RESEARCH ARTICLE

Maternal near-miss, mortality and their correlates at a tertiary care hospital

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Abstract

Objective: To determine the frequency and causes of maternal near-miss and mortality among pregnant women.

Method: The cross-sectional prospective study was conducted from January 2016 to December 2018 at the Services Hospital, Lahore, Pakistan, and comprised all near-miss cases admitted in the gynaecology department. The World Health Organisation criterion was used to identify the near-miss cases. Primary outcome measures were frequency and causes of near-miss and the ratio between maternal mortality and near-miss cases. Secondary outcome measures were delays, need for massive blood transfusion, intensive care unit admission, obstetric hysterectomy and hospital stay >7 days. Data was analysed using SPSS 23.

Results: Of the 10,739 live births, there were 344(3.2%) complications resulting in 305(2.8%) near-miss cases and 29(0.3%) maternal deaths. Frequency of near miss was 28.4 per 1000 live births and the ratio between maternal mortality and near-miss cases was 1:10.5. There were 215(62.5%) unbooked patients and 23(6.7%) of them died ($p<0.001$). Among the near-miss cases, haemorrhage accounted for 150(49.18%), hypertensive disorders 102(33.44%), cardiac disease 25(8.28%) and infection 12(3.97%). Maternal mortality was significantly low for haemorrhage, hypertension, sepsis and cardiac disease ($p<0.001$). Massive blood transfusion was given to 64(20.98%) patients, 48(15.74%) underwent hysterectomy, and 98(32.13%) required admission to intensive care unit. First and second delays were seen in 240(78.6%) near-miss and 25(86.2%) mortality cases ($p<0.001$).

Conclusion: Haemorrhage and hypertension were found to be major reasons for near-miss cases, but timely intervention could prevent mortality.

Keywords: Maternal near-miss, Maternal mortality, WHO criteria. (JPMA 71: 1843; 2021)

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Introduction

Maternal mortality reduction has long been on the global agenda and although there is reduction in the maternal mortality rate (MMR), 94% of maternal deaths occur in low middle income countries (LMICs).[1] Globally, complications of pregnancy and childbirth, like haemorrhage, hypertension (HTN), sepsis and abortion, are responsible for 70% of maternal deaths.[2] Every woman dying passes through a phase where effective timely intervention can save her life. This has led to the definition of maternal near-miss, also called severe acute maternal morbidity, or obstetric near-miss defined as "the near death of a woman from complications during pregnancy, childbirth or within 42 days after the termination of pregnancy".[3]

Ensuring adequate quality of care is the primary objective of the World Health Organisation (WHO) global strategy aimed at decreasing the MMR to 70 per 100,000 live births by 2030.[4] Maternal near-miss case review (NMCR) is an important step in improving quality of care in maternity services. There were different criteria used for near-miss definition which were disease-specific, management-specific and organ-specific, which led to confusion in defining the condition. In 2009, WHO proposed a classification using a criterion based on the presence of organ system dysfunction following life-threatening condition.[5] This classification is now being used worldwide to identify near-miss cases. Maternal near-miss cases are more frequent than maternal deaths, and these cases follow similar pathways. Analysis of these cases can help identify the problems and obstacles in care-providing systems. These reviews can guide policy-makers to prioritise implementation of solutions to areas of neglect. NMCR is considered an effective tool in reducing maternal mortality and morbidity in LMICs.[6]

Pakistan has one of the highest MMRs at 140/100,000 live births among the LMICs.[7] Reduction of maternal mortality is an important component of sustainable development goals (SDGs). Although relevant studies have been conducted in Pakistan, they are of shorter duration having smaller sample sizes and most of them using disease-specific criterion for the identification of near-miss cases.[8,9] The current study was planned to identify near-miss cases, and to compare them with maternal mortality.

