

## MATERNAL NEAR MISS EVENTS: A PROSPECTIVE OBSERVATIONAL STUDY IN A TERTIARY CARE CENTRE

**Dr. C. Vijaya Lakshmi<sup>1\*</sup>, Dr.M.Mallika<sup>2</sup>, Dr.Shabana Penukonda<sup>3</sup>**

<sup>1\*</sup> Associate Professor, Department of Obstetrics and Gynecology, Government General Hospital, Anantapuram, Andhra Pradesh, India.

<sup>2</sup> Assistant Professor, Department of Obstetrics and Gynecology, Government General Hospital, Anantapuram, Andhra Pradesh, India.

<sup>3</sup> Assistant Professor, Department of Obstetrics and Gynecology, Government General Hospital, Anantapuram, Andhra Pradesh, India.

**Corresponding Author: Dr. C. Vijaya Lakshmi**

**Associate Professor, Department of Obstetrics and Gynecology, Government General Hospital, Anantapuram, Andhra Pradesh, India.**

**E Mail: Pallacvl@gmail.com**

### Abstract

**Introduction:** Maternal mortality ratio (MMR) is an indicator of maternal health and obstetric care. Globally there has been decline in MMR, in India too this is declining steadily due to the additional efforts and resources put under NHM for improving health care. There is a need to further accelerate this decline for achieving our national and international goals and targets under them. As per the Sample Registration System (SRS) report by Registrar General of India (RGI) for the last three years, Maternal Mortality Ratio (MMR) of India has reduced from 130 per 100,000 live births in SRS 2014-16 to 122 in SRS 2015-17 and to 113 per 100,000 live births in SRS 2016-18, 99 per 100 000 in 2020.

**Materials and Methods:** The study population will be selected from women admitting in labour room and gynecological emergency at Government Medical College, Anantapuram. After applying inclusion and exclusion criteria, Data will be collected which include the maternal age, socio-economic factors, booking status, obstetric history, clinical insult responsible for MNM, and complications that prompted ICU admission and required intervention, length of hospital stay. Women having more than one clinical insult will be included in the group of primary etiology. e.g., eclampsia with abruption/ DIC/ hemorrhage was included in eclampsia.

**Results:** A Prospective Observational study of Maternal Near Miss (MNM) in the Department of Obstetrics and Gynecology at Govt Medical College and Govt General Hospital, Ananthapuramu was done between November 2020 To October 2021 (1 year). The total deliveries during this period were 10730 and live births were 10200. There were 100 cases of MNM, and 14 maternal deaths during the same period. Present study had 100 near miss cases. Among the causes of near miss events, hemorrhage was the leading cause with 53%, and hypertensive disorders were next at 17%. The other causes included respiratory disorders (9%), others (8%), sepsis (6%), cardiac (5%), renal (2%). Hypertensive disorders of pregnancy, Severe Hemorrhage, Sepsis, Respiratory were the leading causes of maternal mortality at our setup (3 deaths each), followed by cardiac (2 deaths). The

overall mortality index for our set-up was 12.2%.

**Conclusion:** MNM ratio in our study was 9.8/ 1000 live births, comparable with developing countries Hypertensive disorder (50%) is the leading cause of maternal mortality in our study. All cases were un-booked and referred in critical stage. This is due to lack of knowledge and awareness about warning signs of complications, poor antenatal care, and lack of skilled personnel and preparedness for emergencies. There is need for improvement in antenatal care and bring awareness regarding complications and early admission if necessary and need to improve knowledge about the circumstances by conducting simulation in obstetric emergencies. MNM to Mortality ratio (MNM: MD) ratio was 7.1:1.

**Key Words:** Maternal mortality ratio, Hypertensive disorders of pregnancy, Severe Hemorrhage, Sepsis.

## INTRODUCTION

Maternal mortality ratio (MMR) is an indicator of maternal health and obstetric care. Globally there has been decline in MMR, in India too this is declining steadily due to the additional efforts and resources put under NHM for improving health care. There is a need to further accelerate this decline for achieving our national and international goals and targets under them. As per the Sample Registration System (SRS) report by Registrar General of India (RGI) for the last three years, Maternal Mortality Ratio (MMR) of India has reduced from 130 per 100,000 live births in SRS 2014-16 to 122 in SRS 2015-17 and to 113 per 100,000 live births in SRS 2016- 18 <sup>1</sup> 99 per 100 000 in 2020.<sup>2</sup>

