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## Near miss events in pregnancy

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### Abstract

**Background:** Maternal Near Miss refers to a women who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy. The aim of this study is to analyze maternal near miss events in a local context and to identify gaps and contextualize corrective measures to be taken.

**Methods:** This prospective study was conducted in the Obstetrics and Gynaecology department of Raja Muthiah Medical College and Hospital, Chidambaram, Tamil Nadu during January 2020 to January 2022. The study population comprised of critically ill pregnant, laboring, post-partum and post abortal women admitted in OG ICU and were identified based on the WHO criteria for maternal near miss. The data was monitored by maintaining a review register.

**Results:** Most of the participants belonged to the age group of 19 to 24 years. 22.5% were G1 and in antenatal period. 31% were P1 and in postnatal period. Most participants were in their postnatal period. The cause for MNM in 19.5% participants was placenta previa, in 10.5% it was cardiomyopathy and in 7.5% it was COVID pneumonia and severe anaemia, respectively. Abruptio placenta, pulmonary edema and ruptured ectopic, each contributed 7% to causes of MNM.

**Conclusion:** The majority of cases in Raja Muthiah Medical College and Hospital were near miss on arrival, which attribute to failure of recognition of the seriousness of the condition. The study of MNM helps us to reduce the maternal morbidity. This study helps to observe the trends of maternal near miss event in our institution.

**Keywords:** Maternal near-miss events, prospective study, admission to ICU, maternal mortality

### Introduction

Maternal Near Miss refers to a women who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy. Maternal near-miss cases occur in larger numbers than maternal deaths hence they require comprehensive analysis when studied. However, there is scarcity of information on determinants of maternal near-miss cases. Over the last decade, there is gaining momentum to use Maternal Near Miss as an indicator of obstetric care.

As per the latest report of the Registrar General of India, Maternal Mortality Ratio of India has declined from 212 per 100,000 live births in the period 2007- 09 to 130 per 100,000 live births. Reducing maternal mortality and improving existing health care is a prime concern both for the country and worldwide. Both, Maternal mortality and maternal near miss are important indicators of maternal health. Maternal mortality, is often described as “the tip of the iceberg”, and maternal morbidity as the base. That is for each maternal death, there are several women who experienced a severe complication, nearly died but survived (near miss).

However, unlike maternal deaths, it often becomes difficult to define MNM cases. With passage of time and geographical boundaries, the definition of near miss has evolved and literature demonstrates different criteria being used to define near miss (disease specific, management specific, organ system dysfunction specific, WHO criteria etc.). Ministry of Health and Family Welfare (MOHFW), India, have recently laid down Operational guidelines to define and report MNM cases, adapted for and use in the country. Being a relatively new guideline, there is paucity of well-designed, prospective studies using it to Audit Near Miss.

Auditing of such cases are useful in several ways. More numbers of cases permit more simultaneous information. And also, lessons learned by managing these cases who survived are more useful than from these who died, because of the opportunity to interview the woman herself in near miss cases. Thus, near miss cases act as control for deaths and death to severe morbidity ratio and reflects the quality of maternal care.

WHO has crafted guidelines to reduce the maternal mortality ratio and to improve the quality of care in health system. Due to vigilant monitoring and skilful management there is drop in maternal death hence auditing of maternal deaths does not give many valuable information.

Reviewing of maternal morbidity is in trend now. Women who develop life threatening complications during pregnancy have the same pathological causative factors, in which some die and some survive by near escape, so evaluating those factors with the outcome, we can learn a lot about the care received by antenatal mothers.

#### Inclusion criteria

- Whenever any pregnant women comes to the health facility in a critical condition, she needs to be given urgent medical treatment, however prior to the discharge of such cases, there is need to identify whether the case falls under the category of maternal near miss.
- Major criteria have been mentioned in a review conducted by the WHO,
  1. **Disease:** Specific criteria- Post-partum hemorrhage, severe pre eclampsia, sepsis, rupture uterus, severe complications of abortion.
  2. **Organ system:** Based criteria cardiovascular dysfunction, Respiratory dysfunction, renal dysfunction.
  3. **Critical Interventions:** ICU care, Laparotomy including Hysterectomy, Interventional radiology, Use of blood products, dialysis.

