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Original Research Article

Maternal Mortality and Associated Factors in a Tertiary Care Center of Western Nepal

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ABSTRACT:

Introduction: Identifying the cause of maternal death is important. The aim of this study was to determine the causes of maternal deaths and the factors associated with it. **Methods**: This was an observational, cross-sectional, analytical study conducted at Department of Obstetrics and Gynecology, Manipal Teaching Hospital from July 2013 to June 2017. Women who died during pregnancy, delivery, or puerperium were included in the study. Demographic factors, clinical profile, cause and type of maternal deaths were noted by taking history and by inquiring with the medical personnel involved in managing patients. Data analysis was done using SPSS version 16. **Results**: There were 15 maternal deaths and 9923 live births. The maternal mortality ratio was 151 per 100,000 live births. Mean age of mothers was 28 years (*SD* = 7.5). Most of them were from rural areas, had low educational status. The mean gestational age at time of death was 33 weeks (*SD* = 7.5). Most of deaths (73%, *n* = 11) occurred in the postnatal period and 60% (*n* = 9) were critical at presentation. Direct obstetric causes like eclampsia was the most common (26.7%, *n* = 4) direct obstetric cause and cardiac disease was one of the important indirect cause (13.3%, *n* = 2). Delay in seeking health care and delay in reaching health center was the major reason for maternal deaths. **Conclusion**: Maternal mortality were mostly associated with direct obstetric causes, eclampsia being the most common. Most of the deaths were associated with delay in seeking health care and reaching health care centers.

Keywords: developing country • eclampsia • maternal death • maternal mortality • tertiary care referral center

INTRODUCTION :

Maternal death is an immensely sad and tragic event. Although safe motherhood is the basic reproductive health right of every woman, about 830 women die every day globally.[1] In 2015, there were about 303,000 maternal deaths worldwide, almost all deaths occurring in the developing countries with low resources and most of them were preventable.[1] Improvements in the maternal health has been noted with decline in the maternal mortality ratio by 2.3% every year from 1990 to 2015, with rapid decline since 2000.[1] Nepal has been fortunate to follow this global trend. The maternal mortality ratio has dropped from 850 to 229 per 100,000 live births from 1990 to 2011.[2,3] Lately, improvements in the antenatal coverage, institutional delivery, delivery attended by the skilled birth attendants, and safe abortion services contribute to this decline in the maternal mortality ratio.[4] However, the decline is not uniform all across the country and still rooms for improvement exist in the poor and rural Nepal.[5]

Identification of various causes of maternal mortality and factors affecting it are imperative for developing strategies and implementing programs in order to reduce the figures. Tertiary care referral centers also contribute to a great extent in bringing down the maternal deaths. Majority of the maternal deaths in Nepal occur due to direct causes like hemorrhage, eclampsia, and abortion.[6] However,

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the causes of maternal deaths in the tertiary care referral centers could be different than that observed in the community. At the same time, maternal deaths in poor resource country like ours is known to be attributed to three delays: Delay in seeking health care, delay in reaching health center, and delay in receiving appropriate and adequate treatment.

There are studies to determine factors associated with maternal mortality in different parts of Nepal. However, such factors in a tertiary care referral center of Western Nepal is not known. Therefore, this study was conducted to determine factors associated with maternal mortality in a tertiary care center of Western Nepal.

METHODS:

This observational, cross-sectional, analytical study was conducted in the Department of Obstetrics and Gynecology of Manipal Teaching Hospital, Pokhara from July 2013 to June 2017. It is a tertiary care referral center of Western Nepal. Permission was taken from the institutional review committee of the institute prior to commencement of this study.

The study population was the mothers who died during pregnancy, delivery, or within 42 days of delivery. Delivery could be by vaginal route or by Cesarean section. Women who died within six weeks following ectopic pregnancy or abortion were also included in the study.

All patients who were admitted in the obstetric ward or in the intensive care unit of our hospital were closely observed. The patients who developed serious morbidity following admissions in the hospital were followed up. These cases were noted during the morning meetings in the department or in the ward rounds. Those patients who died were included in the study.

