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## Study of maternal near miss and maternal mortality in tertiary care teaching hospitals: An observational prospective study

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### Abstract

**Background:** Maternal near miss is said to have occurred when women presents with life threatening complications during pregnancy, child birth and within 42 days after delivery, but survive by chance or good institutional care.

**Objective:** The aim of the study is to determine near miss cases as per WHO identification criteria and to compare with that of maternal mortality.

**Method:** A prospective observational study conducted in 126 near miss and 84 maternal deaths over a period of 18 months to study and compare the determinants and nature of obstetric complications, presence of organ system dysfunction/ failure.

**Result:** The maternal near miss cases was 16.20 per 1000 live birth and maternal mortality cases were 10.08 per thousand live birth. Maternal near miss: Maternal mortality ratio was 1.5: 1. The majority of the cases were presented during the third trimester and were unbooked. Majority of cases had underlying disorder of hypertensive disorder of pregnancy (33.33%) Maternal near miss, and (48.81%) Maternal mortality the majority of cases in maternal near miss had complication of postpartum haemorrhage (37.3%), and maternal mortality had shock with respiratory failure.

**Conclusion:** Maternal near miss is a good alternative indicator of health care system and most of the cases land in near miss to maternal death due to lack of intervention at primary and other centers.

**Keywords:** Maternal near miss, maternal mortality, hypertensive disorders, postpartum haemorrhage

### Introduction

Maternal and Child Health Care is one of the eight basic components of primary health care in declaration of Alma Ata <sup>[1,2]</sup>. The focus on maternal mortality was sharpened when reduction of maternal mortality became one of the eight Millennium Development Goals <sup>[3]</sup>.

More than 1 woman dies every minute from such causes; 585000 die each year. For every maternal death there are serious life-threatening complications of pregnancy <sup>[4]</sup>. Yet little attention is given to near miss cases <sup>[5]</sup>.

Globally there has been a decline in MMR, In India too this is declining steadily due to additional efforts and resources put under NHM for improving health care <sup>[6]</sup>. Recently, the concept of reviewing severe acute maternal morbidity, "near miss obstetrics events" has been a useful tool to compliment the mortality indicators <sup>[6]</sup>.

In the last two decades, the concept of conducting a Maternal Near-Miss (MNM) review has gained importance as an additional strategy to help identify gaps in health service provision. A near-miss has been defined as 'A woman who almost died but survived complications during childbirth' <sup>[7]</sup>, Near miss audit has been considered a less threatening approach than maternal death audit, and can be used to identify what needs to be done to improve the quality of maternal health care <sup>[7]</sup>. Near-miss cases generally occur more frequently than maternal deaths and therefore a more reliable quantitative analysis can be carried out, which can provide a more comprehensive profile of health system functioning <sup>[8,9]</sup>.

The Indian experience under the guidance of the Government of India, key stake-holders were identified and a National Technical Group (NTG) was constituted. The NTG was given the task of fulfilling four key objectives and developing a comprehensive way forward to guide the decisions at Government of India level for considering national implementation of MNM. The four key objectives were: (i) to agree on the national MNM policy framework and definition of MNM in the Indian context; (ii) to agree on the criteria for identifying an MNM; (iii) to agree on

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the tools for recording and reporting an MNM case; and (iv) to pilot test, and make recommendations for the next steps, including potential scale up across the country [10].

This transition from studying death to studying maternal morbidity has followed a worldwide trend because the absolute number of deaths is relatively small as compared to number of cases of MNM which thus generate more information. Secondly, data on maternal morbidity are more accessible and reliable as the woman is herself a source of information. Thirdly, MNM has a greater acceptability among individuals and institutions since death did not occur. MNMs, therefore, provide useful information to health practitioners and policy makers about the strengths and weaknesses of the emergency obstetric care provided at a facility. Therefore, the present study was conducted to study maternal near miss and maternal mortality at tertiary care teaching hospitals.

### Aims and Objectives

- To determine near miss cases as per WHO identification criteria and calculate its frequency
- To compare ratio of near miss cases with that of maternal mortality.
- Comparison of demographic trends and pattern of MNM (maternal near miss) and MD (maternal death)
- Study maternal near miss indicators:
  1. Maternal near miss
  2. Maternal death
  3. Live birth

4. Near miss rate
5. Mortality index
6. Maternal near miss morbidity index.

### Materials and Methods

The study was conducted in the Department of Obstetrics and Gynaecology, GMC Nagpur, Maharashtra, central India which is a tertiary care centre, all cases of near miss as per newer WHO criteria and maternal deaths were included.