According to WHO Near Miss identification criteria minimum one criteria from each clinical findings, investigations, intervention or one criteria like cardio pulmonary collapse is Maternal Near Miss case.

#### Exclusion criteria

- Patient with gestational hypertension under control.
- Patient with Atonic postpartum haemorrhage medically managed and needed blood transfusions less than 4 units.
- Patient refusal.

#### Study procedure

Thorough and detailed history of present and past medical illness was taken. Routine investigations including coagulation profile/PIH investigations / Cardiac Evaluation was done. General and systemic examination monitoring: ECG, Heart rate, BP, Pulse oximeter was done.

There are 2 formats in which data needed to be entered

1. Facility based Maternal Near Miss review form.
2. Maternal Near Miss Review register – details of column to be made in the register.

Reviewing of maternal morbidity is in trend now. Women who develop life threatening complications during pregnancy have the same pathological causative factors, in which some die and some survive by near escape, so evaluating those factors with the outcome, we can learn a lot about the care received by antenatal mothers.

#### Indicators for monitoring were

1. Total number of Maternal Near Miss cases in the reporting month.
2. Maternal Near Miss reviewed by medical officer.
3. Out of total maternal near miss cases indicated the number against following complications:

- a) PPH
  - b) Eclampsia
  - c) Anemia
  - d) Septic Abortion
  - e) Others
4. Types of gaps identified after review.
  5. Status of corrective action taken for the gaps identified.

Those who did not survive were not included in this study. However, a fleeting comparison with the MNMM and MD shall be made because the disorders and adverse events are the same in both categories Nearly 16 times as many cases of near miss maternal morbidity as mortality were identified in this study.

Patient characteristics including age, education level, parity, booking status, whether came directly or referred from outside, hospital where antenatal care received, whether any life threatening condition at arrival or became so later on, Gestational age at admission, h/o previous LSCS, adverse events, disorders, organ system dysfunction, surgical interventions, contributing factors, need for care in ICU setup, interventions needed in ICU, need for Blood and blood products, mode of delivery, Neonatal outcome, need for other specialty intensive care, duration of ICU stay and duration of hospital stay were studied.

It was decided to analyse whether MNMM was more common in teenage pregnancy or pregnancy > 35yrs. Hence age was included in the study.

It was decided to study whether patients came directly or were referred from other hospitals.

This would indicate the strengths of the referral system and any prehospital delay in seeking care whether they were near miss at arrival or became near miss after admission was analyzed. Near miss at arrival (within 3 to 6 hrs of admission) would reflect the effectiveness of the referral system.

Patient stable, with no disorder on admission but becoming near miss later on would reflect the quality of care in the institution.

Among the patients who were stable on admission, the presence of obstetric risk factors like previous LSCS, placenta previa would be noted to see whether these contributed to the stable cases becoming near misses later on.

The Netherlands study reported primi parity as a risk factor for developing MNMM. It was desired to see whether any such relationship could be noted in our institution, hence Parity was included in the study.

It was decided to study inter-pregnancy interval to see if Morbidity is usually associated with inter pregnancy interval <18 months.

It was desired to study whether regular antenatal care would contribute to preventing these MNMM situations. Hence, the booking status of these patients, whether they received AN care in Government or private hospitals were noted. In our Study, there was no indication to comment that government hospital AN care was found wanting. The quality of care in private and government hospitals were comparable. On the whole, regular AN check up may prevent near miss situations.

MNMM was not common in early pregnancy (defined as gestational age less than 28 completed weeks) but common in late pregnancy (defined as gestational age greater than 28 completed weeks) or postnatally would throw light on the disorders specific to the various trimesters of pregnancy. Hence it was decided to study this. The analysis of mode of delivery in this index pregnancy may reveal whether the pattern of mode of delivery in patients with MNMM is different from the normal patients.

Maternal care started as an offshoot of neonatal care. Based on fetal outcome.

**MNMM is divided into 3 phenotypes**

- **Class I MNMM:** maternal near miss with healthy infant.
- **Class II MNMM:** infant requiring NICU ADMISSION in MNMM cases.
- **Class III MNMM:** maternal near miss with stillbirth or infant death.