Subjects and Methods

The analytical cross-sectional prospective study was

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conducted at the Department of Obstetrics and Gynaecology, Services Institute of Medical Sciences (SIMS), Services Hospital, Lahore, Pakistan, from January 2016 to December 2018. After approval from the institutional ethics review board, the sample was raised using consecutive sampling technique ad enrolling all near-miss cases. WHO criterion was used for identifying near-miss events.[5] It includes maternal complications of severe haemorrhage, severe pre-eclampia, eclampsia, sepsis or systemic infection, complication of abortion and ruptured uterus followed by organ system dysfunction, including cardiovascular, respiratory, renal, hepatic, neurological, coagulation and uterine dysfunction. It incorporates clinical, laboratory and management-based elements for identifying maternal near-miss and critical interventions or intensive care unit (ICU) use, laparotomy including hysterectomy, and use of blood products.

Maternal mortality was also recorded during the same period. Maternal death was defined using the International Classification of Diseases version 10 (ICD-10) defined by the WHO as "a 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 the pregnancy or its management, but not from accidental or incidental causes".[4]

Data was collected on a pre-designed proforma. Patient information, such as age, parity, antenatal booking, condition on admission, interventions done to save the life of patient, and duration of hospital stay were noted. Three delays were identified; the first delay in decision to seek appropriate care, the second delay in reaching the appropriate facility, and the third delay related to situations when timely treatment was not initiated at the facility. Laboratory investigations included complete blood count (CBC), coagulation profile, liver function tests, renal function tests and blood gasses. Primary outcome measures were frequency and causes of near-miss, maternal-mortality-to-near-miss ratio and mortality index for each near-miss case. The data was compared between near-miss and mortality cases. Secondary outcome measures were delays, need for >5 blood transfusion, ICU admission, obstetric hysterectomy and hospital stay >7 days. Maternal near-miss was calculated as number of maternal near-miss cases per 1000 live births. MMR rate was calculated as the number of maternal deaths per 100,000 live births. Maternal-mortality-to-near-miss ratio was also calculated. Mortality index was calculated as:

Mortality Index =

$$\frac{\text{Maternal deaths due to a particular condition}}{\text{Maternal near miss + Maternal Death}} \times 100$$

Data was analysed using SPSS 23. Comparison between qualitative variables was done using chi-square test or Fisher exact test, as appropriate. All p values were two tailed and $p<0.05$ was considered significant.

Results

Of the 10,739 live births, there were 344(3.2%)

Table-1: Demographic characteristics of maternal near-miss and maternal mortality cases.

	Age	Mean	Near-Miss N(%) NTOTAL=305 28.9 5.24	Maternal Mortality N(%) NTOTAL=29 26.4 3.8	P Value
Demographic Characteristics		<20	22(7.21)	3(10.34)	
		21-25	40(13.11)	8(27.59)	
		26-30	122(40)	14(48.28)	
		31-35	100(32.79)	4(13.79)	
		>35	21(6.89)	0	
		Total	305 (100)	29(100)	0.192
	Parity	Primigravid	80(26.23)	5(17.24)	
		2-5	160(52.45)	18(62.06)	
		>5	65(21.31)	6(20.69)	
		Total	305(100)	29(100)	0.149
	Gestational age(weeks)	Mean	34.5 1.6	35.8 1.4	0.015
	Booking Status	Booked	90(29.51)	6(20.69)	
		Un-booked	145(47.54)	15(51.72)	
		Referred from other facility	70(22.95)	8(27.59)	
		Total	305(100)	29(100)	0.000
	Delays	1st Delay	105(34.4)	10(34.48)	
		2nd Delay	135(44.2)	15(51.72)	
		3rd Delay	65(21.3)	4(13.79)	
		Total	305(100)	29(100)	0.000

Table-2: Correlation of causes of maternal near-miss and mortality cases.