Sample size calculated in (126) for near miss and all maternal deaths in study period (84).

### Study Design

This is a prospective observational study which was conducted for period of 18 months between Jan 2020 till June 2021. Cases of severe obstetric morbidity were identified during daily morning meetings, where all the admissions in the last 24hours and serious inpatient cases were discussed. All the cases were followed up during their hospital stay till their discharge. WHO criteria 2009 is used to identify near miss cases from all the severe obstetric morbidity. For each case data was collected including gestational age at the time of sustaining near miss morbidity, nature of obstetric complications, presence of organ system dysfunction/ failure, ICU admission and timing of near- miss event with respect to admission. Information during the study period was obtained from labour room and ICU.

### Inclusion Criteria

All Maternal deaths and patients with the following features.

Cardiovascular dysfunction	Shock Lactate >5	Ph<7.1 Use of continuous vasoactive drugs Cardiac arrest Cardio Pulmonary resuscitation
Respiratory dysfunction	Acute Cyanosis Respiratory rate >40 or < 6/min Oxygen saturation < 90%	Gasping PaO <sub>2</sub> / FiO <sub>2</sub> < 20mmg Intubation and ventilation not related to anaesthesia
Renal dysfunction	Oliguria non responsive to fluids or diuretics	Creatinine > 300mmol/l or 3.5 mg/dl Dialysis of acute renal failure
Coagulation/haematological dysfunction	Clotting failure Transfusion of >_5 units of blood/ red cells	Acute thrombocytopenia (< 50000 platelets)
Hepatic dysfunction	Jaundice in the presence of preeclampsia	Bilirubin > 100mg / dl or 6mg/dl
Neurological dysfunction	Metabolic coma (loss of consciousness and the presence of glucose and ketoacidosis in urine) Stroke Status epilepticus /Uncontrollable fits/ total paralysis	Coma / loss of consciousness lasting 12 hour or more.
Urine dysfunction	Hysterectomy due to infection or haemorrhage	

### Exclusion Criteria

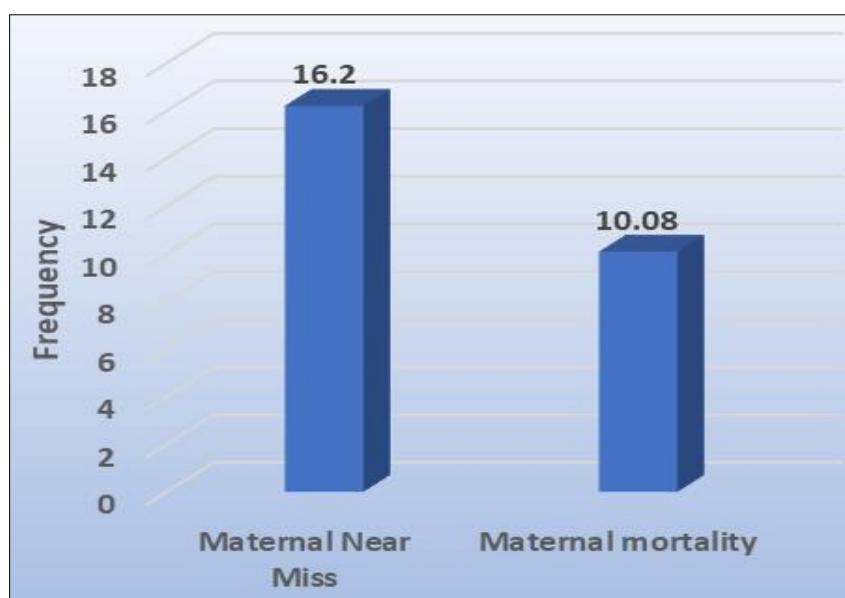
Women that developed those conditions unrelated to pregnancy or 42 days after termination of pregnancy were excluded. All covid positive cases were excluded.

### Observations and Results

This study was conducted for 18 months from January 2020 – June 2021 with total no of deliveries: 11981 and Total Live births: 7,776.