Fetal morbidity would include all infants who need NICU care and are discharged from NICU alive.

It was decided to study these phenotypes because it would indicate how many of the maternal near misses extended into fetal near misses. Gestational age, birth weight of live births were noted.

A WHO study in Latin American countries showed a reduced incidence of MNM, among women of no education, probably because of the low levels of caesarean section in them. Educational level was included in the study to see if any such association could be seen in this part of the world.

Each MNM patient was documented separately based on the ADVERSE EVENT as given by WHO eg: hypertension, hemorrhage, cardiac disease.

Each MNM patient was classified based on the DISORDERS as given by WHO (eg: eclampsia, severe pre eclampsia, PPH, placenta previa, placenta accreta, ectopic pregnancy). This would give an idea about the frequency and morbidity patterns prevalent in this area.

All emergency surgical interventions to control hemorrhage including B Lynch suturing, step wise devascularisation like – Bilateral uterine artery ligation, Bilateral internal iliac artery ligation, caesarean hysterectomy was documented in the study because this would indicate the skill level and quality of care required in the management of these patients.

Any underlying medical disorder in these patients such as anemia, diabetes, hypertension, hypothyroidism was included to study their possible contributory role in the near miss situation.

The reason for being classified as near miss, the indications for shifting to maternal ICU, the interventions done in ICU and the organ system which failed/ dysfunctioned was noted because this can give important information with regard to identifying skills and health care resources and needed to manage these cases effectively.

For example, if respiratory dysfunction, is identified as a common form of organ dysfunction, then Oxygen saturation monitors, arterial blood gas analysers etc., intubation skills and ventilator facilities needed to manage the MNM patients. Duration for which ICU care was needed and duration of hospital stay was documented.

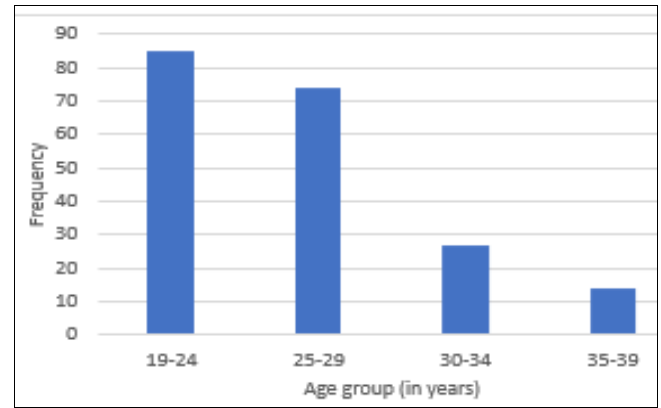
Prolonged hospital stay was defined as hospital stay lasting for more than 14 days.

The other specialties involved in the care of each patient, the number of patients shifted to specialty ICU for further care and the blood components needed were documented and analysed because it may reveal any felt needs that can be addressed.

The above data was analysed to calculate the near miss indices.

**Table 1:** Distribution according to age among the participants.

Variables	Frequency (n=200)	Percentage (%)	
Age group (in years)	19-24	85	42.5
	25-29	74	37
	30-34	27	13.5
	35-39	14	7

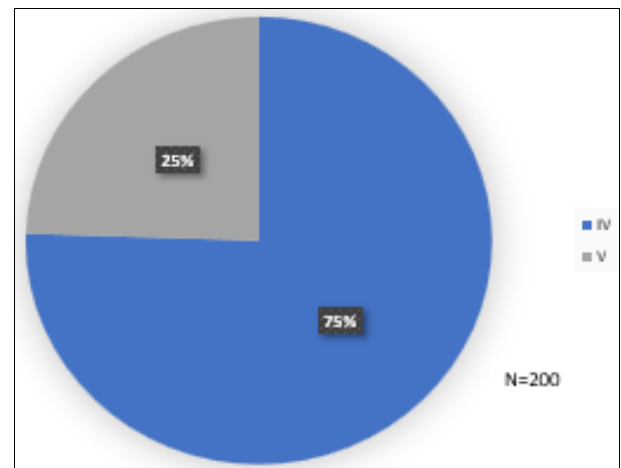


**Fig 1:** Bar chart showing distribution according to age among the participants

42.5% were in the age group 19 to 24 years followed by 37% in the age group 25 to 29 years. The age among the participants was 25.88±4.67 years