**Maternal near miss:** A Woman Who Survives Life Threatening Conditions during Pregnancy, Abortion, and Childbirth or within 42 Days of Pregnancy Termination, irrespective of Receiving Emergency Medical/Surgical Interventions, is called Maternal Near Miss (MNM).<sup>3</sup> Near- miss cases share many characteristics with maternal death and can directly inform on obstacles that had to overcome after the onset of an acute complication. Corrective actions for identified problems can be taken to reduce mortality and long-term morbidity. Conceptually, MNM has epidemiological, clinical, and pathophysiological characteristics that are similar to maternal death cases, which contributed to a better understanding of the chain of events that determine the outcome, allowing the evaluation and identification of its determinants in different regions or countries.

There is continued need to identify near miss cases to assess the quality of Health care. Analyzing near miss cases can strengthen the understanding of the disease progression that ultimately kills women and there by empower us to prevent maternal death. Woman can experience sudden and unexpected complications during pregnancy, childbirth and just after delivery. Morbidity during pregnancy represents part of a continuum between extremes of good health and death. On this continuum a pregnancy may be thought of as being uncomplicated, complicated, severely complicated or life threatening. From these conditions the woman may recover, she may be temporarily or permanently disabled or she may die. Death is the last stop on a continuum of adverse

events. Survival of a pregnant woman is dependent on the disease, her basic health, the health care facilities and the personnel of the health care.<sup>4</sup> Sequence of events: Normal pregnancy Morbidity Severe - morbidity Near Miss (MNM) Death. Maternal mortality is the tip of iceberg, there is a large base of the maternal near miss, the identification and analysis of which will tell the true story of the complications.

### **AIMS AND OBJECTIVES**

1. To analyse the causes of Maternal Near Miss events.
2. To assess Maternal Near-Miss Ratio (MNMR).
3. To document Maternal Near-Miss mortality Ratio (MNMMR) during the same period.
4. To identify gaps and reasons for severe maternal morbidities which could also lead to maternal deaths so that corrective actions to fill such gaps can be taken for improving service delivery.

### **MATERIALS AND METHODS**

**Study Population:** Women admitting in labour room and obstetric emergency at Government Medical College, Anantapuram.

**Place of Study and Source of Patients:** Government Medical College, Anantapuram.

**Method of Data Collection:** The study population will be selected from women admitting in labour room and gynecological emergency at Government Medical College, Anantapuram. After applying inclusion and exclusion criteria, Data will be collected which include the maternal age, socio-economic factors, booking status, obstetric history, clinical insult responsible for MNM, and complications that prompted ICU admission and required intervention, length of hospital stay. Women having more than one clinical insult will be included in the group of primary etiology. e.g., eclampsia with abruption/ DIC/ hemorrhage was included in eclampsia. Data will be collected by frequent visit to ICU/CCU, from registers in operation theaters and from medical records on a pre-defined performa and the results expressed as numbers and percentages.

### **Inclusion Criteria:**

#### **Disease - specific criteria**

- Patient with Postpartum hemorrhage
- Severe pre-eclampsia or eclampsia
- Sepsis
- Rupture uterus
- Severe complications of abortion

### **Organ system based criteria**

- Patient with Cardiovascular dysfunction
- Respiratory dysfunction
- Renal dysfunction
- Coagulation/hematological dysfunction
- Hepatic dysfunction
- Neurological dysfunction
- Uterine dysfunction

### **Critical interventions**

- Admission to intensive care
- laparotomy (includes hysterectomy for uterine rupture and excludes uncomplicated cesarean deliveries) interventional radiology
- Use of massive blood and blood products.

Women who are pregnant, in labour, or who delivered or aborted up to 42 days ago arriving at the facility with any of the listed conditions or those who develop any of those conditions during their stay at the health-care facility would be eligible. The eligibility is not restricted by gestational age at which complications occurred (i.e. women having abortions or ectopic pregnancies and presenting with any of the inclusion criteria are eligible).

### **Exclusion Criteria:**

1. Pregnancy conditions which don't match the inclusion criteria
2. Women who develop those conditions unrelated to pregnancy (i.e. not during pregnancy or 42 days after termination of pregnancy)
3. Non-obstetric morbidity: Morbidity resulting from causes not related to pregnancy or its complication or management, eg: hepatic failure as a result of cirrhosis, malignancies, cancer breast, liver rupture.
4. Morbidity from accidental or incidental causes no way related to pregnancy, eg: Morbidity from automobile accident/suicide.

