

Analysis of Causes and Contributory Factors for Maternal Mortality during Covid-19 Lockdown

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ABSTRACT

Background: Covid-19 pandemic affected maternal health directly by causing respiratory disease in pregnant women as well as indirectly by affecting health care delivery and caused sharp increase in maternal mortality. **Aim:** This study aimed to assess causes and contributing factors for maternal mortality during six months of Covid-19 lockdown. **Methodology:** This was a retrospective review of all maternal mortalities over the period of six months (23rd March - 22nd September 2020) after implementation of lockdown. Information regarding demographic variables, obstetric characteristics, referral, diagnosis, cause of death and any delay present were obtained from the patient records. The data were analyzed using SPSS 11.5 and descriptive statistics was used. **Results:** There were 19 maternal deaths, of which one was due to accidental cause. The MMR was 419 per 100,000 live births. Mean age was 29.16 ± 9.53 years with age ranging from 16 to 49 years, 44.4% women never had antenatal check-up, mean POG at presentation was 29.7 ± 9.7 weeks. Four patients died during early pregnancy (two (11.1%) due to abortion related complications and two molar pregnancies) and six (33.3%) expired during antenatal period. Three most common causes for maternal mortality were sepsis (27.8%), hypertensive disorder (22.2%) and obstetric hemorrhage (16.7%). Covid pneumonia caused one (5.6%) mortality. Main contributory cause was anemia (50%). Major delay was in providing appropriate care timely. **Conclusion:** Maternal mortality was very high during lockdown and the leading cause was sepsis contributed by anemia in most cases. Delays in screening high-risk pregnancies as well as delay in appropriate treatment were responsible factors.

Key words: Contributing factors, Covid-19, maternal mortality.

INTRODUCTION

Maternal mortality is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy or its management from conditions other than accidental and incidental causes (1). Evaluation of maternal mortality provides us with knowledge about the quality of care being provided to the patient, any shortcomings in management and areas of improvement in patient treatment (2).

Worldwide maternal mortality is in alarming condition with nearly thousand women dying everyday mostly from preventable causes. More than 90% of such death occur in low-middle-income countries (3). South East Asia region

accounted for nearly 20% of global maternal death in 2017. However, the maternal mortality followed decreasing trend from 2000-2017 with 38% reduction globally and South East Asia Region demonstrated maximum overall reduction of 60% (4). Nepal has also made significant progress on reduction of maternal death in 20 years duration. The maternal mortality ratio decreased from 539 per 100,000 live births in 1996 to 281 per 100,000 live births in 2006 to 239 per 100,000 live births in 2015 (5). The national data for maternal mortality beyond 2016 has not been published and the most recent data available is from 2017 which was 186 per 100,000 live births (6).

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Nearly 75% of maternal deaths globally occur secondary to obstetric hemorrhage, infections, hypertensive disorders and unsafe abortion (7). Hemorrhage, hypertensive disorders and infection or sepsis are the major causes of maternal mortality both in developed as well as developing countries (8-10). However, in developed world, the deaths are less due to direct cause and more likely related to pre-existing comorbidities (8).

The reduction in maternal mortality achieved by Nepal over decades was the result of adoption of various intervention strategies. Implementation of Safe Motherhood program which included free maternity care and monetary incentive scheme for those delivering at health facilities, scaling up number of skilled birth attendants and birthing facilities; all helped to increase institutional deliveries from 8% in 1996 to 57% in 2016 (5). This hard-earned achievement however, succumbed to the effect of Covid-19 pandemic beginning from early 2020.

Covid 19 affected maternal health both directly as well as indirectly by affecting the regular health care service delivery to pregnant women. Pregnant women were not found to be at increased risk of Covid-19 infection or to experience more severe symptoms as compared to non-pregnant if infection occurred (11). The highly contagious nature of Covid 19 led to the fear and anxiety among people about the possibility of infection during hospital visits. This led to reduced antenatal visits and screening of pregnancy related complications as well as institutional deliveries (12). The health institutions were strained in responding to Covid-19 pandemic as well as many health facilities were converted to covid dedicated hospitals which led to disruption of maternal and newborn health-services delivery, particularly in resource-limited countries (13). The Government of Nepal implemented nationwide lockdown came into effect from 24th March 2020 for preventing spread of corona virus (14). There were severe restrictions on transport and closure of outpatient departments of many hospitals. Maternal and perinatal outcome worsened during Covid-19 pandemic and significant increase in maternal deaths noted (15). A sharp increase was seen in maternal mortality during the

first two month lockdown period between March and May, 2020 in Nepal (16). This study aimed to study the causes and contributory factors for maternal mortality during the six-month period of lockdown.