	Causes	Maternal Near-Miss (MNM) N (%)	Maternal Mortality (MM) N (%)	P Value	Severe Maternal Outcome (MNM+ MM) N	Mortality Index %
Haemorrhage	Ectopic Pregnancy	24 (7.87%)	00		24	0.00
	Miscarraige	01(0.33%)	00		1	0.00
	PPH	69(22.62%)	04(13.79%)		73	5.48
	Placenta Praevia/	20(6.55%)	00		47	4.26
	MAP	25 (8.19%)	02			
	Abruptio Placenta	11(3.61%)	00		11	0.00
	Total	150(49.18%)	6(20.69%)	0.000	156	3.85
Hypertensive Disorder	Severe Pre-Eclampsia	63(20.66%)	03(10.34%)		66	4.55
	Eclampsia	34(11.15%)	05(17.24%)		39	12.82
	Hellp	05(1.64%)	00		5	0.00
	Total	102(33.44%)	8(27.59%)	0.000	110	7.27
Infections	Preupral Sepsis	03(0.98%)	01(3.45%)		4	25.00
	Septic Abortion	01(0.33%)	00		1	0.00
	HEP E	08(2.62%)	02(6.90%)		10	20.00
	Total	12(3.93%)	03(10.34%)	0.000	15	20.00
	Uterine Rupture	16(5.25%)	00	0.000	16	0.00
	Cardiac Disease	25(8.20%)	10(34.48%)	0.000	35	28.57
	Pulmonary Embolism	00	02(6.90%)	0.000	2	100.00
	Grand Total	305 (100%)	29 (100%)		334	8.68

PPH: Postpartum haemorrhage; MAP: Mean arterial pressure.

Table-3: Outcome morbidity measures of maternal near-miss cases.

Outcome Measures	N_{TOTAL}=305					
	Haemorrhage N (%)	Hypertensive Disorder N (%)	Infection N (%)	Uterine Rupture N (%)	Cardiac Disease N (%)	Total N (%)
Hysterectomy	46 (15.08)	-	-	2 (0.66)	-	48(15.74)
Repeat Surgery	5 (1.64)	-	-	1 (0.33)	-	6(1.97)
Massive Blood Transfusion	60 (19.67)	-	-	4 (1.31)	-	64(20.98)
Higher Antibiotic Use	20 (6.56)	-	3 (.98)	6 (1.97)	-	29(9.51)
ICU admission	55 (18.03)	30 (9.84)	1 (0.33)	2 (0.66)	10 (3.28)	98(32.13)
Mechanical Ventilation	5 (1.64)	10 (3.28)	-	-	2 (0.66)	17(5.57)
Multi-organ Dysfunction	20 (3.28)	5 (1.64)	10 (0.33)	2 (0.33)	1 (0.33)	38(14.09)
>7 days Hospital Stay	25 (6.56)	10 (3.28)	5 (0.33)	3 (0.98)	-	43(12.45)

ICU: Intensive care unit.

complications resulting in 305(2.8%) near-miss cases and 29(0.3%) maternal deaths. Frequency of near-miss was 28.4 per 1000 live births and the ratio between maternal mortality and near-miss cases was 1:10.5.

Mean age of near-miss cases was 28.9±5.24 years, while it was 26.4±3.8 years for mortality cases (p>0.05). Mean gestational age was 34.5±1.6 and 35.8±1.4 weeks in the two groups respectively (p<0.05). There were 215(62.5%) unbooked patients and 23(6.7%) of them died (p<0.001). First and second delays were seen in 240(78.6%) near-miss and 25(86.2%) mortality cases (p<0.001) (Table-1).