**Table 2:** Distribution according to socioeconomic status among the participants

Variables	Frequency (n=200)	Percentage (%)	
Socioeconomic status	IV	151	75.5
	V	49	24.5

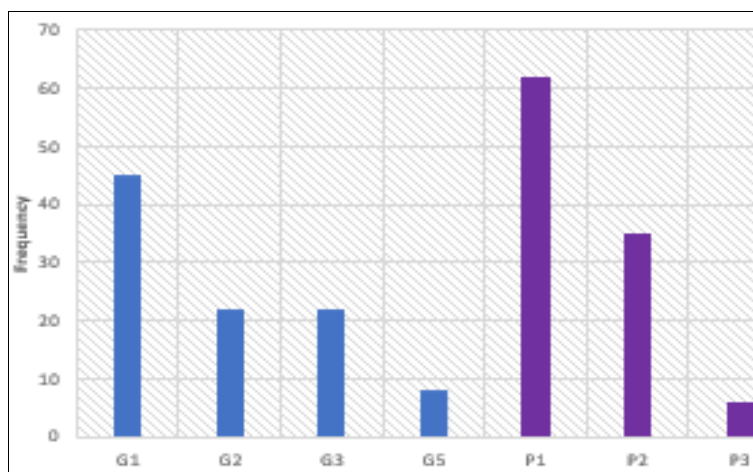


**Fig 2:** Pie chart showing distribution according to socioeconomic status among the participants

75.5% belonged to socioeconomic class IV and 24.5% belonged to socioeconomic

**Table 3:** Distribution according to obstetric code among the participants

Variables	Frequency (n=200)	Percentage (%)		
Obstetric code	ANP	G1	45	22.5
		G2	22	11
		G3	22	11
		G5	8	5
	PNP	P1	62	31
		P2	35	17.5
		P3	6	3

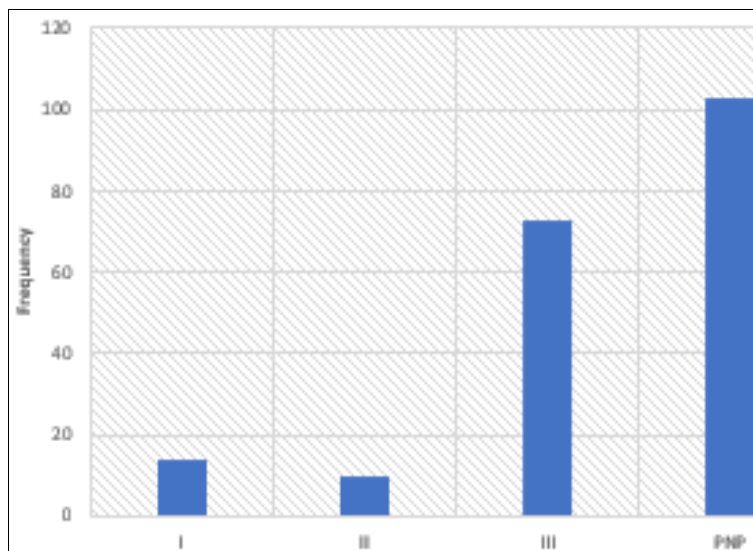


**Fig 3:** Bar chart showing distribution according to obstetric code among the participants

22.5% were G1 and in antenatal period. 31% were P1 and in postnatal period

**Table 4:** Distribution according to gestational age among the participants

Variables		Frequency (n=200)	Percentage (%)
Gestational age	I	14	7
	II	10	5
	III	73	36.5
	PNP	103	51.5