METHODOLOGY

This was a retrospective descriptive study conducted at B.P. Koirala Institute of Health Sciences, Dharan, Nepal after ethical approval from Institutional Review Committee (IRC). It is a tertiary care hospital situated in Eastern Nepal and acts as referral center for this region of Nepal. Patients from rural areas of several hilly and mountainous districts as well as from some major cities are referred to the institute for treatment.

Medical records of all the maternal mortalities over the period of six months (23rd March 2020- 22nd September 2020) after the emergence of Covid-19 pandemic when there was strict lockdown imposed by the Government of Nepal were reviewed. Data regarding total number of admissions and deliveries were obtained from the record section. All the maternal mortalities; women expired in the hospital during course of treatment both in the department of obstetrics and gynecology or maternal death that had occurred in other departments were included. Also, the women who were brought dead were included in the analysis. The information regarding demographic variables, obstetric characteristics, presenting complaints, vital status at presentation, referral, diagnosis, cause of death and any delay associated with the death were obtained from the records.

For the analysis, all cases of bleeding related to abortion, molar pregnancies, antepartum hemorrhage and postpartum hemorrhage were grouped as obstetric hemorrhage. Similarly, all cases of gestational hypertension, pre-eclampsia, eclampsia and chronic hypertension were grouped as hypertensive disorder of pregnancy. All cases of sepsis during pregnancy or postpartum or post abortion were grouped as sepsis. The maternal mortality ratio was calculated as number of maternal deaths per 100,000 live births.

The data were collected in a proforma and entered in Ms Excel spreadsheet. Analysis was done using SPSS version 11.5. Descriptive statistics was

used and the results were presented as frequency and percentage for categorical variables and mean with standard deviation for continuous variables.

RESULTS

There were total of 5406 admissions over six months duration. There were total of 4410 deliveries with 4290 live births over the period of six months. Nineteen maternal deaths occurred during the study period. Among them, one patient died of severe head injury due to fall from height

and was brought dead to the hospital. For her the cause of death was accidental, so this patient was not included in the study. Excluding the accidental cause, the Maternal Mortality Ratio (MMR) for the period of six month was 419 per 100 000 live births.

Mean age of women was 29.16 ± 9.53 years with age ranging from 16 years to 49 years. Nearly one third were from rural areas and rest from urban areas. The baseline demographic and obstetric profile of the women is presented in Table 1.

Table1: Baseline demographic and obstetric characteristics of deceased women (n=18)

Characteristics		Frequency (%)	Mean $\pm$ SD
Age (years)			29.16 (± 9.53)
	Less than 20	2 (11.1)	
	20-34	10 (55.6)	
	35 or more	6 (33.3)	
Residence	Rural	7 (38.9)	
	Urban	10 (61.1)	
Time of presentation			
	Early pregnancy	4 (22.2)	
	Antenatal	12 (66.7)	
	Postpartum	2 (11.1)	
Referral	No	8 (44.4)	
	Yes	10 (55.6)	
Gravida			2.94 $\pm$ 1.94
Parity			
	Nullipara (0)	6 (33.3)	
	Multipara (1-4)	10 (55.6)	
	Grand multipara (>4)	2 (11.1)	
Antenatal Care			
	Registered	1 (5.6)	
	Unregistered	9 (50.0)	
	No ANC	8 (44.4)	
POG at presentation (weeks)			29.7 $\pm$ 9.7
Type of pregnancy			
	Singleton	17 (94.4)	
	Multiple	1 (5.6)	
Antenatal Complications (n=7)	Anemia	3(16.7)	
	Hypertension	3(16.7)	
	Hypothyroidism	1 (5.6)	
	Multiple pregnancy	1 (5.6)	
	SLE	1 (5.6)	
	Morbidly adherent placenta	1 (5.6)	

ANC: Antenatal Care, POG: Period of Gestation, SLE: Systemic Lupus Erythematosus, SD: Standard Deviation

Four women presented during early weeks of pregnancy. Out of the rest 14 women, six women expired during antenatal period and eight had delivered. Among them who had delivered, five women (62.5%) delivered by cesarean section and three (37.5%) women delivered vaginally. Six

(75%) women delivered at BPKIHS and two women (25%) delivered outside BPKIHS. The perinatal mortality among women who expired was 37.5%. The pregnancy outcome of the women expired are presented in Table 2.