**Table 1:** Magnitude of Maternal Near miss

Sr. No.	Magnitude	Frequency	Per 1000 live birth
1	Maternal Near Miss	126	16.20
2	Maternal mortality	84	10.08
	MNM: MM ratio	1.5:1	



**Fig 1:** Magnitude of Maternal Near miss

The age distribution among cases shows that majority of cases in MNM were in age group 21-25 years (40.38%) followed by 26-30 years (34.13%). The MMR cases show majority of cases in age group 26-30 years (34.52%) and 21-25 years. (34.52%).

The majority of cases in MNM and MMR were below poverty line (BPL) i.e. 73.81% and 80.95% respectively.

The majority of cases in MNM and MMR had not booked ANC registration in GMC Nagpur i.e. 87.30% (MNM) and 96.43% (MMR) respectively.

The majority of cases in MNM and MMR had referral from District hospital i.e. 29.37% and 29.76% respectively. RH was 2<sup>nd</sup> most common referral institute in MNM (18.25%) and MMR (19.05%) cases.

**Table 2:** Gestational age among MMR and MNM cases:

Gestational age	MNM cases		MMR cases	
	Frequency	%	Frequency	%
1 <sup>st</sup> trimester (1-12 wks)	02	1.59	00	0.00
2 <sup>nd</sup> trimester (13-27 wks)	03	2.38	14	16.67
3 <sup>rd</sup> trimester (28-pregnancy)	93	73.81	44	52.38
Puerperium (till 42 days)	28	22.22	26	30.95
Total	126	100	84	100

The majority of cases in MNM and MMR were presented during third trimester i.e. 73.81% and 52.38% respectively, while in puerperium 22.22% and 30.95% cases presented in MNM and MMR respectively.

**Table 3:** Referral at the time of admission among MMR and MNM cases

Referral	MNM cases		MMR cases	
	Frequency	%	Frequency	%
Severe illness	42	33.33	44	52.38
With disorder	80	63.49	37	44.05
Without disorder	04	3.17	03	3.57
Total	126	100	84	100

The majority of cases in MNM had referral with disorder i.e. 63.49% while in MMR cases severe illness (52.38%) was major reason for referral.

**Table 4:** Underlying disorder among MMR and MNM cases

Underlying disorder	MNM cases		MMR cases	
	Frequency	%	Frequency	%
APH	14	11.11	03	3.57
Anemia	26	20.63	17	20.24
Hypertensive disorders of pregnancy	42	33.33	41	48.81
Acute Pancreatitis	01	0.79	00	0.00
RHD	03	2.38	03	3.57
Thrombocytopenia	01	0.79	02	2.38
Asthma	02	1.59	02	2.38
GDM	01	0.79	02	2.38
Jaundice	07	5.56	05	5.95
Pancytopenia	02	1.59	01	1.19
Cerebral malaria	01	0.79	01	1.19
Bronchopneumonia	01	0.79	02	2.38

The majority of cases in MNM and MMR had underlying disorder of hypertensive disorder of pregnancy i.e. 33.33% and 48.81% respectively. Anemia was 2<sup>nd</sup> most common underlying disorder

in MNM (20.63%) and MMR (20.24%) cases. APH was observed in 11.11% cases in MNM and 3.57 cases of MMR respectively.



**Fig 2:** Mode of delivery among MMR and MNM cases

The majority of cases in MNM and MMR delivered by LSCS i.e. 73.02% and 46.43% respectively.