Demographic data like age, address, educational status, status of booking were noted from history taking. State of pregnancy - parity, gestational age, diagnosis, and clinical status at the time of admission were also noted. Whenever required, information were taken from the charts and from the medical personnel involved in her treatment. Mode of delivery and the neonatal outcome were noted as well. Information regarding the time and cause of maternal deaths, the critical interventions provided in the management were obtained. Information were also obtained from the confidential inquiries held in the department following every maternal mortality.

Relatives of all patients, especially those who presented in critical condition, were inquired about the reason for arriving late. The information provided was analyzed to determine where the delay had been and for what reason.

The number of live birth during the study period was also noted and the maternal mortality ratio was calculated.

The data analysis was done using SPSS™ Version 16. Descriptive data were presented as frequency and percentage. Non parametric Chi-square test and Fisher Exact test were used to analyze relationship between categorical data. P value less than 0.05 was considered statistically significant.

RESULTS:

There were 15 maternal deaths during a period of four years. There were total of 9923 live births. Therefore, the maternal mortality ratio (MMR) was 151 per 100,000 live births. Mean age of the mothers was 28 years (*SD* = 7.5).

The demographic and obstetric variables of the patients are presented in Table 1. None of the variables had a statistically significant difference as analyzed by *Chi-square* test.

Condition of the mothers and provisional diagnosis at the time of admission are presented in Table 2. Most of the patients (60%) were unstable at the time of admission and included cases of pregnancy induced hypertension, sepsis, and hemoperitoneum. Among the stable patients at admission, two cases died of embolism and the other two died of postpartum hemorrhage; one following vaginal delivery and other following cesarean section.

Table 1: *Demographic and obstetric characteristics of the study population (N = 15)*

Demographic Characteristics		*n* (%)	Stats
Age (Years)	≤ 19	3 (20)	X^2=1.6 *df*=2 *p*=0.5
	20 - 35	7 (46.7)	
	> 35	5 (33.3)	
Residence	urban	9 (60)	X^2 =0.6 *p*=0.5
	rural	6 (40)	
Educational status	primary level or below	10 (66.7)	X^2 =1.66 *p*=0.2
	secondary level or above	5 (33.3)	
Antenatal registration	unbooked	6 (40)	X^2 =0.6 *p*=0.44
	booked	9 (60)	
Parity	para ≤ 2	11 (73.3)	X^2 =3.2 *p*=0.07
	para > 2	4 (26.7)	

Table 3 presents the gestational age and the time of death, mode of delivery and neonatal outcome. Most of the maternal deaths occurred between 29 to 37 weeks of gestation. Mean gestational age at time of death was 33 weeks (*SD* = 7.5). Most of the mothers died in the postpartum period. More than 50% of the women had been delivered by cesarean section with one postmortem cesarean section. Almost 54% of the mothers had live born babies.

Cause and type of maternal deaths are given in Table 4. Two-thirds of the deaths were due to direct causes with eclampsia leading the list.

Table 2: Condition of the mothers and provisional diagnosis at the time of admission (N =15)

Condition and diagnosis		*n* (%)
Condition	stable	6 (40)
	unstable	9 (60)
Diagnosis	septicemia	3 (20)
	eclampsia	4 (26.7)
	severe preeclampsia	1 (6.7)
	impending eclampsia with asthma	1 (6.7)
	postdated pregnancy	2 (13.3)
	advanced Preterm labor with cardiac disease	1 (6.7)
	Transverse lie at term	1 (6.7)
	Jaundice with oligohydramnios at 35 weeks	1 (6.7)
	Hemoperitoneum (? ruptured uterus)	1 (6.7)

Table 3: Gestational age, mode of delivery, and time of maternal death and neonatal outcome (N = 15)

Characteristics		*n* (%)
Gestational age	≤ 12 weeks	1 (6.7)
	13-28 weeks	0
	29- 36 weeks	11 (73.3)
	≥ 37 weeks	3 (20)
Mode of delivery*	vaginal delivery	3 (20)
	vacuum delivery	1 (6.7)
	LSCS#	8 (53.3)
	postmortem CS$	1 (6.7)
Timing of death	antepartum	2 (13.3)
	intrapartum	2 (13.3)
	postpartum	11 (73.3)
Neonatal outcome*	abortion	1 (6.7)
	stillborn	5 (33.3)
	live born	8 (53.3)

**One patient had septicemia following unsafe abortion and one antepartum death baby was not delivered; # Lower segment Cesarean section; $ Cesarean section*