**Sample Size:** As there were no similar previous studies done in our institute, the prevalence of Maternal Near Miss for this study was assumed to be 50%, and the estimated sample size was calculated to be 100.

**Duration of study:** 1 year Study

**Design:** Prospective Observational Study.

## **RESULTS**

A Prospective Observational study of Maternal Near Miss (MNM) in the Department of Obstetrics and Gynecology at Govt Medical College and Govt General Hospital, Ananthapuramu was done

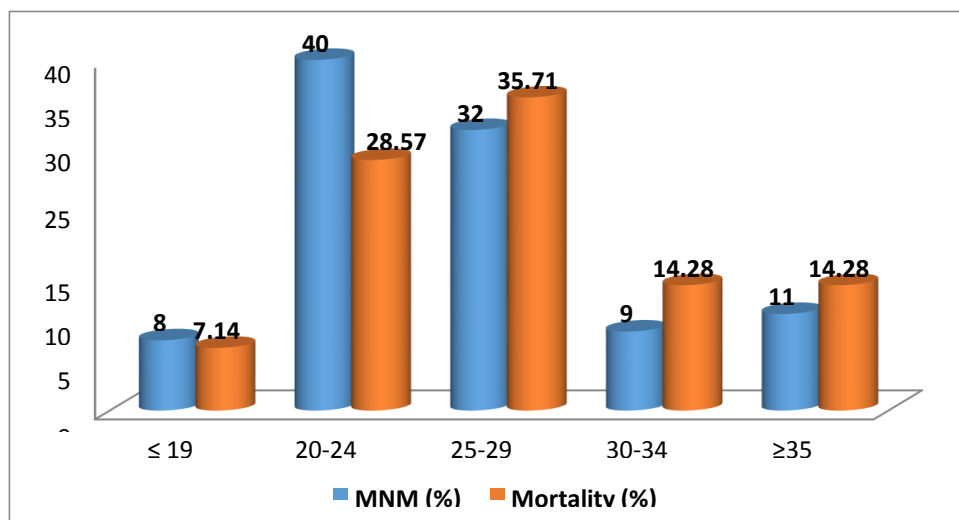
between November 2020 To October 2021 (1 year). The total deliveries during this period were 10730 and live births were 10200. There were 100 cases of MNM, and 14 maternal deaths during the same period. Data were collected as per study proforma and statistical analysis was performed. Results are presented as frequencies, percentages and descriptive statistics.

**Table 1: Age distribution**

| Age Group (years) | MNM          |     | Mortality    |       |
|-------------------|--------------|-----|--------------|-------|
|                   | No. of cases | %   | No. of cases | %     |
| ≤ 19              | 8            | 8   | 01           | 7.14  |
| 20-24             | 40           | 40  | 04           | 28.57 |
| 25-29             | 32           | 32  | 05           | 35.71 |
| 30-34             | 9            | 9   | 02           | 14.28 |
| ≥35               | 11           | 11  | 02           | 14.28 |
| <b>Total</b>      | <b>100</b>   | 100 | <b>14</b>    | 100   |

Table 1 shows that majority, 72% of MNM cases were in the age group of 20- 29years, whereas 64.28% of mortality cases were in the age group of 20-29 yrs years.