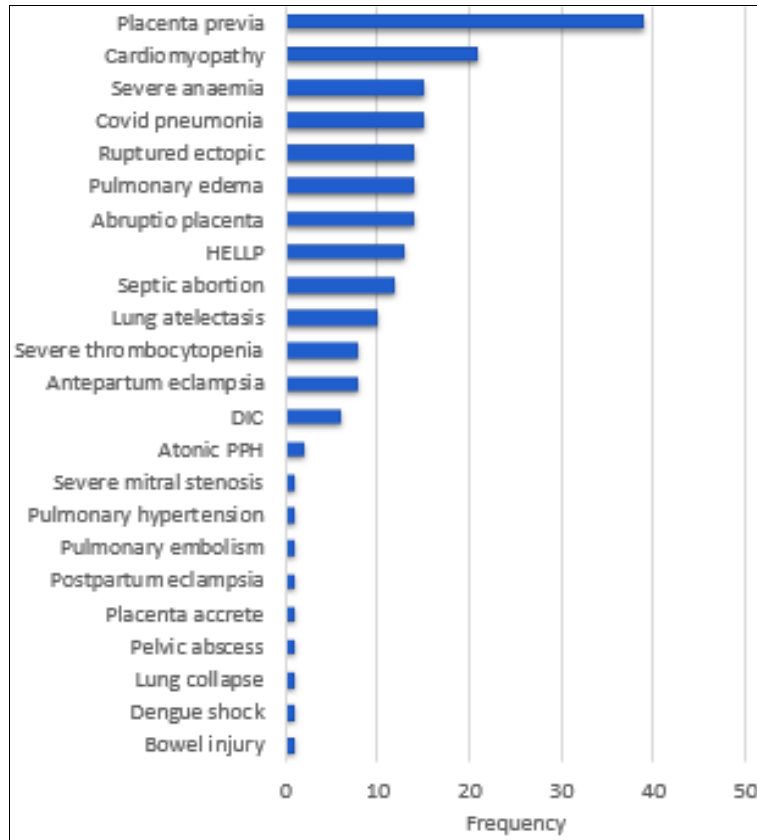
**Fig 4:** Bar chart showing distribution according to gestational age among the participants

7% Participants were in I trimester, 5% were in II trimester and 36.5% were in trimester III. 51.5% were in postnatal period

**Table 5:** Distribution according to causes of maternal near miss among the participants

Variables	Frequency (n=200)	Percentage (%)	
Causes	Placenta previa	39	19.5
	Cardiomyopathy	21	10.5
	Covid pneumonia	15	7.5
	Severe anaemia	15	7.5
	Abruptio placenta	14	7.0
	Pulmonary edema	14	7.0
	Ruptured ectopic	14	7.0
	HELLP	13	6.5
	Septic abortion	12	6.0
	Lung atelectasis	10	5.0
	Antepartum eclampsia	8	4.0
	Seven thrombocytopenia	8	4.0

DIC	6	3.0
Atonic PPH	2	1.0
Bowel injury.	1	0.5
Dengue shock	1	0.5
Lung collapse	1	0.5
Pelvic abscess	1	0.5
Placenta accrete	1	0.5
Postpartum eclampsia	1	0.5
Pulmonary embolism	1	0.5
Pulmonary hypertension	1	0.5
Severe mitral stenosis	1	0.5



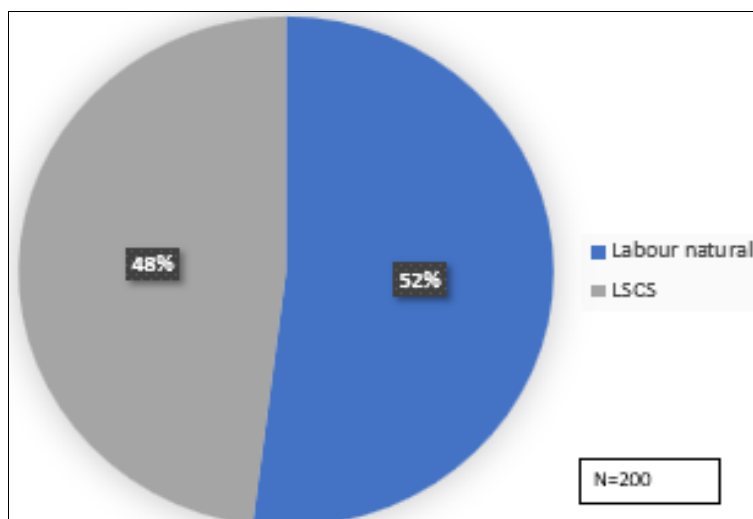
**Fig 5:** Bar chart showing distribution according to cause of MNM

The cause for MNM in 19.5% participants was placenta previa, in 10.5% it was cardiomyopathy and in 7.5% it was COVID pneumonia and severe anaemia, respectively. Abruptio placenta,

pulmonary edema and ruptured, respectively, each contributed 7% to cause of MNM.