Table 2: Pregnancy outcome for the deceased women (n=18)

Characteristics	Frequency (%)	Mean $\pm$ SD
POG at delivery (weeks)		33.1 $\pm$ 7.3
Final outcome of pregnancy		
Abortion	2 (11.1)	
Suction and Evacuation for Molar Pregnancy	2 (11.1)	
Vaginal Delivery	3 (16.7)	
Delivery by Cesarean Section	5 (27.8)	
Not delivered	6 (33.3)	
Place of delivery (n=8)		
BPKIHS	6 (75.0)	
Outside BPKIHS	2 (25.0)	
Perinatal outcome (n=8)		
Alive	5 (62.5)	
Perinatal Mortality	3 (37.5)	

POG: Period of Gestation, SD: Standard Deviation

The most common cause for maternal mortality was maternal sepsis accounting for 27.8% of total mortalities. Among five cases of sepsis, two were puerperal sepsis, one septic abortion. Other two were sepsis during antenatal period. This was followed by hypertensive disorder of pregnancy and obstetric hemorrhage. Out of three cases of

obstetric hemorrhage, one was bleeding secondary to incomplete abortion, one morbidly adherent placenta causing antepartum as well as postpartum hemorrhage and one antepartum hemorrhage due to abruptio placenta. The primary causes of maternal mortality are expressed in Figure 1.

Table 3: Contributory causes for maternal mortality (n=18)

Contributory causes	Frequency (%)
Anemia	9 (50.0)
Acute Kidney Injury	4 (22.2)
Coagulopathy	2 (11.1)
Postpartum Hemorrhage	1 (5.6)
Pulmonary Edema	1 (5.6)
Pancytopenia	1 (5.6)
Thrombocytopenia	1 (5.6)
SLE	1 (5.6)
Scabies	1 (5.6)
None	5 (27.8)

SLE: Systemic Lupus Erythematosus

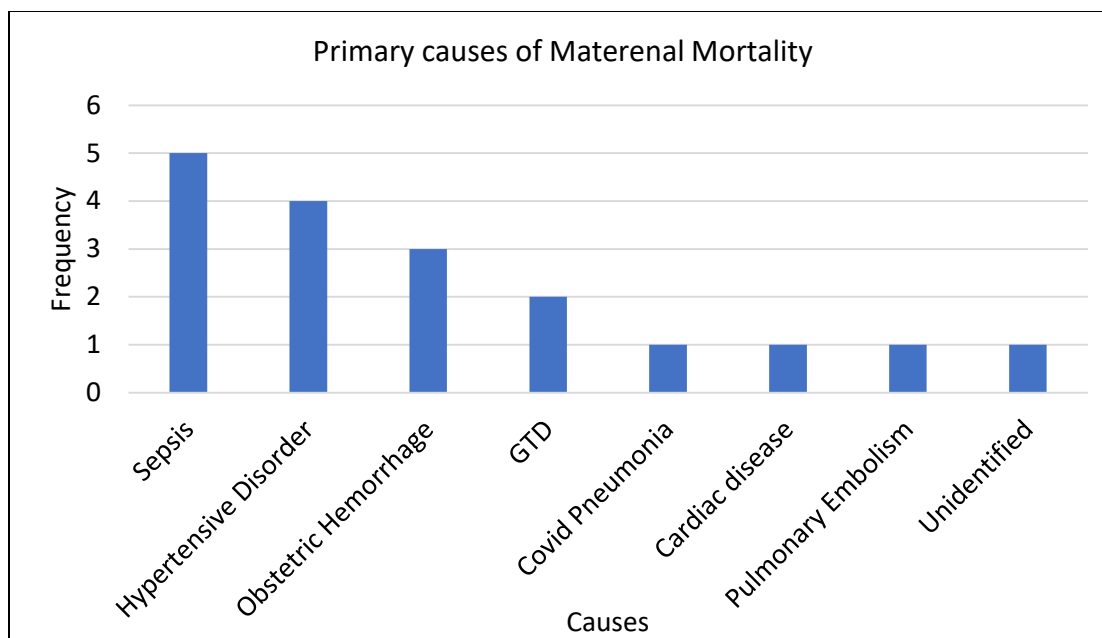


Figure 1: Primary causes of maternal mortality

Most of the maternal deaths (72.2%) were complicated by one or more contributory causes. The most common contributory cause was anemia in 50% women, either alone or in combination with other causes. Other common causes were acute kidney injury followed by coagulopathy. The list of contributory causes is presented in Table 3.

On analyzing the delays leading to maternal mortalities, one or more delays were identified in 77.8% women. The most common delay identified was delay in providing appropriate care in 44.4% women. The types of delays identified are illustrated in Table 4.