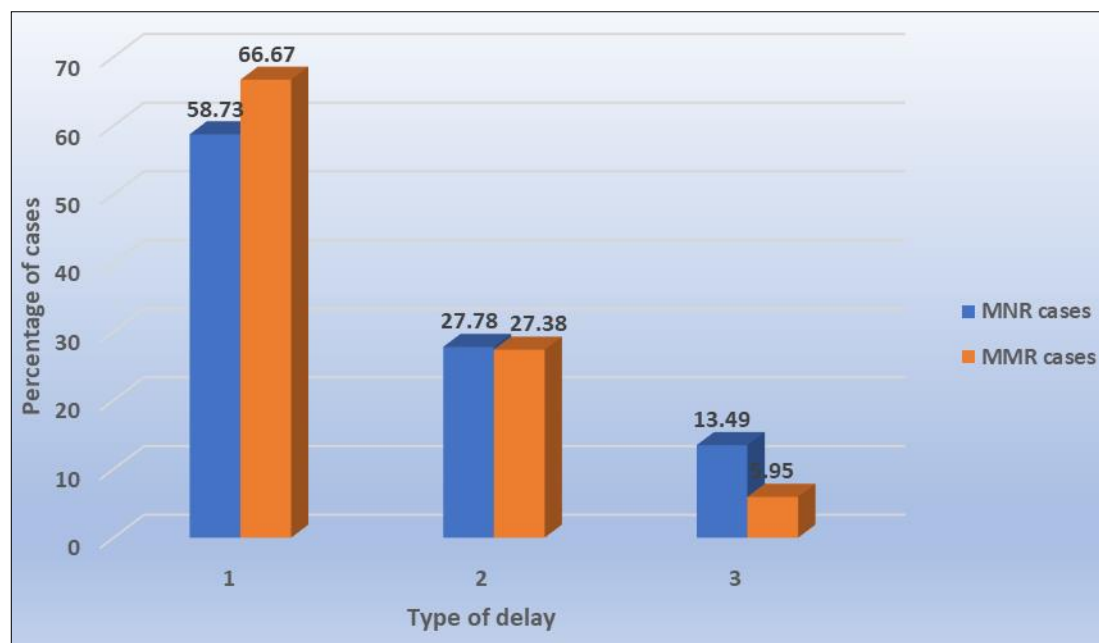
Out of the 30 undelivered MMR cases 18 of them were <28wks of gestation and 6 patients from >28wks gestation were IUD.

**Table 5:** Complications among MMR and MNM cases

Complications	MNM cases (n=126)		MMR cases (n=84)	
	Frequency	%	Frequency	%
PPH	47	37.30	09	10.71
Eclampsia	31	24.60	16	19.05
Hypovolumic Shock	24	19.05	32	38.10
Uterine Rupture	09	7.14	04	4.76
Pulmonary edema	23	18.25	11	13.10
Respiratory failure	14	11.11	28	33.33
AKI	06	4.76	09	10.71
LVF	04	3.17	03	3.57
ARDS	06	4.76	03	3.57
Pulmonary embolism	02	1.59	04	4.76
Sepsis	13	10.32	10	11.90
Liver Cirrhosis	01	0.79	00	0.00
Acute pancreatitis	02	1.59	00	0.00
Acute fatty liver of pregnancy	02	1.59	00	0.00
Peripartum Cardiomyopathy	01	0.79	00	0.00
Placenta accreta	01	0.79	00	0.00
MODS	04	3.17	21	25.00
Anaphylactic shock	01	0.79	00	0.00
HELLP	02	1.59	03	3.57

The majority of cases in MNM had complication of PPH (37.30%) followed by eclampsia (24.6%), shock (19.05%).

In MMR cases major complication was shock (38.1%) followed by respiratory failure (33.33%), MODS (25%) and eclampsia (19.05%).



**Fig 3:** Type of delay among MMR and MNM cases:

The type of delay shows that, the majority of cases in MNM and MMR had type 1 delay i.e. 58.73% and 66.67% respectively.

The dialysis was done in 21.43% and 20.24% cases of MNM and MMR respectively.

**Table 6:** Initial stabilizing interventions among MMR and MNM cases

	MNM cases*		MMR cases	
	Frequency	%	Frequency	%
<b>ICU Stay</b>				
Yes	109	86.51	83	98.81
No	17	13.49	01	1.19
Total	126	100	84	100
<b>Blood transfusion</b>				
Yes (<6 units)	04	3.17	02	2.38
Yes (>6 Units)	81	64.29	34	40.48
No	41	32.54	48	57.14
Total	126	100	84	100
<b>Vasopressor used</b>				
Yes	75	59.52	59	70.24
No	51	40.48	25	29.76
Total	126	100	84	100
<b>Intubation done</b>				
Yes	76	60.32	54	64.29
No	50	39.68	30	35.71
Total	126	100	84	100
<b>Dialysis done</b>				
Yes	27	21.43	17	20.24
No	99	78.57	67	79.76
Total	126	100	84	100

The majority of cases in MNM and MMR had ICU stay i.e. 86.51% and 98.81% respectively.

\* Massive transfusion protocol was followed in 2 MNM and 2 MMR cases i.e. transfusion of >4 units of PRCs in 1 hr when on going need is foreseeable.