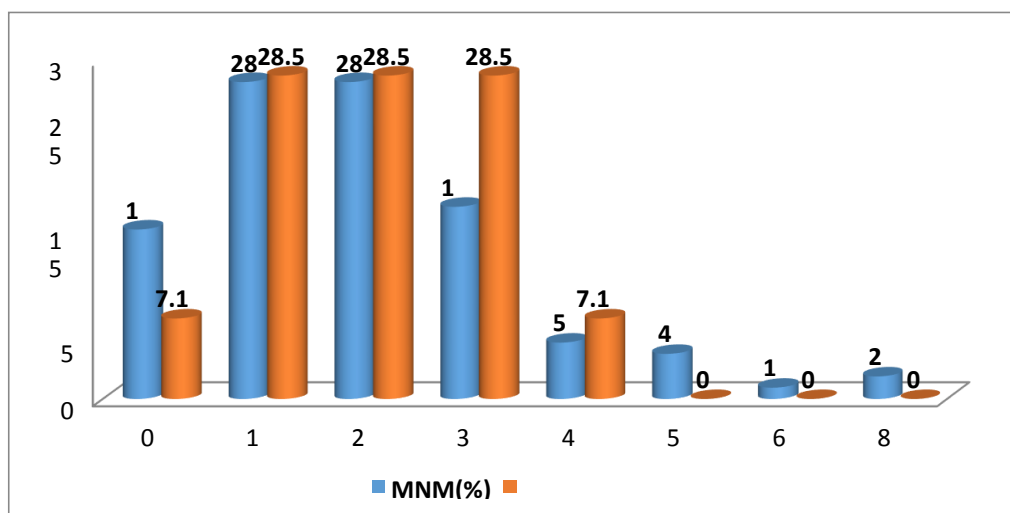
**Fig 1: Age distribution**



**Table 3: Gravida**

| Gravida | MNM          |    | Mortality    |       |
|---------|--------------|----|--------------|-------|
|         | No. of cases | %  | No. of cases | %     |
| 0       | 15           | 15 | 01           | 7.14  |
| 1       | 28           | 28 | 04           | 28.57 |

|   |    |    |    |       |
|---|----|----|----|-------|
| 2 | 28 | 28 | 04 | 28.57 |
| 3 | 17 | 17 | 04 | 28.57 |
| 4 | 05 | 05 | 01 | 7.14  |
| 5 | 04 | 04 | 0  | 0     |
| 6 | 01 | 01 | 0  | 0     |
| 8 | 02 | 02 | 0  | 0     |



**Fig. 2: Gravida distribution**

From the above Table 3, majority were primi and second gravida, 28% among MNM and in mortality group primi, second and third gravida are equally affected.

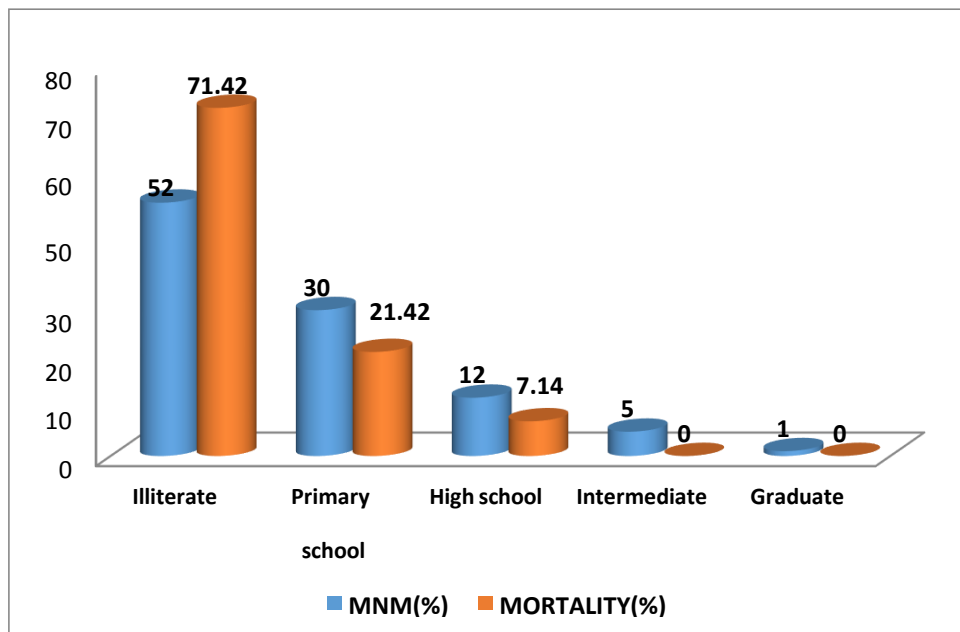
**Table 4: Parity**

| Parity       | MNM          |    | Mortality    |       |
|--------------|--------------|----|--------------|-------|
|              | No. of cases | %  | No. of cases | %     |
| Nullipara    | 32           | 32 | 05           | 35.71 |
| 1            | 45           | 45 | 06           | 57.14 |
| 2            | 16           | 16 | 02           | 14.28 |
| 3            | 02           | 02 | 01           | 7.14  |
| 4            | 04           | 04 | 0            | 0     |
| 6            | 01           | 01 | 0            | 0     |
| <b>Total</b> | 100          |    | 14           |       |

In the above table 4, Majority of the MNM cases were para 1 of about 45%. Where as in mortality group majority were para 1 of about 57.14%.

