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Maternal near miss: A single centric experience

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Abstract
Introduction: Investigating severe maternal morbidity (near-miss) is a newly recognized tool which helps to identify women at highest risk of maternal death and helps allocate resources especially in low income countries.
Aims and Objectives:
1. Document frequency and nature of maternal near miss.
2. Evaluate the level of care at maternal life saving emergency services.
Methods: It was a retrospective study conducted at Santokba Durlabhji Memorial Hospital, Jaipur (India) during September 2017 to August 2018. The study population included near miss cases and maternal deaths. The WHO near miss criteria 2009 was followed including clinical, laboratory and management based criteria for case identification.
Results: Out of 2805 deliveries, 98 were near miss cases and 5 maternal deaths during the study period. The maternal near miss incidence ratio was 35/1000 live births. Most cases were referred to at perinatal period. Amongst the near-miss cases sepsis (36.5%) was the most common cause followed by haemorrhage (22.5 %) and hypertension (22.2 %). 60% required direct ICU admission.
Conclusion: Near miss/mortality is an important indicator of the health care system of any country. Stress should be more towards training and improving services at district level. There should be a good referral system and patients with antenatal complications should be referred with fetus in utero to have a better feto-maternal outcome. Availability of adequate amount of blood products at district level could change the outcome drastically.

Keywords: Maternal near miss, maternal death, maternal outcomes, tertiary hospital

Introduction
Mother and child constitute a large, vulnerable, and a priority group as the risk is involved with childbearing in women and of development in children.
Maternal mortality is described as "Just the tip of the iceberg" with the vast base of the maternal morbidity that still remains largely undescribed [1]. The pregnant women who suffer severe complications and come close to maternal death but do not die are the "near-misses" which need to be investigated. Stones *et al* were the first to use the term "near miss morbidity" to define a narrow category of morbidity which includes "potentiality life threatening episodes" [2, 3]. Due to the success of modern medicine, maternal deaths are fewer in number but there are innumerable "near miss" events. It is well known that complications during pregnancy and child birth can occur at any point of time, and it is important to ensure that readiness in terms of infrastructure, HR, equipment etc. for timely management of complications are available at all the basic and emergency obstetric care health facilities. If such complications are not managed on time they can become fatal for the mother and the child.
For several years, maternal near miss was used as a reliable tool for evaluating maternal health conditions which was defined on differing criteria, which led to heterogeneous estimates of its incidence [4, 5]. In 2009, with a view to standardizing the criteria on which maternal near miss is defined, the WHO proposed a new classification using 25 criteria based on the presence of organ and system (cardiovascular, respiratory, renal, hepatic, neurologic, coagulation and uterine) dysfunction. Since then, several studies from various countries and institutions have been published taking these criteria into account.
For every woman who dies from pregnancy or childbirth-related causes, it is estimated that twenty more suffer from pregnancy-related illness or experience other severe complications [6]. At the country level, India (17%) accounted for one-third of these global maternal deaths [7]. Maternal mortality ratio (MMR) in India has declined from 301 in 2001 and 212 in 2011 to 167

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per lakh live births in 2014 [8, 9] thus missing the target set by the Millennium Development Goal 5 (MDG; MMR < 150/lakh live births). Despite the progress made worldwide in reducing maternal mortality, the global MDG targets could not be achieved. Now, the unfinished task has been taken over by sustainable development goals: Goal 3 which has set a global target to reduce MMR to < 70/lakh live births by 2030 [10].

This study aims to analyse the near miss events and mortality events which occurred in the study setting from August 2017 to September 2018 to compare the causes that led to the events and to analyse the quality of care given to mothers. It helps to analyse the pattern of referral and what all modification can be made at referral level for better outcome. This study will act as a guiding tool for policy-makers by highlighting the most common and the infrequent but serious maternal morbidities to help direct the expenditure of the modest national health budget towards health care priorities.

Materials and Methods
We conducted a retrospective study between August 2017 and September 2018 for all admissions to Santokba Durlabhji Memorial Hospital (tertiary care referral hospital). The study participants include all antenatal patients who had severe maternal outcome either maternal death or near miss events. All healthy patients with uneventful childbirth were excluded.

The definitions for near miss used in this study was the specific criteria given by WHO in 2009. According to WHO, various events were classified as life threatening conditions present at hospital admissions (Type A) and Life threatening conditions developing during hospital stay after admission (Type B). Various symptoms were classified system wise. Clinical, management and laboratory criteria were identified as per WHO guidelines.