Table 4: Delays causing the maternal mortality (n=18)

Type of Delay	Frequency (%)
Delay in seeking care (Delay 1)	6 (33.3)
Delay in reaching care (Delay 2)	4 (22.2)
Delay in receiving care (Delay 3)	8 (44.4)
No Delay	4 (22.2)

DISCUSSION

Maternal and perinatal outcome were affected severely during COVID-19 pandemic. The study found a very high maternal mortality ratio of 419 per 1,00,000 live births. The major cause of mortality was maternal sepsis followed by hypertensive disorders of pregnancy and obstetric hemorrhage as second and third most common causes. Covid-19 was a direct cause of mortality in 5.6% of mortality. The most common contributory cause was anemia affecting 50% of mortality.

However, only 16% had pre-existing anemia and for others anemia was detected at the time of admission. The delays in all levels were identified but the most common was delay in receiving appropriate care at the health facility.

According to the report from the Government of Nepal, 153 maternal deaths were reported from March -September 2020 (same as this study period) as compared to 104 maternal deaths at the equivalent period of the previous year i.e. 47 excess maternal deaths were reported (17).

In our study, the maternal mortality ratio was way too high as compared to the previous study in the same institute (419 vs 129 per 100 000 live births) (9). The higher ratio may be because we have included the women who were brought dead to the hospital whereas the previous study excluded such cases. However, there was only one such case and even after excluding that patient the mortality ratio was high. Another reason for this increased mortality may be because many hospitals in the periphery especially private clinics were closed and the high-risk patients got concentrated in the institute. A nationwide data in Mexico also showed that the maternal mortality ratio increased by 56.8% during one year of pandemic (18).

The major cause for mortality was maternal sepsis followed by hypertension and obstetric hemorrhage. This again was not in accordance with the previous report where the leading cause was obstetric hemorrhage. However, obstetric hemorrhage, hypertensive disorders and sepsis were still the top three causes (9). This change in cause for the death may be because there was delayed presentation of the women as well as delay in diagnosis of sepsis and initiation of appropriate antibiotics. The availability of medications was also affected during Covid-19 which might have contributed to this fact. The sepsis cases mentioned here however were not related to the Covid-19. The covid pneumonia itself was responsible for 5.6% of mortality. A retrospective review in Mexico reported that Covid-19 was responsible for 22.93% of the mortalities (18). Similarly, a study from Brazil reported that 13.19% deaths were attributed to Covid-19 (19). The less contribution of covid-19 was may be because a very few numbers of pregnant women with diagnosed Covid-19 infection were admitted during that period in the institute and most of them were either asymptomatic or having mild symptoms.

Anemia was the contributory factor in 50% of the maternal mortalities. Among those diagnosed with anemia, three had been diagnosed with anemia prior to admission and in the rest, it was diagnosed at the time of admission. In almost all patients, anemia was related to recent bleeding episodes. However, 44.4% of patients never had antenatal check-up which means they did not take iron

supplementation. This fact may also be related to the higher proportion of anemia among the women expired. Delay in appropriate treatment was also the contributory factor. This was either due to delay in presentation to the health facility or due to delay after presentation to the facility. There was delay in presentation because there was delay in seeking care in 33% women. The next delay was the delay in reaching the care. Both these delays were related to Covid-19. Because of the novelty as well as highly contagious nature, people were scared of visiting hospitals unless the condition became very serious. Even if someone was aware of the danger signs and wanted to go to the hospital, there was almost no provision of transportation due to strict lockdown. The ambulance services were also overused and the fare was too high for all to afford. Even after the women presented to the hospitals overcoming these delays, there was delay in providing appropriate care. This was mainly because of shortage of manpower as the health workers were divided to provide care to the covid patients as well as non-covid patients, inadequate supply of necessary drugs and unavailability of blood and blood products. Therefore, besides the disease itself, covid 19 contributed to almost every maternal death occurred during the lockdown period in these indirect ways.

LIMITATION OF THE STUDY

The current study is a retrospective one and small number of maternal mortalities was reviewed. The information on contributory factors like literacy, socioeconomic status, burden faced due to pandemic could not be assessed due to its retrospective nature. Also, comparison with the mortality before or after the pandemic would have given actual information on impact on lockdown on the maternal mortality.

CONCLUSION

Maternal health was affected largely during Covid - 19 pandemic. The maternal mortality ratio was quite high during the lockdown. The triad of sepsis, hypertension and hemorrhage is still responsible for two thirds of maternal deaths. The leading cause was maternal sepsis and was contributed by anemia in most cases. Covid-19 might have affected maternal mortality by contributing to delay in

presentation and delay in appropriate treatment. However, larger, comparative studies will be of help to establish the role of Covid-19 pandemic in maternal mortality.

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CONFLICT OF INTEREST

None

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