**Table 6:** Distribution according to mode of delivery

Variables	Frequency (n=200)	Percentage (%)
Mode of delivery	Labour natural	52
	LSCS	58



**Fig 6:** Pie chart showing distribution according to mode of delivery

52% delivered through natural labour and 48% through LSCS

All participants were found to have normal outcome

**Table 7:** Distribution of cause, of MNM with regard to SES

Cause	SES			
	IV		V	
	N	%	N	%
Placenta previa	28	71.8	11	28.2
Cardiomyopathy	15	71.4	6	28.6
Covid pneumonia	13	86.7	2	13.3
Severe anaemia	12	80	3	20
Abntptio placenta	10	71.4	4	28.6
Pulmonary edema	10	71.4	4	28.6
Ruptured eaopic	9	643	5	35.7
HELLP	10	76.9	3	23.1
Septic abortion	S	66.7	4	33.3
Lung atelectasis	10	100	0	0
Antepamun eclampsia	7	87.5	1	12.5
Severe thrombocytopenia	4	50	4	50
DIC	6	100	0	0
Atonic PPH	2	100	0	0
Bowel injury	I	100	0	0
Dengue shock	1	100	0	0
Lung collapse	1	100	0	0
Pelvic abscess	0	0	1	100
Placenta accrete	0	0	1	100
Postpartum eclampsia	1	100	0	0
Pulmonary embolism	1	100	0	0
Pulmonary hypertension	1	100	0	0
Severe mitral stenosis	1	100	0	0

X2-21.07 P value- 0.515

**Table 8:** Distribution of causes of MNM with regard to obstetric code

Causes	Obstetric code							
	ANP				PNP			
	GI		>G1		P1		>PI	
	N	%	N	96	Z	%	Z	96
Placenta previa	8	20.5	10	25.6	10	25.6	11	28.2
Cardiomyopathy	4	19	7	33.3	6	28.6	4	19
Covid pneumonia	3	20	4	26.7	7	46.7	1	6.7
Severe anaemia	1	6.7	9	60	4	26.7	1	6.
Abruptio placenta	6	42.9	3	21.4	3	21.4	2	14.3
Pulmonary edema	5	35.7	5	35.7	3	21.4	1	7.1
Ruptured ectopic	3	21.4	0	0	8	57.1	3	21.4
Hellp	3	23.1	4	30.8	4	30.8	2	15.4
Septic abortion	1	8.3	3	25	5	41.7	3	25
Lung atelectasis	2	20	1	10	2	20	5	50

Antepartum eclampsia	2	25	2	25	3	37.5	1	12.5
Severe thrombocytopenia	1	12.5	2	25	4	50	1	12.5
DIC	5	83.3	0	0	0	0	1	16.7
Atonic PPH	0	0	0	0	1	50	1	50
Bowel injury	0	0	1	100	0	0	0	0
Dengue shock	0	0	0	0	0	0	1	100
Ling collapse	0	0	0	0	0	0	1	100
Pelvic abscess	0	0	0	0	1	100	0	0
Placenta accrete	0	0	0	0	1	100	0	0
Postpartum eclampsia	0	0	0	0	0	0	1	100
Pulmonary embolism	0	0	1	100	0	0	0	0
Pulmonary hypertension	1	100	0	0	0	0	0	0
Severe mitral stenosis	0	0	0	0	0	0	1	100