Clinical criteria were acute cyanosis, breathing rate more than 40 or less than 6, oliguria unresponsive to fluids or diuretics, loss of consciousness for greater than 6 hours, cardiac arrest, jaundice, gasping, shock, coagulation disorders, cerebrovascular accident, total paralysis. Laboratory criteria were oxygen saturation <90% for >60mts, acute thrombocytopenia (<50000), creatinine >3.5mg/dl, bilirubin >6mg/dl, lactate >5, paO2/FiO2 <200, pH <7.1. Management criteria use of continuous vasoactive drug, dialysis for treatment of acute kidney failure, puerperal hysterectomy due to infection or hemorrhage, cardiopulmonary resuscitation, transfusion greater than 5 units of red blood cell concentrate, intubation and ventilation for a period of >60mts unrelated to anesthesia.

Maternal death and near-miss cases were retrospectively identified by searching the Medical Records register at SDMH. Each patient's medical record was checked and their discharge summary was collected which includes a complication section where all complications which happened as a result of either the primary or the secondary diagnoses are listed. Discharge summaries include investigations (like ultrasonography and blood investigations) and interventions (like hysterectomy, diagnosticlap, exploratory laparotomy and blood transfusion etc.)

Using the data documented in the admission /discharge summaries of the patients, we identified cases where WHO criteria were fulfilled. All the data was then inserted into Microsoft Excel spreadsheet. For each case, we collected data on demographic characteristics including patients age, parity, previous deliveries and gestational age at delivery. We also collected data on the nature of obstetrical complication, type of

delivery and ICU admission including length of stay and any special procedure carried out during the care of the patient.

Results were defined as percentages, frequencies and descriptive statistics. We could identify near misses and subsequently calculate maternal near miss indicators like severe maternal outcome ratio, maternal near miss to mortality ratio and mortality index. Severe maternal outcome ratio refers to the number of women with life threatening condition (MNM+MD) per 1000 live birth. Maternal near miss ratio refers to the number of maternal near miss cases per 1000 live birth (MNMR= MNM/LBx1000). Both ratios give us an estimation of amount of care and resources needed in an area. Maternal near miss to mortality ratio (MNM: 1MD) refers to the ratio between maternal near miss cases and maternal deaths. Higher ratios indicate better care. Mortality index refers to the number of maternal deaths divided by the number of women with life threatening condition expressed as a percentage (MI=MD/MNM+MDx100) The higher the index, the more women with life threatening conditions die (low quality of care).

Results
Out of 2805 deliveries, 98 were near miss cases and 5 maternal deaths during the study period during September 2017 to August 2018.

The demographic characteristics of the women classified as near-miss was median age- 26. Majority of them were primigravida. Postnatal patients were more as compared to antenatal patients. Maximum hospital stay required was 15 days with median stay required was 5 days. Majority of them required direct ICU admission.

Table 1: Distribution of near miss according to age and hospital stay

	N	Mean	SD	Median	Minimum	Maximum
Age	98	26.35	4.69	26	18	37
Hospital stay	98	5.98	3.24	5	0	15
ICU admission	98	2.35	2.52	2	0	10

Table 2 presents the clinical complications causing the near-misses. Pregnancy-related sepsis, hypertension and obstetric haemorrhage were the most frequent clinical complications causing the near-misses, accounting for 36 (36.73%), 22 (22.45%), and 22 (22.45%), respectively. Less common causes were medical conditions (15.31) % and postpartum CVT (3.06 %).

Table 2: The distribution of clinical complications causing the near-miss

Cause	No.	%
Hemorrhage	22	22.45
Hypertension	22	22.45
Medical	15	15.31
Postpartum CVT	3	3.06
Sepsis	36	36.73
Total	98	100.00

Table 3 presents the primary diagnosis at admission. The data shows non obstetric causes contribute 53 % of total near miss cases. Among Obstetric causes Eclampsia has the major contribution (10.20 %) and severe preeclampsia (9.18%). Amongst the hemorrhage maximum near miss patients came with antepartum haemorrhage (9.18 %). There was 4 cases of ectopic patients who presented with shock, 1 case of rupture uterus and 1 case of septic abortion.

Table 3: The distribution of primary diagnosis at admission

Primary Diagnosis at Admission	No.	%
Obstetric Causes		
APH	9	9.18
Eclampsia	10	10.20
Ectopic	4	4.08
HELLP	3	3.06
Rupture Uterus	1	1.02
Septic Abortion	1	1.02
Severe Preeclampsia	9	9.18
PPH	8	8.16
Total obstetric causes	45	45.91
Non Obstetric Causes		
Respiratory(H1N1)	3	3.06
Sepsis	35	35.71
Hepatitis	12	12.2
Postpartum CVT	3	3.06
Total Non Obstetric Causes	53	54.0%

Organ dysfunction occurred in 57 (58.1%) of the 98 near-misses; 42 women had dysfunction of one organ and 15 dysfunction of two or more. The most common organ dysfunctions was hepatic dysfunction occurring in 13%. Other organ dysfunctions were renal (8.6%), coagulation (8.16%) and neurological (5.10%), respiratory (4.08 %) and uterine (4.08 %).

