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Original Research Article

Maternal mortality in a tertiary hospital of North India- analysis of causes and risk factors

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ABSTRACT

Background: Approximately 529,000 women die from pregnancy-related causes annually and almost 99% of these occur in developing nations. Even with decline, India still is one of the major contributors to maternal deaths in the world. Hence, the present study was conducted to assess the causes, sociodemographic factors and level of delay influencing maternal mortality.

Methods: A retrospective descriptive study based on all maternal deaths within 2.5 years from June 2020 to December 2022 in tertiary care center New Delhi was included. All deaths were assessed for sociodemographic risk factor and processed using descriptive statistics for various variables.

Results: During the study 77 deaths were identified. 48 deaths were direct and 29 were indirect maternal deaths. Sepsis and infectious diseases were the leading cause of direct and indirect maternal death respectively. 47% women died at more than 34 weeks' gestation. 12 women died undelivered. 65 women who died in the postpartum period, caesarean section was performed in 32%. Of total deaths 53 women were unbooked and level 1 delay in 78% cases.

Conclusions: Education and awareness of importance of antenatal care, diagnosis and management of anemia to be given prime importance. Institutional deliveries to be encouraged. Optimization of comorbid conditions in the preoperative period is quintessential.

Keywords: Maternal mortality, Risk factor, Infection disease

INTRODUCTION

Approximately 529,000 women die from pregnancy-related causes annually and almost all (99%) of these maternal deaths occur in developing nations.¹ Despite a significant reduction in the number of maternal deaths - from an estimated 523 000 in 1990 to 289 000 in 2013 - the rate of decline is less than half of what is needed to achieve the Millennium development goals target of a three quarters reduction in the mortality ratio between 1990 and 2015.² The target for India was hence estimated at 139 per 1,00,000 live births by the year 2015. As per the sample registration system (SRS) report by Registrar General of India (RGI) for the last three years, maternal mortality ratio (MMR) of India has reduced from 130 per 100,000 live births in SRS 2014-16 to 122 in SRS 2015-

17 and to 113 per 100,000 live births in SRS 2016-18.³ India's maternal mortality ratio (MMR) has improved to 103 in 2017-19, from 113 in 2016-18, marking an 8.8% decline.

This is in sync with the trend of progressive reduction in the MMR over the years. With this persistent decline, India is on the verge of achieving the national health policy (NHP) target of 100/lakh live births by 2020 and certainly on track to achieve the sustainable development goal (SDG) target of 70/ lakh live births by 2030.⁴

Despite this reduction, India still is one of the major contributors to maternal deaths in the world. Every maternal death affects the whole family. Also for every death, there are many who suffer varying degrees of

morbidity. In many cases of maternal deaths, the newborns also die because of lack of care. Although the absolute numbers may seem small, maternal death is the tip of the iceberg of serious maternal morbidity. Hence reducing maternal death is quite essential for upliftment of the society. Analysing the deaths, their causes and the various risk factors will give us an insight into the scenario which will help us prevent maternal mortality.

In light of the above, the present study was conducted to assess the causes, sociodemographic factors and level of delay influencing maternal mortality in a tertiary care center, situated in Delhi, India.

METHODS

It is a retrospective descriptive study based on secondary data collection. All maternal deaths within 2.5 years from June 2020 to December 2022 in Deen Dayal Upadhyay Hospital, New Delhi were included in the study.

The World Health Organization's (WHO's) 10th revision of the International statistical classification of diseases and related health problems (ICD-10) defines maternal mortality as "the death of a woman while pregnant or within 42 days of termination of pregnancy irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes".

The ICD-10 defined direct obstetric deaths as "maternal deaths resulting from obstetric complications of the pregnant state (pregnancy, labor, and the puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above."

Indirect obstetric deaths, by contrast, are "those resulting from previous existing disease or disease that developed during pregnancy and which was not due to obstetric causes, but was aggravated by physiologic effects of pregnancy."

For each maternal death, data was collected regarding general and obstetric history, history of present pregnancy, past history and level of delay (as Deen Dayal Upadhyay is a tertiary referral center).

Maternal mortality in poor resource countries has been attributed to the 3 delays: level 1 delay- delay in deciding to seek care, level 2 delay- delay in reaching care in time, and level 3 delay- delay in receiving adequate treatment.¹

The case records of all deaths were individually assessed for sociodemographic risk factors. All cases were discussed in a group meeting for final decision on classification as per ICD 10 classification and any modifiable risk factor that could be taken care while giving care to the women.

The data was processed using descriptive statistics and by calculating mean, standard deviation and odds ratio for various variables.

