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Original Research Article

A RETROSPECTIVE COMPARATIVE ANALYSIS OF THE TRENDS OF NEAR MISS MORTALITY AND MATERNAL MORTALITY IN A RURAL TERTIARY CARE CENTER

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ABSTRACT

Background: Severe acute maternal morbidity is emerging as an important indicator for evaluating maternal health worldwide. As the load of critically ill obstetrics patients is quite high in our institute, this study was undertaken to provide insights into the quality of obstetric and critical care providence and help modify current policies and strategies.

Material and Methods: With purposive sampling, near miss cases were identified using 2000 WHO criteria and compared with maternal mortality indicators. 390 patents were included in the study. For data collection, case files from the medical records department, labor room and ICU records were used. Statistical analysis was done using SPSS version 28.0.2. Observational descriptive statistics, Chi square/Fisher test and Mann-Whitney U Test were applied.

Results: From all critically ill obstetric admissions during the study period; 280 near miss cases & 111 maternal deaths were observed, leading to a high mortality index of 28%. The number of deliveries were 9807. The maternal near miss prevalence was 2.8% and maternal death to near miss ratio was 2.5:1. Near miss patients in the 3rd trimester were significantly higher (70%) than in mortality cases (41%). A large bulk were postpartum. (p= 0.009).

Conclusion: Haemorrhage and hypertension remain the main causes of severe maternal outcomes with preponderance in the peripartum period. Analysis of near miss cases high-lighten the magnitude of severe maternal outcomes and help develop evidence-based protocols and better utilization of resources at hand.

Keywords: Hypertensive disorders, maternal morbidity, maternal near miss, mortality index, postpartum haemorrhage.

INTRODUCTION

The millennium department goals (2015) target was to reduce maternal mortality by 75%. This goal has yet not been achieved.[1] Although it is undeniable that MMR continues to fall worldwide, we are still far from the target of 70/100000 live births. The scenario in India is no different. The MMR in India is 99/100000 Live births as on 2020.[2] Major inequalities prevail among various states in India pertaining to perinatal care. Some states show better statistics than others. The government of India has launched several programs in its armamentarium to combat this issue. Janani Shishu Suraksha Karyakram, Janani Suraksha Yojana & Pradhanmantri Matru Vandana Yojana to mention some.[3,4,5] Some states have adopted the Professional Midwife-Led Maternity Care module to improve maternal care and implement effective triaging of patients in our socioeconomic and cultural setting.[6] The burden of maternal mortality and morbidity are conspicuously high in developing countries. The attributable factors are poor access or utilization of health care services, delayed referral, lack of adequate skilled services for obstetric emergencies and critical events, unwillingness to implement many

government promoted national maternity care quality improvement programs by many care providers.[7,8]
Audits of maternal mortality reviews alone do not suffix to highlight the level of obstetric care. The study of women with severe acute maternal morbidity is a complementary approach to provide additional information on relevant factors contributing to terminal events and possible preventive strategies.[9] The WHO in 2009 has identified a set criterion which includes clinical, laboratory, and management-based criteria for standardized inclusion of near miss cases and can be used for global implementation. According to WHO definition, 2009, maternal near miss is a woman who nearly died but survived a complication during pregnancy, childbirth or within 42 days after terminating pregnancy.[10] Since near miss women have traversed the same course of terminal events as maternal deaths and are themselves available for interrogation, it is a better method of reliable and statistically relevant quantitative analysis.

MATERIAL AND METHODS

Design

The setting for this study is a 1000 bedded specialty tertiary teaching hospital providing perinatal care to a large population of women in rural and semi urban regions. It is a retrospective data based observational analysis of 7 years from January 2014 to December 2021. Sampling technique is purposive. Assuming 40 per 1000 near miss incidence and 3:1 near miss to maternal death ratio at our institute, considering 5% level of confidence with 20% allowable error on either side, the minimum estimated sample size was 369. Near miss cases were identified using WHO criteria which includes a set of clinical laboratory and management based criteria. Maternal mortality during the same time was also analyzed. We calculated the prevalence of maternal near miss mortality cases, maternal near miss ratio, mortality index, maternal mortality rate and near miss to maternal death ratio.
Medical records (both labor room registers and ICU files) of women with severe maternal outcomes both near miss and maternal deaths were reviewed. Parameters analyzed were demographic profile, etiological factors, severe obstetric complications, perinatal outcome, ICU admissions and critical surgical interventions. The trend in obstetric care over 7 years was also observed.

