.

Human Participants The data were gathered from the individual case sheets and facility-based maternal death review forms. These forms were filled by the treating doctor and reviewed by the

supervising Faculty within 24 h of the death of the women. Hence, the institutional review body explicitly approved the study.

Informed Consent No consent taken as there was no intervention with the patient for the purpose of study. Only the data were gathered from individual case sheets and facility-based maternal death review forms.

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