RESULTS

During the study period of 2.5 years from June 2020 to December 2022, 77 deaths were identified. As per the ICD classification 48 deaths were direct maternal deaths and remaining 29 were indirect maternal deaths. Cause of direct and indirect maternal death are listed in Tables 1-4.

Sepsis was the leading cause of direct maternal deaths followed by obstetric hemorrhage and pre/eclampsia as shown in Table 1.

Infectious diseases were the leading cause of indirect maternal death which could be due to COVID 19 pandemic seen worldwide as shown in Table 2.

Women pregnant with their first child showed lowest risk in comparison to women of higher parity shown in Table 3.

Table 1: Underlying causes of direct maternal deaths in DDUH from June-2020 to December-2022.

Underlying cause	N (%)	OR (95% CI)	P value
Pre-eclampsia/eclampsia	9 (11)	0.8 (0.4-1.6)	0.525
Obstetric hemorrhage	11 (14)	1.3 (0.6-2.4)	0.409
Sepsis (genital tract)	17 (22)	1.5 (0.8-2.1)	<0.001
Genital tract trauma	2 (3)	0.5 (0.2-1.4)	0.572
Complications of CS	0	-	-
Choriocarcinoma/ H. mole	0	-	-
Complication of anaesthesia	0	-	-
Ectopic pregnancy	0	-	-
Acute fatty liver of pregnancy	4 (5)	1.5 (0.5-4.2)	0.401
Amniotic fluid embolism	3 (4)	2.5 (0.9-3.5)	0.527
Sudden death in pregnancy	1		
Miscellaneous	1		

Table 2: Underlying causes of indirect maternal deaths in DDUH from June-2020 to December-2022.

Underlying cause	N (%)	OR (95% CI)	P value
Cardiovascular disorder	3 (4)	20.78 (6.19-69.71)	<0.001
Cerebrovascular disorder	1 (1)	0.5 (0.1-1.3)	0.372
Infectious disease	23 (11)	2.5 (0.8-4.1)	0.023
Mental disorder	0	-	-
Disease of blood	0	-	-
Endocrine disorder	0	-	-
Miscellaneous	2 (3)	0.5 (0.1-1.6)	0.425

Table 3: Maternal death and parity.

Parity	No. of death n (%)	Odds ratio	P-value
0	30 (39)	0.5 (0.3-0.8)	0.012
1	20 (26)	1.2 (0.7-2.1)	0.336
2	21 (27)	2.3 (1.4-3.9)	0.008
3+	6 (8)	0.6 (0.2-1.5)	0.304

In the present study the overall mean age was 26.9 years (mean±SD=26.9±4, min-max=18-41) (Table 4).

Table 4: Characteristics of 77 deaths in the DDUH from June 2020 to December 2022.

Factor	No. of death (n)
Age (years)	
15-19	2
20-24	24
25-29	28
30-34	16
35-39	5
40-44	2
>45	0
Duration of pregnancy (weeks)	
Before 22	6 (8)
22-34	13 (17)
>34	36 (47)
Postnatal period	22 (28)
Mode of delivery	
Vaginal birth	26 (34)
CS	32 (32)
Spontaneous abortion	2 (3)
Induced abortion	5 (6)
Education	
Uneducated	58 (75)
Primary education	11 (15)
Secondary education	8 (10)

A total 36 (47%) women died at more than 34 weeks' gestation. 12 women died undelivered. Out of 65 women who died in the postpartum period, caesarean section was performed in 32 (32%). 5 women underwent laparotomy in which two patients with a history of previous caesarean section had vaginal birth at home and suffered uterine rupture. One patient had obstetric hysterectomy for atonic

postpartum hemorrhage. Two patients who had undergone dilatation and evacuation had intestinal perforation.

A total 5 (6%) women delivered at home of which three women died within 24 hours postpartum. One woman was brought dead to the emergency and one died after 5 days postpartum.

Out of 77 deaths studied, 53 women were unbooked patients. There was level 1 delay seen in 60 cases (78%), level 2 delay in 4 cases (5%) and level 3 delay in 1 case (1.2%).

Anemia was a contributory factor in 12 cases (16%) (OR=0.4, 95% CI=0.2-0.8 and p value ≤0.001).

Mean hemoglobin (%) was 9.3±2.4 (min-max=1.8-14.5).

A total 61 patients out of 77 deaths were admitted in ICU for management.

None of the patients had an autopsy.