Functional definitions that were used in the study are as follows

Prevalence of near miss mortality = No. of NMM/No. of deliveries in the hospital x 100, expressed as a percentage.
Mortality index = No. of maternal deaths/NMM+MD x 100. It is the no. of maternal deaths divided by no. of women with life threatening conditions. Higher the index, more the women with the threatening condition dies.
Maternal death to near miss ratio = NMM/MD. It is the proportion between near miss cases and maternal deaths. Higher ratios indicate better care. NMM: MD.
Maternal mortality rate = MMR / 1,00,000 LB. It is no. of maternal deaths per 1,00,000 live births births.
Maternal near miss incidence ratio= It is the number of maternal near miss cases / number of live birth in the hospital x 100.
Statistical analysis was done using SPSS version 28.0.2 Observational descriptive statistics was applied for demographic and clinical characteristics of the study population. Chi square, incidence rate difference and measures of central tendency were calculated.
Institutional ethics committee approval was taken.

RESULTS

During the study period, there were 9807 deliveries and 9133 live births. The cumulative numbers of women reaching our facility with severe maternal outcomes were 391, out of which 280 were MNM case and 111 were MM cases. This gives a mortality index of 28% which is high. The MMR during this 7-year period was 1215 per 100000 live births and prevalence of near miss cases was 2.8%. Higher prevalence shows better management of critical patients. The maternal death to near miss ratio was 2.5:1 which means out of 2-3 critical patients, 1 died.
Table-1 outlines the comparison in the demographic profile. The medium age in both groups was 25 yrs. The distribution of primigravidae and multigravidae was comparable in both groups. 41% of near misses and 43% of MMR were primigravidae while 58% of NM and 57% of MMR were multigravidae. With respect to gestational age, maximum numbers of patients in both groups were in their 3rd trimesters. However, the percentage of NM patients in the 3rd trimester was significantly higher (70%) than in the mortality case (41%). A large bulk of critical patients were postnatal with the preponderance being among the mortality cases (38%) versus NM cases (20%). This was statistically significant P value (0.0001). 10 patients in the NM group had multiple pregnancies. Regarding the booking status, only 7.8% of the NM cases and 7.2% of the mortality cases were booked in their antenatal periods, with infrequent and irregular visits. A huge proportion of these patients were unbooked, referred patients. 65% of near misses and 71% of mortality cases were high risk patients.
Table 2 displays the spectrum of primary causes leading to critical events in our study. Among the near miss cases, hypertensive disorders of pregnancy were the leading cause (36%) followed by hemorrhage (29%) and indirect causes (12%). There were 105 covid 19 patients who delivered during 2020 to 2021 out of which, 7 were near miss

cases. In contrast, hemorrhage (36.9) was the leading cause of maternal mortality followed by sepsis (21%) and hypertensive disorders (19.8%). This has also been proved statistically. The second wave of covid claimed 12 mothers among the sepsis group while 4 were dengue hemorrhagic fever cases. 2 cases of MMR presented with post abortal septic shock. One patient died within 12 hours of hysterotomy due to irreversible hemorrhagic shock. Among the indirect causes, cardiac disease contributed maximally towards critical outcomes. With references to table 3, vaginal delivery was the main mode of delivery among the mortality cases, while cesarean section was more commonly performed in the near miss group.

The average hospital days were 8 in the NM group and 2 in the MN groups. 73% of NM cases and 93.4% of MM cases show ICU admissions, with average ICU stay of 5 days and 2 days respectively. 41.07% of NM cases and 90% of mortality cases required ventilator support. The complication rate was significantly higher among the mortality cases. Perinatal outcome was comparable in both groups except that premature deliveries occurred more frequently in near miss mothers. More than 40% of these patients in both groups received massive blood transfusion and a sizable proportion underwent critical surgical interventions. Massive transfusion protocol was initiated whenever required in the ratio of RBC: FFP: Platelets = 1:1:1. About 30 patients in the near miss group and 7 patients in the mortality group required more than 15 units of blood products. 3.2% of patients in the near miss group were discharged against medical advice due to financial or social reasons after overcoming the critical phase. All of them were doing well on follow up. 5.4% patients in the mortality group went DAMA due to very poor prognosis with death ensuring at civil hospital or home. 7 patients in the near miss group were in the 2nd or early 3rd trimester and were discharged after stabilization during the study period. 6 of them were covid 19 patients.