**Table 5: Educational status**

| Education   | MNM         |    | Mortality   |       |
|---|-------------|----|-------------|-------|
|   | No. ofcases | %  | No. ofcases | %     |
| Illiterate  | 52          | 52 | 10          | 71.42 |
| Primary school (1 <sup>st</sup> to 5 <sup>th</sup> std) | 30          | 30 | 03          | 21.42 |
| High school (6 <sup>th</sup> to 12 <sup>th</sup> std)   | 12          | 12 | 01          | 7.14  |
| Intermediate  | 05          | 05 | 0           | 0     |
| Graduate  | 01          | 01 | 0           | 0     |
| <b>Total</b>  | <b>100</b>  |    | <b>14</b>   |       |



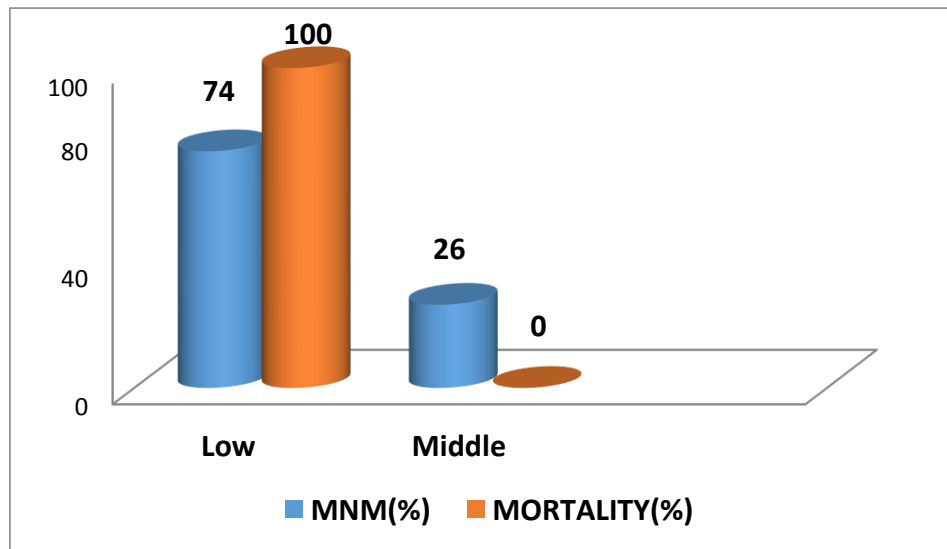
**Fig 4: Educational status**

The above table 4 shows that majority were illiterate, 52% and 71.42% respectively among MNM and mortality groups.

**Table 6: Socioeconomic status**

| SES        | MNM         |    | Mortality   |     |
|------------|-------------|----|-------------|-----|
|            | No. ofcases | %  | No. ofcases | %   |
| <b>Low</b> | 74          | 74 | 14          | 100 |

|               |     |    |   |   |
|---------------|-----|----|---|---|
| <b>Middle</b> | 26  | 26 | 0 | 0 |
| <b>Total</b>  | 100 | 14 |   |   |



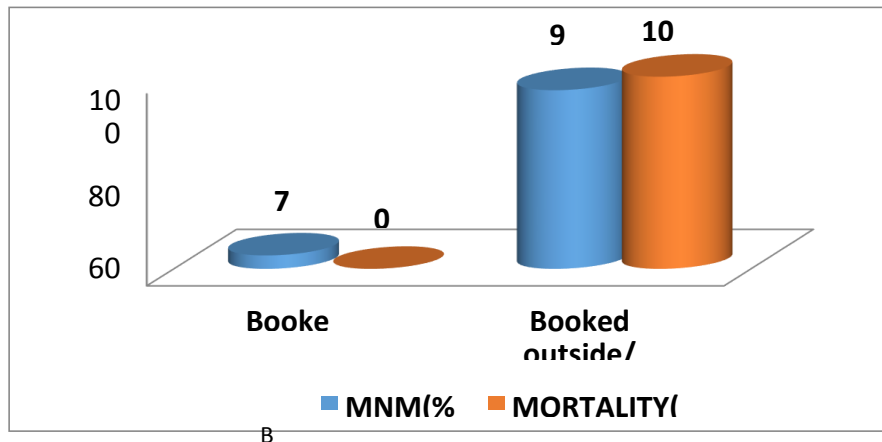
**Fig 5: Socioeconomic status**

In the above table 6, Majority belonged to the low socioeconomic status among both MNM and Mortality groups, 74% and 100% respectively.