DISCUSSION

This study aims to analyze and correlate causes of death (direct and indirect), with various sociodemographic factors influencing maternal mortality and levels of delay that can be prevented to decrease maternal mortality. It is observed that the highest burden of maternal death belongs to the developing nations. Moreover, the rate of MMR decline in these countries is steady. The ratio of maternal mortality is found very high which ranges from 7 to 1360 deaths per 100,000 live births with a mean of 195.4 (SD=163) per 100,000 live births in the study of 82 developing countries.⁷ As per SRS report by Registrar General of India (RGI) for last three years MMR of India was 103 per 100,000 live birth in 2017-2019.⁴

Total 77 deaths were reported in a time period of 2.5 years from June 2020 to December 2022. The high number of maternal mortalities in our center may be explained by the fact that our center is a tertiary referral center attending to high-risk patients from 5 district level hospitals and 10 dispensaries. Also, the COVID 19 pandemic contributed to a high number of mortalities with an indirect cause.

Maternal mortality reflects the status of population health and quality of life across the country. Our finding during the study suggests that the risk of death is influenced by both age and parity. Teenagers and women above 40 years were at higher risk in our study period (Table 4) which was also seen in the Netherlands where maternal mortality above 45 years was high. On analysis they concluded that maternal age was shown to be an important risk factor for all causes.⁵ The risk of mortality was low in nulliparous and increased with parity of 1 or 2 (Table 3). However, published literature showed that parity did not have a significant effect on maternal mortality.⁵ This could be due to the fact that with increasing parity other contributory factors like anemia increase in developing countries.

Sepsis was the leading cause of direct maternal mortality in the institute with 17 deaths (22%) which is statistically significant followed by obstetric hemorrhage (11 deaths; 14%) and pre/eclampsia (9 deaths; 11%). This was different from other developed nations like the Netherlands where the leading cause of death was pre/eclampsia.⁵ In the US cardiovascular disease was the leading cause and sepsis was reported as 3rd leading cause of death.⁸ In the present study there was a statistically significant increase in death due to infectious disease with OR 2.5 as leading indirect cause but this may be attributed to the global COVID-19 pandemic. It was followed by deaths due to heart disease which were 4% (n=3, OR 18.8). This was consistent with the data available in published literature.⁵ Recent data from the CDC maternal mortality in the 21st century also showed this shift in cause of death and listed the top 3 causes of death in the United States from 2011 to 2013 as cardiovascular disease (15.5%), other medical non-cardiovascular disease (14.5%), and infection/sepsis (12.7%).⁸ Recent evidence also shows that cardiovascular diseases are emerging as an important indirect cause of maternal mortality worldwide. Awareness of this changing trend is pertinent as it highlights the importance of pre-conceptional counselling.

2 deaths were reported after MTP pill intake with septic abortion, severe anemia and pancytopenia. Such deaths can be prevented by stopping over the counter sale of MTP pills. This is a double-edged sword as evidence shows that if unwanted pregnancies are prevented, between 25% to 40% of maternal deaths could be eliminated.¹ However, easy and uncontrolled access to these drugs can also prove hazardous as shown in present study. So, some regulations and supervision are essential for the proper use of these drugs.

There were 2 deaths (3%) due to genital tract trauma in women with a history of previous caesarean section who delivered vaginally at home. It has been seen that there is a statistically significant decrease in maternal death due to genital tract trauma in the Netherlands even with an increase in the percentage of caesarean sections.

Analysis of the records also showed that the importance of preoperative assessment cannot be underestimated. In 2 mortalities due to perforation peritonitis following spontaneous intestinal perforation after MTP, the history of prolonged fever and ulcerative colitis was ignored in a private clinic.

Anemia was a contributory cause in 12 cases (16%). Significant correlation of anemia with maternal morbidity and mortality has been reported in various studies.⁷ Published literature suggests that the proportion of deaths resulting from obstetric hemorrhage has increased in poorer states in India compared with 2001–2003 estimates, suggesting that persistent underlying medical conditions, including severe anemia, as well as delayed recognition and management, may exacerbate postpartum bleeding.⁹ Understanding the importance of diagnosis and management of anemia for maternal health GOI has launched the Anemia Mukht Bharat campaign in which early diagnosis of anemia during antenatal visits, giving proper iron supplements as prophylaxis and treatment for correcting it before term by giving intravenous iron therapy or blood transfusion is focused.

Awareness needs to be increased not only about proper ANC visits but also about the importance of institutional deliveries.¹⁰ Home delivery always results in significant morbidity and mortality as reflected in the present study (5 deaths; 6%) and study by Azuh et al in Nigeria.⁶

Delay in management of postpartum hemorrhage at a district hospital was the contributing factor in one of the mortalities (level 3 delay). This points to the fact that the continuous and ongoing training of professionals with special emphasis on the mock drills should be given prime importance.

Limitations

Being a retrospective study data available was limited.

CONCLUSION

Education and awareness about the importance of antenatal care, diagnosis and management of anemia to be given prime importance. Institutional deliveries to be encouraged. Optimization of comorbid conditions in the preoperative period is quintessential.

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