The markers of WHO criteria for identification of acute severe maternal morbidity were analyzed. As per the clinical criteria, most near miss cases presented with shock followed by uncontrolled fits and clotting failure. As for the laboratory criteria, oxygen desaturation was the most conspicuous finding followed by acute thrombocytopenia and raised bilirubin. Among the management-based criteria, 115 patients required intubation and ventilation > 60 minutes, 70 patients required continuous vasopressors. Obstetric hysterectomy was performed in 46 patients while 18 patients required dialysis for acute renal failure. 20 patients had status eclampticus. Table 5 reflects the trend of performance with respect to maternal outcomes over a period of 7 years. The MMR and mortality index is higher in the second half of the study due to a huge contribution from covid 19 patients. Our institute was designated as covid hospital by the government of India. The other indicators however revealed a better outcome performance. Maternal death to near miss ratio also reflects a similar trend.

Table 1: Demographic profile

Characteristics	Near miss (280)		Mortality (111)			
	N	%	N	%	Total	P value
Age (years) (median)	25		26		51	0.1
Parity: Primi	116	41%	47	42%	163	0.8
Multi	164	58%	64	57%	228	
Gestational age (wks.): 1st	4	1.4%	4	3.6%	8	<0.0001
2nd	24	8.5%	18	16%	42	
3rd	196	70%	46	41%	242	
Postnatal	56	20%	43	38%	99	
Multiple pregnancy	10	3.5%	2	1.8%	12	0.3
Booking status: Booked	22	7.8%	8	7.2%	361	0.9
Unbooked	258	92%	103	92%	123	
Govt Hosp	87	31%	36	32%	206	
Private	150	53%	56	50%	36	
Home	25	8.9%	11	9.9%		
High risk Antenatal	183	65%	79	71%	262	0.5

N= Number of patients

Table 2: Spectrum of primary causes for near miss and maternal death

Diagnosis	**Near miss (280)**		**Mortality (111)**					
	N	**%**	**N**	**%**	**Total**	**Prevalence ratio**	**Mortality index**	**P value**
Hemorrhage:	83	29.6%	41	36.9%	124	.66	33	0.23
Ectopic	1	0.3%	2	1.8%	3	.33	66	
Abortion	3	1.07%	2	1.8%	5	.6	40	
Perf. of uterus	0	0	1	0.9%	1	0	100	
Abruption	21	7.5%	9	8.1%	30	.7	30	
Placenta previa	23	8.2%	4	3.6%	27	.85	14	
PPH (atonic/ traumatic)	35	12.5%	23	20%	58	.60	39	
Hypertensive disorder:	103	36%	22	19.8%	125	.82	17	0.007

								95%CI (0.04-0.2)
Uterine rupture: Inversion of uterus Sepsis / Seasonal Infection Dystocia	25 3 28 10	8.9% 1.07% 10% 3.5%	2 1 24 6	1.8% 0.9% 21.6% 5.4%	27 4 52 16	.93 .75 .54 .63	7.4 25 46 37	0.01CI (0.01-0.12) 0.8 0.004 0.4
Indirect Cause Cardiac Hepatic Respiratory Renal CNS	34 17 8 5 2 2	12.1% 6.07% 2.8% 1.7% 0.7% 0.7%	19 8 5 3 2 1	17% 7.2% 4.5% 2.7% 1.8% 0.9%	53 25 13 8 4 3	.64 .68 .62 .63 .5 .67	35 32 38 37 50 33	0.9

Table 3: Maternal and Perinatal Outcome

	Near miss (280)		Maternal death (111)			
	N	%	N	%	Total	P. value
Mode of delivery: Vaginal LSCS Hysterotomy Instrumental	 101 153 0 8	 36.07% 54.64% 0 2.86%	 49 46 1 3	44% 41% 0.9% 2.7%	 150 199 1 11	 0.2 0.09 0.1 0.9
Undelivered D&E	7 2	0.36% 0.71%	9 0	8.1% 0	10 2	0.000
Avg hosp. stay (days) (median)	8	2.86	2			<0.0001
ICU Admission	205	73.21%	104	93.4%	319	0.04
Avg. ICU stay (days) (median)	5	1.79	2			0.8
Ventilatory support	115	41.07%	101	90%	216	0.0001
Live Births	182	65%	64	57.5%	246	0.4
Fresh Stillbirths	69	24.64%	23	20.7%	92	0.4
Macerated Stillbirths	28	10%	12	10.8%	40	0.8
NICU Admissions	73	26.07%	29	26.1%	102	0.9
Preterm Births	92	32.86%	20	18.1%	112	0.01
Massive Blood Transfusion > 15 units	150 30	53.6% 10.7%	46 7	41% 6.3%	166 37	0.1 0.2
Critical Surgical Intervention	92	32.86%	27	24%	119	0.1
Chronic Sequelae	19	6.79%	1	0.9%	20	0.01
Complications	69	24.64%	60	54%	129	<0.0001
DAMA	9	3.21%	6	5.4%	15	0.3