Table 4: Distribution of near miss according to organ dysfunction

Organ Dysfunction	No.	%
Brain	5	5.10
Coagulation	8	8.16
Liver	13	13.27
MODS	15	15.31
Renal	8	8.16
Respiratory	4	4.08
Uterine	4	4.08
No specific organ dysfunction	41	41.84
Total	98	100.00

Table 5 shows that the 98 women with near-miss underwent 83 critical interventions (some women had more than one). These included 10 (10.20 %) who had a hysterectomy, 7 had to undergone exploratory laparotomy, 5 women had diagnostic lap (5.10 %),12 women taken for examination for anesthesia and only 1 women had uterine artery embolization. 2 women (2.04%) had massive blood transfusion (>5 units of red cells). 11 (11.2%) required anticonvulsants and ventilation (22.2%).

Table 5: Special procedures carried out in the management of near-miss

Active Intervention	No.	%
Anticonvulsant	11	11.22
Blood Transfusion	2	2.04
Conservative	4	4.08
Diagnostic Laparoscopy	5	5.10
Dialysis	8	8.16
EUA	12	12.24
Exploratory Laprotomy	7	7.14
Obstetric Hysterectomy	10	10.20
Uterine Artery Embolization	1	1.02
Vasoactive Drugs	1	1.02
Ventilation	22	22.45
Medical management	15	15.31
Total	98	100.00

In our study period there were 5 maternal deaths. 4 out of 5 deaths occurred directly due to pregnancy related cause which includes sepsis (most common) followed by haemorrhage and hepatic failure (acute fatty liver of pregnancy). One woman died due to infective hepatitis who had presented at late stage.

Table 6: Causes of maternal death

	Main Cause	Total
Expired	PPH	1
	Hepatic Failure	1
	Infective Hepatitis	1
	Septic Abortion	1
	Postpartum Sepsis	1
	Total	5

Discussion
Maternal near miss is defined as an event in which a pregnant or recently delivered woman survived a complication either during pregnancy, childbirth or 42 days after termination of pregnancy. The current study used the WHO near-miss audit tool for defining and investigating near-misses.

In our setting we were able to apply the WHO criteria for ascertaining near-misses because of ready availability of laboratory services for evaluating organ failure and sufficient access to life-saving interventions such as blood products and intensive care. In many poor resourced settings these are not available, which would limit the identification of near-miss cases. In poor resource settings like in Africa some parameters of WHO criteria were not applicable especially due to limitations of laboratory test availability.

2805 deliveries were conducted with 2770 live births. As per WHO criteria based on primary near miss event and organ system involvement, 98 cases were near miss cases. There were 5 maternal deaths during the study period. Cases were identified and followed up throughout their period of hospital stay. 80% of the patients needed ICU intervention which highlights the importance of the role of timely intervention and critical care.

In our study, the median age group involved was 26 years. In a similar study by Pandey et al [11], majority (88.3%) were between 18-35 years age whereas Singh Abha et al [12] reported 21-30 years as the most common age group involved.

Postpartum patients presented to our centre with various complications. 51.02 % patients were in the postpartum period on presentation at our centre while in a similar study by Parmar et al [13] 19.5% patients were postpartum. Early marriage and multiple pregnancies coupled with anaemiaand malnutrition increase the risk of various complications. Most common complication for referral in our study was postpartum sepsis followed by haemorrhage and hypertension.

During the study period there were a total 98 maternal near miss cases and 5 maternal deaths. Maternal near miss incidence ratio was 35.3 per 1000 live births. Mortality index was 48.5%. High mortality index indicates that more number of women with life threatening conditions die, in our study high mortality index was due to the fact that our centre is the only tertiary care referral centre in the region and most of the patients reached hospital in critical state.

The maternal mortality ratio at our setup was 180/100000 live births. India maternal mortality ratio is 130/100000 live births. In other developing countries the maternal mortality ratios were 423/100000 live births and 324/100000 live births.

A total 5 deaths were observed in our study. The main leading cause was sepsis (40%) Most of the patientsof the maternal death group came to our hospital at terminal stage and died within 10-12 hours.

Maternal mortality index (MI =Maternal death/maternal near

miss+maternal death) in our setup is 48%. This is very high. Syrian study showed a ratio of 60:1 and study done in Nepal showed a ratio of 7.2:1. [14, 15] This ratio is similar to those of African country where the range is 5-12:1. [16]

Ours is a tertiary referral centre covering remote and tribal areas of Rajasthan and neighboring states like Haryana, Uttar Pradesh and Punjab. Most of the cases are referred to inan already moribund state. High standard care is being given at our centre but due to inadequate utilization of resources at periphery centre, poor antenatal care, delayed referrals, poor transport facilities and lack of skilled personnel at sub centre, PHC and CHC levels mortality index is still up.