Table 4: Cause and type of maternal death (N = 15)

Characteristics		*n* (%)
Cause of death	Post-partum hemorrhage	2 (13.3)
	Eclampsia	4 (26.7)
	Septic abortion	1 (6.7)
	Chorioamnionitis	1 (6.7)
	Pulmonary embolism	1 (6.7)
	Amniotic fluid embolism	1 (6.7)
	Eisenmenger syndrome	1 (6.7)
	Primary pulmonary artery hypertension	1 (6.7)
	Retroperitoneal hemorrhage	1 (6.7)
	Septicemia	2 (13.3)
Type of death	Direct	10 (66.7)
	Indirect	5 (33.3)

Table 5 presents the critical interventions provided before the maternal deaths. Critical interventions like mechanical ventilator support were required for most of the patients. Almost 80 % were admitted in the intensive care unit prior to their deaths. All patients with eclampsia received Magnesium sulphate.

The delay was considered when the patient reported late and had they presented early probably they could have been saved. In 10 (66.7%) mothers, there was delay at the community level in seeking health care and in reaching the health facility due to various reasons. None of the factors among age, residence in terms of rural or urban, educational status, booking status, and parity had a significant relationship with delay in seeking health care as shown in Table 6.

Delay in seeking health care was observed in four patients with eclampsia, four patients with

Table 5: Critical intervention provided in maternal deaths (N=15)

Critical Interventions*	*n* (%)
High grade antibiotics (Meropenem, Piperacillin and Tazobactum, Clindamycin)	6 (40)
Inotropes	5 (33.3)
Dialysis	2 (13.3)
Mechanical ventilation	8 (53.3)
Re-laparotomy	1 (6.7)
Magnesium sulphate	4 (26.7)
Massive transfusion of blood and its products (more than 5 pints of blood and blood products transfusion over 12 hours)	4 (26.7)
ICU admission	12 (80)

** more than one critical intervention required in more than one case.*

Table 6: Factors associated with deaths due to delay in seeking and reaching health care (N = 15)

Characteristics		Delay	No delay	*p*
Age (years)	≤ 19	3	0	0.62*
	20-35	4	3	
	≥ 35	3	2	
Area of residence	rural	7	2	0.33*
	urban	3	3	
Educational level	primary level or below	2	2	0.56*
	secondary level or above	8	3	
Booking status	unbooked	5	1	0.58*
	booked	5	4	
Parity	para ≤ 2	6	5	0.23*
	para > 2	4	0	

* *Fisher Exact* test

infections and two patients with cardiac disease undiagnosed prior to admission. Delay in diagnosis and treatment was noted in three patients: Diagnosis of hemoperitoneum following Cesarean section in one, prompt management of postpartum hemorrhage in second, and early management of embolism in third case..

DISCUSSION:

Maternal mortality is an important indicator the maternal health status, health care delivery system of the country and the status of woman in the society. WHO estimated MMR of Nepal in 2015 was 258 per 100,000 live births. In our study, maternal mortality ratio was calculated to be 151 per 100,000 livebirths much lower than that of the country. This is much lower than maternal mortality studies done in the other parts of Nepal as this is a more recent study and this study is not community based.[7,8,9,10]

More than 50% of the maternal deaths were in adolescent and elderly gravidas. Similar observations were made in other studies.[10,11] As extremes of age is one of the known high risk factors in pregnancy, more deaths were observed when these two groups were combined. Mean age was 28 years similar to that of other studies.[10,11] In the present study, most of the women were from rural area as in the studies done in Nepal and India.[8,12,13,14] However, the difference of area of residence was not found to be statistically significant in our study. Nevertheless, it is difficult to infer that women residing in rural and urban areas are equally at risk of suffering mortality as the sample population in our study is too small.