Among the near-miss cases, haemorrhage accounted for 150(49.18%), hypertensive disorders 102(33.44%), cardiac disease 25(8.28%), uterine rupture 16(5.3%) and infection 12(3.97%). Among those with haemorrhage, postpartum haemorrhage (PPH) accounted for 69(46%) near-miss cases, placenta previa/accrete/percreta 45(30%), ectopic pregnancy 24(16%) abruption 11(7.3%) and miscarriage 1(0.33%). Hypertensive disorders included severe preeclampsia 63(61.7%), eclampsia 34(33.3%) and haemolysis, elevated liver enzymes and low platelets (HELP) 5(4.9%) patients. Puerperal sepsis and induced septic abortion was seen in 4(1.3%) patients, hepatitis E in 8(2.6%) cases who went into hepatic encephalopathy and deranged coagulation/haematological function. There were 16(5.2%) patients with previous caesarean section (CS) and came with uterine rupture after having been

exposed to untrained birth attendant. Out of 25(8.28%) cardiac patients, 18(72%)had severe mitral stenosis and cardiac failure, while 7(28%) had peripartum cardiomyopathy.

Out of 29(0.3%) maternal deaths, HTN was responsible for 8(27.59%), haemorrhage 6(20.69%) and sepsis 1(3.45%). Mortality was significantly low for haemorrhage, HTN, sepsis and cardiac disease ($p<0.001$) (Table-2).

Regarding morbidity outcome measures of patients with near-miss events, 48 (15.74%) underwent obstetric hysterectomies due to morbidly adherent placenta, PPH and ruptured uterus. Massive blood transfusion was given to 64(20.98%) patients, 48(15.74%) underwent hysterectomy, 98(32.13%) required ICU admission, and 43(12.45%) had hospital stay >7 days, with 15(35%) of them staying for a month (Table-3).

Discussion

The current study noted frequency of near-miss morbidity as 28.1/ 1000 live births, which is similar to studies from India and Iran which reported 24/1000 and 25.2/1000 respectively using the WHO criterion.[10,11] Studies from other centres in Pakistan using disease-specific criteria reported near-miss frequency as 67/1000 and 76.9/1000.[8,12] The incidences vary widely because different diagnostic criteria were used to identify these cases. Since the advent of WHO criteria in 2009, things have been standardised and most countries now use this criterion to report near-miss events. Tuncalo et al. reported 0.4-14.9% prevalence in a systematic review depending on the criteria used, with higher incidence from LMICs.[13] Higher incidence from LMICs also suggests gaps and obstacles in maternal healthcare delivery systems.

The maternal-mortality-to-near-miss-ratio was 1:10.5 in the current study, depicting that 10 women were saved for loss of one woman. This is comparable to studies done in Lahore, Islamabad and Baghdad.[8,9,14] Studies from India and Karachi had higher rates.[10,12] Ratio of 1:117-223 have been reported from higher-income countries (HICs), reflecting the good standards of care they offer15. Many factors play an important role in saving mothers when an obstetric emergency arises, like trained skilled birth attendant at childbirth, distance from facility, emergency obstetric care (EMOC) services, blood transfusion and intensive care setup.

In the current study, unbooked patients had significantly higher near-miss and mortality incidents compared to booked patients. Antenatal booking helps to segregate high- and low-risk patients, anticipate complications and plan interventions which can lead to reduction in maternal near-miss morbidities. Lack of regular antenatal care is a dilemma in developing countries.[16-18] This is also the reason for late presentation to the hospital as is shown in the current study where 78.6% patients had a near-miss event before coming to hospital with first and second delays being responsible. It was also responsible for 86.2% of maternal mortality. Studies have reported similar results.[19,20] Although some pregnancy-related complications leading to high-risk childbirth are almost unavoidable, the evaluation of near-miss cases in the current study helped to identify the factors and hindrances which lead to delays in getting proper obstetric healthcare. First and second delays represent societal issues in LMICs as most of the population resides in rural areas where appropriate facilities are lacking. These include illiteracy, poverty, lack of skilled birth attendants (SBAs) with inadequate antenatal care, properly equipped facilities, infrastructure, transportation and poor referral systems. The third delay is due to inadequacies in diagnosis, blood arrangement and overburdened ICU at tertiary care facilities. Most of the limitations can be removed by continuous surveillance and establishing auditing systems to improve quality of care. The provincial government in Pakistan's Punjab province has recently made basic health units (BHUs) functional round the clock and had developed a proper referral system with ambulance service.[21] These interventions can definitely play a pivotal role in addressing the delays and reduction of maternal mortality. NMCRs should be an integral part of all health facilities with data collection by health managers so that uniform policies can be designed to reduce the burden of maternal and newborn morbidity and mortality.[22]