Conclusion

Maternal near miss is an important indicator of health care system. Health care workers should be trained to identify the risk factors and refer to them before they are potentially life threatening. The underlying disease processes for near miss and mortalities were almost the same so evaluation of the circumstances surrounding the near miss cases can help in reducing maternal mortality.

In our study, the large magnitude of MNM cases were attributed to improper management of obstetric emergencies at referring hospitals, poor referral practices, inefficient transport system, limited availability of blood products and poor utilization of health care services. Our study had maximum number of patients with puerperal sepsis with or without MODS f/b patients with hypertensive disorder and haemorrhage. Our emphasis should be towards using aseptic methods for delivery and use of proper antibiotics before delivery and operative procedure.

BP should be checked in all ANC visits and use of magnesium sulphate should be done while transferring cases of patients with eclampsia. Availability of an adequate amount of blood and blood products at district level could change the outcome drastically.

Main reasons for women not seeking medical help could be poverty and ignorance and the social status of females in the family. Our emphasis should be on health education and mother should be explained about warning signs and symptoms. Health care facilities should be improved. Working pattern of ASHA, ANM workers should be improved so that the maximum number of patients will attend hospital during the antenatal period. If any complication is diagnosed a transport facility should be provided so that patients can reach the higher centre early. This will help to reduce maternal morbidity and mortality.

The addition of near-miss audits will allow the care of critically ill women to be analyzed, deficiencies in the provision of care to be identified, and comparison within and between institutions to be carried out overtime. This will ultimately improve the quality of obstetric care.

References

1. Marwah S, Sharma M. Maternal near miss review: a brief appraisal. International Journal of Reproduction, Contraception, Obstetrics and Gynecology 2017;6:1703-6.
2. Stones W, Lim W, Al-Azzawi F, Kelly M. An investigation of maternal morbidity with identification of life-threatening'nearmiss' episodes. Health trends 1991;23:13-5.
3. Geller SE, Rosenberg D, Cox SM, Kilpatrick S. Defining a conceptual framework for near-miss maternal morbidity. J Am Med Womens Assoc 2002;57:135-9.
4. Say L, Souza JP, Pattinson RC. Maternal near miss–towards a standard tool for monitoring quality of maternal health care. Best Pract Res Clin Obstet Gynaecol 2009;23:287-96.
5. Lobato G, Nakamura-Pereira M, Mendes-Silva W, Dias MA, Reichenheim ME. Comparing different diagnostic approaches to severe maternal morbidity and near-miss: a pilot study in a Brazilian tertiary hospital. European Journal of Obstetrics & Gynecology and Reproductive Biology 2013;167(1):24-8.
6. Kalhan M, Singh S, Punia A, Prakash J. Maternal near-miss audit: Lessons to be learnt. International Journal of Applied and Basic Medical Research 2017;7(2):85.
7. Park K. Park's Textbook of Preventive and Social Medicine. 23rd ed. Jabalpur: BanarsidasBhanot Publishers 2015,556p.
8. Sample Registration System Bulletin. Office of the Registrar General. Ministry of Home Affairs, Government of India 2014.
9. Government of India. Ministry of Health and Family Welfare. Family Welfare Statistics in India 2011,11.
10. World Health Organization. Evaluating the quality of care for severe pregnancy complications: the WHO near-miss approach for maternal health.
11. Pandey A, Das V, Agarwal A, Agrawal S, Misra D, Jaiswal N. Evaluation of obstetric near miss and maternal deaths in a tertiary care hospital in north India: Shifting focus from mortality to morbidity. J Obstet Gynaecol India 2014;64:394-9.
12. Rathod AD, Chavan RP, Bhagat V, Pajai S, Padmawar A, Thool P. Analysis of near-miss and maternal mortality at tertiary referral centre of rural India. J Obstet Gynaecol India 2016;66:295-300.
13. Parmar NT, Parmar AG, Mazumdar VS. Incidence of maternal "near-miss" events in a tertiary care hospital of Central Gujarat, India.. J Obstet Gynaecol India 2016;66:315-20.
14. Shrestha NS, Saha R, Karki C. Near miss maternal morbidity and maternal mortality at Kathmandu Medical College Teaching Hospital. Kathmandu University Medical Journal 2010;8(2):222-6.
15. Almerie Y, Almerie MQ, Matar HE, Shahrour Y, Al Chamat AA, Abdulsalam A. Obstetric near-miss and maternal mortality in maternity university hospital, Damascus, Syria: a retrospective study. BMC pregnancy child birth 2010;10(1):65.
16. Prual A, Huguet D, Garbin O, Rabe G. Severe obstetric morbidity of the third trimester, delivery and early puerperium in Niamey (Niger). African Journal of Reproductive Health 1998;2(1):10-9