Most of the patients had low level of education (primary) as in other studies.[8,11,12,13,14,15] In terms of antenatal registration and supervision of pregnancy, it was paradoxically observed in this study that 60% of the mortality was in women who had antenatal supervision. Antenatal supervision is important and maternal mortality has been more common in women who do not have antenatal care as observed in many other studies.[10,11,12,13,14,15] In the present study, however, though most of the women were booked during their pregnancy, only two (13.3%) were booked at our center while 46.7% were booked outside with majority being booked at health post. The quality of antenatal care and supervision is important in preventing the maternal deaths. Proper antenatal care not only supervises pregnancy and its complications, but also imparts knowledge about the danger signs in pregnancy and when to seek health care. Therefore, quality of care should improve to bring about favorable results. Most of them were multiparous though it was not statistically significant. Similar observations were made in other studies.[8,11,13,14,15]

Most of the deaths occurred in the postpartum period as in the other studies.[8,9,10,12,15] Maternal deaths were more common in the later part of the pregnancy. In our study, more than 90% woman who died, had delivered in the third trimester. Similar results were observed in other studies.[8,10,12,13] Hemorrhage, hypertensive disorders, and infection are the vital causes of maternal death and are more common in the latter part of gestation. Therefore, latter trimesters of pregnancy harbors more risk and thus close supervision is needed during this time as advised by others.[16]

Almost two-thirds of mothers were brought in a critical condition. Arrival in a critical condition as shown in other studies is one of the major factors leading to death.[8,10] All patients with eclampsia (26%) and all with infection (26%) had presented late in a critical state in our study. Early presentation at the time they had impending eclampsia could have prevented deaths. Also in patients presenting with sepsis, death could have been avoided if had not come so late in terminal state. Delay in seeking health care was the factors leading to maternal deaths in our study. Delay to seek health care was due to several reasons - lack of information as most of these

patients did not have antenatal care and also those who were booked at health center had substandard care and were not properly educated about when to seek health care service.

It has also been suggested that knowledge and education are the major factors that affect health seeking behavior of women and affects the health status of a women as seen in our study.[17,18] Lack of transport especially at night, inaccessibility to health care due to topography of our country also contributed to late arrival to health care facility.

Most (67%) of the maternal deaths were due to direct causes and remaining 33% due to indirect causes. Classical triad of maternal mortality as in any developing country – eclampsia, postpartum hemorrhage, and infection was observed in our study. All of these causes are the preventable causes of maternal death. Other causes of mortality were embolism, cardiac disease, retroperitoneal bleed, and septicemia unrelated to pregnancy. Hemorrhage was the major killer in maternal mortality and morbidity study conducted by the government of Nepal.[6] Similar was the observation in other studies conducted in tertiary care centers.[10,11,13,14,15,19] Eclampsia was the leading cause in other studies.[8,12] Abortion related deaths occurred only in one patient over a period of four years unlike in a study in eastern Nepal were abortion related deaths were more common.[9] It could be due to easier access to safe abortion service in our region.

Eclampsia was the leading cause of maternal mortality. Of all these patients, only one had received magnesium sulfate for seizures. Therefore, proper education and information to the health care providers about primary care prior to referral would help in preventing such maternal death. This also emphasizes on the need to improve quality of antenatal care and management.

Cardiac disease was the indirect cause of maternal death contributing to 13.3% of the death. These pre-existing medical disorders were unknown prior to admission and so delay was noted here as well. Similar observations were noted in another study.[8] Antenatal diagnosis and optimization of clinical condition prior to conception could probably prevent these deaths. This could be possible only with an appropriate antenatal care and patient education. Suspected embolism was an important cause of maternal death. Amniotic fluid embolism was suspected in one of the patients and pulmonary embolism in the other. High index of suspicion and prompt management with multidisciplinary approach could be of help in such cases. Thromboembolism prevention by using heparin in high risk cases is not routinely practiced in our center though deaths due to thromboembolism has been reported in most of the maternal mortality studies.

It has been observed in our study that most of the delay leading to maternal deaths has been at the community level – delay to seek health care and to reach on time. Importance of education, woman empowerment, encouraging quality antenatal care at the community level should be stressed upon. Government should also work at making quality health services available at periphery. Transportation facilities should be made more accessible and affordable. At hospital level, appropriate guidelines and protocols should be formulated for management of common obstetric complications.

This study was conducted for a short period of time and therefore has small sample size. Probably a longer study period would provide us with a more meaningful data.

CONCLUSION:

Maternal mortality ratio was 151 per 100, 000 live births. Most of the maternal deaths were due to direct obstetric complications like eclampsia, infection and hemorrhage which are all preventable causes of maternal mortality. Most of the delays had been at the community level in seeking and reaching health leading to the maternal deaths.

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