Haemorrhage (49.18%) followed by hypertensive disorder of pregnancy (33.44%) were found to be main causes of near-miss, as shown in other studies.[7-18] Hypertensive disorders were second most common reason for near-miss and mortality in the current study. Severe pre-eclampsia and eclampsia are preventable disorders and use of magnesium sulphate as anticonvulsant was lacking in patients who were referred after undergoing home delivery resulting in fits. Lack of use of anticonvulsant was reported in 52% of hypertensive near-miss patients.[9] Antenatal care with detection and treatment of HTN at early stage can help overcome this catastrophe. Incidence of sepsis was low as only 5 patients in the current study compared to other studies from Africa.[17,18] The reason may be liberal use of antibiotics by healthcare providers in rural areas or better sterilisation at private clinics from where most of the patients were referred. We had 25 cardiac patients with 18 of them diagnosed cases of severe mitral stenosis and cardiac failure, and seven had

peripartum cardiomyopathy. Our hospital is adjacent to the largest cardiac hospital of the province, the Punjab Institute of Cardiology (PIC), and we have a large proportion of cardiac patients who book at our antenatal clinic. Cardiac patients in pregnancy as near-miss cases are also reported in study from Karachi.[12] Rheumatic heart disease remains a significant health problem in LMICs owing to poor health systems.[23]

All near-miss patients had morbidity in terms of hysterectomy, massive blood transfusions, prolonged hospital stay and ICU admission. Haemorrhage was especially responsible for major obstetric morbidity in terms of ICU admissions, obstetric hysterectomy, prolonged hospital stay and massive blood transfusions, which is line with other studies.[9,10,12,16] Although haemorrhage was the major cause of near-miss, the mortality index was the lowest for haemorrhage (3.85%). The reason was that 40 patients of placenta previa/accrete/percreta were booked patients with adequate arrangement of blood beforehand. Moreover, PPH patients who reached the facility were managed with early resort to hysterectomy, timely blood transfusions and subsequent ICU admission. Sixty of the 150 patients with haemorrhage required massive blood transfusion. A study reported massive blood transfusion in 42.6%, hysterectomy in 5.7% and ICU admission in 75% of near-miss patients.[16] The patients who died mostly reached the hospital in a state where organ dysfunction had already set in because of first or second delay. Multidisciplinary approach is essential in these women as their young age is a good prognostic factor and timely intervention can save life. These interventions proved to be live-saving measures as all patients had significantly less maternal mortality for all the conditions in the current study. Facility of round the clock blood bank and ICU admission is reported as an important step in reducing mortality in near-miss cases in other studies as well.[8-12,16-18] A study reported ICU admissions in 51.72% hypertensive patients, followed by sepsis 44.4% and haemorrhage 43.5%. In the current study, 32.13% patients were admitted to ICU, while other studies reported admission in 64% and 100% patients of near-miss cases.[8,24] ICU admission is an important life-saving intervention in critically sick patients, but admission also depends on availability and capacity of ICU. We do not have separate ICU for obstetric patients and there is generally one surgical ICU with a long waiting queue. The problem of the developing world is a large load of critically ill patients with shortage of qualified intensivists[25]. Fully functional ICUs on a large scale should be available specifically for obstetric patient care.

Conclusion

Haemorrhage and hypertensive disorder were found to be the most common causes of maternal near-miss cases. Proper management in terms of blood transfusion and ICU admissions saved lives. Antenatal care and addressing the first two delays in seeking medical advice can reduce maternal mortality. NMCRs should be essential part of any healthcare system.

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