$\chi^2$ - 81.93 P value - 0.089

**Table 9:** Distribution of causes of NINNI with regard to gestational age

Causes	Gestational age							
	I		II		III		PNP	
	N	%	N	%	N	%	N	%
Placenta previa	1	2.6	3	7.7	14	35.9	21	53.8
Cardiomyopathy	2	9.5	0	0	9	42.9	10	47.6
Covid pneumonia	1	6.7	2	13.3	4	26.7	8	53.3
Severe anaemia	1	6.7	1	6.7	8	53.3	5	33.3
Abruptio placenta	2	14.3	2	14.3	5	35.7	5	35.7
Pulmonary edema	0	0	0	0	10	71.4	4	28.6
Ruptured ectopic	2	14.3	0	0	1	7.1	11	78.6
Hellp	1	7.7	2	15.4	4	30.8	6	46.2
Septic abortion	1	8.3	0	0	3	25	8	66.7
Lung atelectasis	0	0	0	0	3	30	7	70
antepartum eclampsia	1	12.5	0	0	3	37.5	4	50
Seven thrombocytopenia	0	0	0	0	3	37.5	5	62.5
DIC	1	16.7	0	0	4	66.7	1	16.7
Atonic PPH	0	0	0	0	0	0	2	100
Bowel injury	0	0	0	0	1	100	0	0
Dengue shock	0	0	0	0	0	0	1	100
Lung collapse	0	0	0	0	0	0	1	100
Pehic abscess	0	0	0	0	0	0	1	100
Placenta accrete	0	0	0	0	0	0	1	100
Postpartum eclampsia	0	0	0	0	0	0	1	100
Pulmonary embolism	1	100	0	0	0	0	0	0
Pulmonary hypertension	0	0	0	0	1	100	0	0
Severe mitral stenosis	0	0	0	0	0	0	1	100

$\chi^2$  - 63.74 P value - 0.556

## Discussion

- 42.5% were in the age group 19 to 24 years followed by 37% in the age group 25 to 29 years. The mean age among the participants was 25.88±4.67 years.
- 75.5% belonged to socioeconomic class IV and 24.5% belonged to socioeconomic class V.
- 22.5% were G1 and in antenatal period. 31% were P1 and in postnatal period.
- 7% participants were in I trimester, 5% were in II trimester and 36.5% were in trimester III. 51.5% were in postnatal period.
- The cause for MNM in 19.5% participants was placenta previa, in 10.5% it was cardiomyopathy and in 7.5% it was COVID pneumonia and severe anaemia, respectively. Abruptio placenta, pulmonary edema and ruptured ectopic, each contributed 7% to causes of MNM.
- All participants were found to have normal outcome.
- Among the participants with placenta previa, 41% were in the age group 25 to 29 years followed by 38.5% in the age group 19 to 24 years. Among those with cardiomyopathy, 47.6% were in the age group 19 to 24 years followed by 23.8% in the age group 25 to 29 years.

- Among the participants with placenta previa, 71.8% belonged to SES IV. Among those with cardiomyopathy, 71.4% were SES IV. In COVID pneumonia, the SES IV contributed to 86.7%.

## Conclusion

- The majority of cases in RMMCH were near miss on arrival, which attribute to failure of recognition of the seriousness of the condition.
- The leading causes of MNM are Placenta previa, Cardiomegaly, COVID Pneumonia, Severe anemia.
- The study of MNM helps us to reduce the maternal morbidity.
- The study thus helps to observe the trends of maternal near miss event in our institution.

## Conflict of Interest

Not available

## Financial Support

Not available

## References

1. Women with Life-Threatening Conditions (WLTC) refers to all women who either qualified as maternal near-miss cases or those who died (i.e., women presenting a severe maternal outcome). It is the sum of maternal near-miss and maternal deaths (WLTC=MNM+MD).
2. Severe Maternal Outcome Ratio (sMOR) refers to the number of women with life-threatening conditions (MNM+MD) per 1000 live births (LB). {SMOR=(MNM+MD)/LB}. MNM Ratio (MNM) refers to the number of maternal near miss cases per 1000 live births (MNM=MD/LB). Maternal Near-Miss Mortality Ratio (MNM: MD) refers to the ratio between MNM cases and Maternal Deaths (MD).
3. Mortality Index (MI) refers to the number of maternal deaths divided by the number of women with life-threatening conditions expressed as a percentage [MI=MD/(MNM+MD)].
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