The blood transfusion >6 units was done in majority of MNM cases (64.29%) while no blood transfusion was seen in majority of MMR cases. (57.14%).

The vasopressor was used in majority of MNM and MMR cases i.e. 59.92% and 70.24% respectively.

The intubation was done in majority of MNM and MMR cases i.e. 60.32% and 64.29% respectively.

**Table 7:** Obstetric Interventions done among MMR and MNM cases:

Interventions done	MNM cases* (n=126)		MMR cases (n=84)	
	Frequency	%	Frequency	%
B lynch sutures	09	7.14	02	2.38
Hysterectomy	15	11.90	05	5.95
Uterine Balloon tamponade	16	12.70	01	1.19
Laparotomy	05	3.97	00	0.00
Bladder repair	02	1.59	01	1.19
Uterine repair	02	1.59	00	0.00
Internal Iliac ligation	02	1.59	01	1.19
Antishock garment	01	0.79	00	0.00

The hysterectomy was major intervention done in 11.90% and 5.95% cases of MNM and MMR respectively.

Uterine Balloon tamponade was done in 12.7% and only 1% cases of MNM and MMR respectively.

The major outside intervention done in MNM cases was blood transfusion (18.25%) followed by Inj. MgSO<sub>4</sub> (15.08%)

In MMR cases major outside intervention done was intubation (11.90%) followed by blood transfusion (10.71%)

No interventions was done in 61.11% and 59.52% MNM and MMR cases respectively.

## Discussion

The quality of care is recognized as a crucial aspect in WHO global strategies for ending preventable maternal mortality. In WHO's vision, the quality of care is defined as "the extent to which health care services provided to individuals and patient populations improve desired health outcomes".

In the present study, the maternal near miss cases was 16.20 per 1000 live birth. Maternal mortality cases was 10.08 per thousand live birth. MNM: MM ratio was 1.5:1.

Similar findings were seen in studies done by Khushpreet Kaur *et al.* [14] and R P Reena *et al.* [16] where MNM was 29.1 and 9.27 per 1000 live birth.



**Table 8:** Comparison of MNM and MMR in present and other studies

Study	Setting	MNM per 1000 live birth	Maternal Mortality per 1000 live birth	MNM:MM ratio
Khushpreet Kaur <i>et al.</i> (2018) <sup>[14]</sup>	Patiala	29.1	14.9	1.5:1
R P Reena <i>et al.</i> (2018) <sup>[16]</sup>	Kerela	9.27	1.5	6.18:1
Present study (2021)	Nagpur	16.20	10.08	1.5:1

The majority of cases in MNM and MMR were presented during third trimester i.e. 73.81% and 52.38% respectively, while in puerperium 22.22% and 30.95% cases presented in MNM and MMR respectively.

Khushpreet Kaur *et al.* <sup>[14]</sup> conducted audit of maternal near miss and maternal death at tertiary care hospital observed majority of the women develop life threatening conditions in third trimester (>28 weeks gestational age) leading to 64.6% of MNM and 64.5% of MD cases. This finding was in accordance to present study. Fehmida Shaheen *et al.* <sup>[17]</sup> observed majority of cases were in third trimester i.e. 66.66% and 57.14% in MNM and Maternal deaths respectively.

The majority of cases in MNM and MMR had ANC care i.e. 76.19% and 71.43% respectively. The majority of cases in MNM and MMR had not booked ANC registration i.e. 87.30% and 96.43% respectively.

Sanju Kumari *et al.* <sup>[15]</sup> in a study on the incidence and cause of MNM cases and Maternal deaths in a tertiary care hospital observed unbooked cases as 91.2% and 93.95 in MNM and MD cases respectively. This was in accordance to present study.

The majority of cases in MNM and MMR had underlying disorder of hypertensive disorder of pregnancy i.e. 33.33% and 48.81% respectively. Anemia was 2<sup>nd</sup> most common underlying disorder in MNM (20.63%) and MMR (20.24%) cases. APH was observed

in 11.11% cases in MNM, and 3.57% in MM

Jyoti Ramesh Chandran *et al.* <sup>[13]</sup> in a study on Maternal near miss review from a tertiary care centre in South India observed hypertensive disorders comprised 46%, followed by haemorrhage 36%, sepsis 7% and other causes 10%. This finding was similar to present study.

These findings were similar to Anuradha *et al.* <sup>[18]</sup> {41% & 39%}; Gazala *et al.* <sup>[19]</sup> {44.3% & 34.4% }.