Table 4: Critical Surgical Interventions

Identities	Near miss N= 280	%	MMR N=111	%	Total	P Value
Obstetric Hysterectomy	46	16.43%	10	9.01%	56	0.07
Relaparotomy	10	3.57%	2	1.80%	12	0.3
Cervicovaginal exploration/Repair	22	7.86%	10	9.01%	32	0.7
Exploratory laparotomy /Repair of uterus/ Others/Internal iliac ligation	17	6.07%	4	3.60%	21	0.3

Table 5: Comparison of trends of near miss to maternal mortality

	2014-2016 (3 yrs.)	2017-2021 (5 yrs.)	Total
Deliveries	3191	6616	9807
Live Births	2891	6242	9133
Near Miss Cases	122	158	280
Prevalence of near miss	3.8%	2.3%	2.8%
Maternal Deaths	34	77	111
MMR/100000 LB	1176	1233	1215
Critically ill obstetric patients MNM+MM	156	235	391
Maternal death to near miss ratio	3.5:1	2.1:1	2.5:1
Mortality index	21.7	32	28
Maternal near miss incidence ratio	42	25	30

DISCUSSION

Every day, approximately 830 women die globally due to pregnancy related causes. 99% of these deaths occur in developing countries.[11] There has been a steady decline in maternal mortality worldwide by about 44% between 1990 and 2015.[11] The MMR in India is estimated to be 99 per

1 lakh live births (2015). 26% of deaths can be prevented by introducing antenatal and community-based interventions. Another 48% can be prevented with access to quality essential obstetric care.[12] Most community-based surveys suggest high prevalence of anemia, pregnancy induced hypertension, hemorrhage, sepsis, labor dystocia etc. across the country.[13]

India has also witnessed a sharp decline in MMR and a rise in institutional deliveries. On the other hand, there is a sizable population of women who have faced life threatening complications during the course of their pregnancy and childbirth, but did not succumb to death. The recent trend is systematic study of these women with severe acute maternal morbidities; as comparative analysis of disease processes responsible for near miss and maternal deaths can highlight factors that constitute significant threat to survival of affected women.

In 2009, WHO introduced clinical, laboratory and management criteria for the identification of near miss mortality cases.[10] As the sample size of near miss cases is more than maternal deaths, review of near miss cases has the potential to throw light on the quality of obstetric care provision in a more appropriate manner. Majority of maternal deaths are unpreventable as they occur in unbooked emergency cases that present too late to the hospital. Therefore, inquiry into comparable determinants of both near miss cases and maternal deaths can be a useful tool in community services.

The maternal near miss incidence ratio in our study was 30 per 1000 live births. Studies from other parts of the world show a varying incidence ratio of 15-46/1000 live births.[14,10] The incidence ratio in another tertiary care hospital in North India was 120/1000 live births which is even higher than our study.[15] Another study by Bansal et. al in Bastar, Chhattisgarh in 2016, showed an NM incidence ratio of 11.9/1000 live births.[16] There are some Nigerian studies, which quote incidence ratios of 28.6/1000 live births in Accra Ghana.[17] 19.8/1000 live births in South Nigeria to 68.3/1000 live births by Akpan et. Al.[18,19] The high incidence ratio at our center was due to the fact that it is a tertiary referral center based in a semi urban location covering a large area of rural and tribal population.

The medium age of patients in our study was 25, which is comparable to most other studies like Bansal et. al. A large number of critically ill patients were in their third trimester or postpartum. 70% of near miss cases were in the third trimester while 38% patients in MM were postpartum. It is known that pregnancy complications peak during the third trimester and our institute being a tertiary center, receives a large volume of referral patients. The large number of postpartum patients in the mortality group signifies poor quality of obstetric care received at PHC, CHC level, unattended home deliveries or delayed referrals. This was also statistically significant. Similar observations were made by Bansal et al, Mansuri et.al. in Ahmedabad and Roopa in Karnataka.[16,20,22] It is noteworthy that more than 92% of patients experiencing severe outcomes were unbooked emergencies.

The burden of high-risk obstetric patients was significantly high in both groups. A large number of patients had moderate to severe anemia, previous cesarean deliveries and some had preexisting cardiac conditions. There were 10 cases of placenta accreta in previous 2 LSCS and 2 cases of placenta increta in previous 4 LSCS.

The MMR at our facility was 1176/100000 live births, which is significantly higher than the National average. This alarming MMR is because of the strategic location of our college providing services to a large population in rural and remote areas. Most of the women have a low inclination for availing any antenatal care. Widespread gender inequalities and negligence towards female health is a realistic issue. The most disadvantaged women suffer the worst outcomes.[23,24,25,26] Widespread deficiencies in infrastructure, supplies, equipment, staffing compound these problems. The MMR given by Roopa et.al in the Karnataka study was 313/100000 live births.[21] A Brazilian study showed MMR of 260/100000 live births.[26] Study by Bansal et.al. from Chhattisgarh shows MMR of 580/100000 live births.[16] Recent studies from Nigeria quote MMR of 1908/100000 live births.[18,27]

The most common cause leading to near miss was hypertensive disorders followed by hemorrhage in our study. This observation is similar to observations made by Jain et al in 2019[28], Mansuri et.al. in Ahmedabad.[20] and another study in North India.[15] The studies by Bansal et.al. and Roopa et.al. Amita Pandey et.al.[29] Sultana et.al. in Karachi.[30] and Chi Kadaya et.al, Zimbabwe.[31] however show hemorrhage as the leading cause of MNM followed by hypertensive disorder.

Among women who experienced mortality, hemorrhage was the leading cause followed by sepsis /infection and hypertensive disorders. India being a tropical country, is home to several endemic diseases. Sepsis and seasonal infections resulted in 10% of NM cases and 21.6% mortality. Amita et al reported a significant MNM (7.4%) and MMR (10.0%) due to sepsis. Similar findings were supported by Chikadaya et.al. Zimbabwe and Dessalegn et.al. Ethiopia.[32] Covid 19 contributed to a significant number of maternal deaths towards the latter half of this study. Among the indirect causes, cardiac condition was responsible for 7.2% maternal mortality.

Mortality index is a reflection of the quality of obstetric care received by a woman. Higher the index poorer in the quality of care. The high mortality index at our center is again due to poor or no antenatal care received by women, underutilization of resources, unavailability of skilled staff at rural centers and delayed referrals. A similarly high mortality index was quoted by Bansal et al in Chhattisgarh of 32.7.

With respect to disease specific mortality index; uterine rupture and placenta previa had the lowest M.I. A well-equipped ICU facility and availability of modern blood banks with massive transfusion protocol in order was instrumental for achieving this. We have also incorporated the technique of internal iliac ligation which in many cases saves life as well as the uterus. The mortality index is quite high in sepsis due to the effect of covid 19. The spuriously high mortality index seen in some conditions like perforation of uterus, ectopic pregnancy, abortion and some indirect causes is due to very low incidence rates. The mortality index was lower in hypertensive disorders, which shows good outcome results for these patients.

The maternal near miss to mortality ratio was 2.5:1. Similar ratios were quoted by Bansal et al, Pravat A. et al in Africa,[33] and Verma S. et al at Manipal.[21] Almerie et al from Syria,[34] and Shrestha NS et al from Kathmandu,[35] however quoted a high ratio of 60:1 and 7.2:1 respectively. which is a reflection of better care. Western literature reports quite impressive ratios of 117-273:1.[14]

36 patients with hypertensive disorders had visual symptoms out of which 3 had complete loss of vision and 15 had blurring of vision. 9 patients had grade 1+2 HTN retinopathy and 9 had serous retinal detachment. Most others had macular oedema, optic atrophy, choroidal ischemia. This reflects successful resuscitation and blood product management in these patients. Similar observation was made by Ugwu et al.[36]

Limitation – The main limitation of this study is its retrospective nature, which might have resulted in some loss of data. The second half of the study period is heavily influenced by the covid 19 pandemic, which shows a spurious display of deteriorating maternal health. This was a simple audit in a single center. Multi centric studies of prospective nature spanning over several years can paint a true picture of the severity of acute severe maternal morbidities and inadequacies at multiple levels of care.

CONCLUSION

Hemorrhage and hypertensive disorders remain the main causes of severe maternal outcomes.

Majority of maternal deaths are unpreventable as they occur in unbooked emergency cases that present too late to the hospital. Therefore, inquiry into comparable determinants of both near miss cases and maternal deaths can yield adequate information on the standard of obstetric care received by women in the hospital and community at large. It can safely be suggested that strengthening the tertiary care centers with staff, material and equipment across the country is of paramount importance.

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