Like other studies hemorrhage and hypertensive disorders of pregnancy were the leading cause of MNM (45.7 and 24.2%, respectively) and maternal deaths (28.7 and 21.5%, respectively) in the setting too. Life-threatening obstetric hemorrhage was the commonest with a high prevalence ratio, but mortality index of this condition was low (19.7%) emphasizing a key role of timely management and blood transfusions in saving these women <sup>[11, 12]</sup>. Improving protocols and resources for combating PPH and focused strategies for managing APH and early pregnancy hemorrhage can further help in reducing morbidity due to this condition. Hypertensive disorder of pregnancy was the commonest cause of MNM and maternal death with a high mortality index. Early diagnosis of hypertension by proper antenatal care and timely management with Magnesium sulfate must be made universally available to prevent this condition <sup>[11]</sup>.

**Table 9:** Comparison of underlying disorder in present and other studies

Study	Setting	Hypertensive disorder of pregnancy MNM	Hypertensive disorder of pregnancy MM
Kumari S <i>et al.</i> <sup>[15]</sup> (2020)	New Delhi	53.8%	31.2%
Jyoti Ramesh Chandran <sup>[13]</sup> <i>et al.</i> (2016)	Kozhikode	46%	-
Anuradha <i>et al.</i> (2017) <sup>[18]</sup>	Visakhapatnam.	41%	44.3%
Present study (2021)	Nagpur	33.33%	48.81%

The majority of cases in MNM had complication of PPH (37.30%) followed by eclampsia (24.6%). In MMR cases major complication was shock (38.1%) followed by respiratory failure (33.33%), MODS (25%) and eclampsia (19.05%)

A detailed analysis of women in haemorrhage group reveals that most of the critically bleeding women were in the postpartum phase with PPH (39.3%). This observation is similar to other Indian studies by Roopa PS *et al.* <sup>[12]</sup> and an Australian study by Jayaratnam S *et al.* which have also observed PPH as the most common complication of MNM.

**Table 10:** Comparison of complications in present and other studies

Study	Setting	PPH in MNM	PPH in MM
Kumari S <i>et al.</i> (2020) <sup>[15]</sup>	New Delhi	61.8%	38.9%
Anuradha <i>et al.</i> <sup>[18]</sup>	Visakhapatnam.	41%	
Present study (2021)	Nagpur	37.3%	19.05%

This shows that most of the cases land in near miss to maternal death due to lack of intervention at primary and other centres.

Low resource countries like India carry the highest burden of maternal mortality and morbidity. Despite an increase in institutional deliveries, most pregnant women do not receive any antenatal care and are at risk for obstetric complications. NMA aids maternal mortality audit in identification of factors

contributing to high maternal morbidity and mortality.

In the present study, the large magnitude of MNM cases may be attributed to improper management of obstetric emergencies at referring hospitals, poor referral practices, inefficient transport system, limited availability of blood products, and poor access/utilization of health care services.

Poor documentation could have interfered with case identification and data collection leading to a clinical bias. Prospective surveillance of severe maternal morbidity will permit epidemiological surveillance and aid in generating interventions to reduce unnecessary maternal deaths.

Maternal mortality is among the worst performing health indicators in resource-poor settings despite increased global attention for its reduction. For those deaths occurring in health facilities, it is crucial to understand the processes of obstetric care in order to address any identified weakness or failure within the system.

### Conclusion

The present study concluded that hypertensive disorder of pregnancy and anaemia were the most common underlying disorder during pregnancy. Hence, services at the grass route level helps in early identification, treatment and proper referral of complicated pregnancies should be made available.

PPH was the most common complication, hence proper

insemination IEC activities of the primary health care staff about the complication among the antenatal mothers, their referral and further evaluation of the disorder should be given.

Further in this study, it can be concluded that apart from causes of MNM, reducing delay in referring such cases which further complicate outcome in ANC mother. This shows that most of the cases land in near miss to maternal death due to lack of intervention at primary and other centres.

Hence, from the present study it is concluded, that mothers may benefit by upgradation of the infrastructure of the peripheral health centres (like ensuring availability of blood banks, round the clock operation theatre facility, magnesium sulphate for seizure prophylaxis etc.) along with a network of referral linkage to ensure speedy and appropriate referrals.

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