**Table 7: ANC registration**

| <b>Booked/Unbooked</b>             | <b>MNM</b>          |          | <b>Mortality</b>    |          |
|------------------------------------|---------------------|----------|---------------------|----------|
|                                    | <b>No. of cases</b> | <b>%</b> | <b>No. of cases</b> | <b>%</b> |
| <b>Booked</b>                      | 07                  | 07       | Nil                 | -        |
| <b>Bookedoutside/<br/>Unbooked</b> | 93                  | 93       | 14                  | 100      |
| <b>Total</b>                       | <b>100</b>          |          | <b>14</b>           |          |





**Fig 6: ANC registration**

Above table 6, implies that only 7% of MNM cases were booked at our hospital. The remaining 93% were Booked outside/ un-booked. In mortality group, all were booked outside/un-booked.

**Table 8: Gestational age at the time of admission**

| Gestational Age (weeks) | MNM          |    | Mortality    |       |
|-------------------------|--------------|----|--------------|-------|
|                         | No. of cases | %  | No. of cases | %     |
| <13                     | 21           | 21 | 01           | 7.14  |
| 13 to 28                | 10           | 10 | 05           | 35.71 |
| 28 to 42                | 52           | 52 | 07           | 50    |
| Post delivery           | 17           | 17 | 01           | 7.14  |
| <b>Total</b>            | <b>100</b>   |    | <b>14</b>    |       |

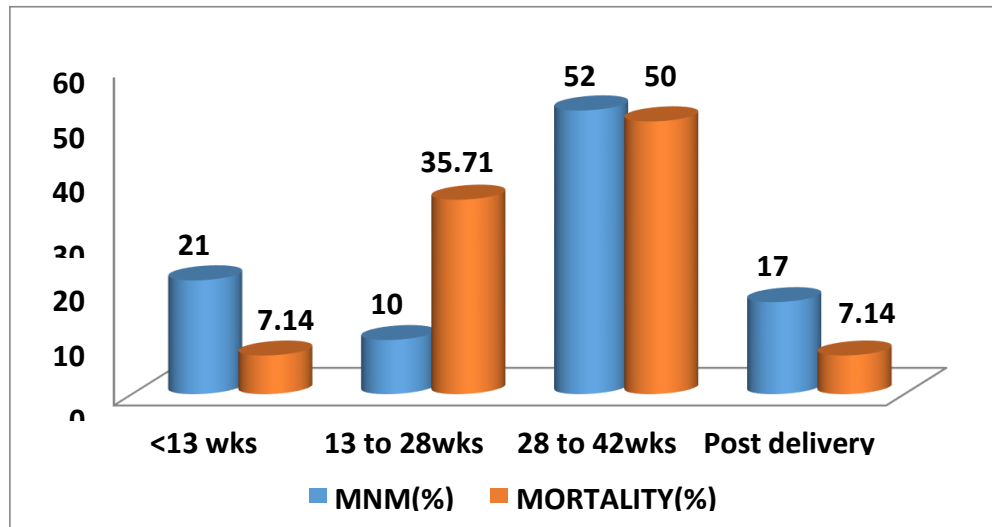


Fig 7: Gestational Age at the time of admission

Above table shows that, majority, 52% and 50% respectively, among MNM and mortality groups were of third trimester (28 to 42 weeks)

Table 9: Descriptive data

|  | MNM           | Mortality    |
|--|---------------|--------------|
|  | n             | N            |
|  | 100           | 14           |
| <b>Mean ± SD of</b>                            |               |              |
| <b>Age in years</b>                            | 25.77± 5.184  | 27.35±4.202  |
| <b>Gravida</b>                                 | 1.97± 1.4     | 2± 1.071     |
| <b>Parity</b>                                  | 0.76 ± 0.904  | 1.64 ± 0.929 |
| <b>GA in weeks</b>                             | 27.59± 10.587 | 27.28± 9.099 |
| <b>Average duration of hospital stay(days)</b> | 9± 5.989      | -            |
| <b>Average duration of ICU stay(days)</b>      | 2.81± 1.463   | -            |

The above table 9, shows the descriptive data. During the study period, MNM cases were 100 and mortality were 14. They were similar in respect to age, parity, gestational age.

In the MNM group, the mean (SD) duration of hospital stay was 9± 5.9 days, and ranged from 1 days to 35 days. The mean (SD) duration of ICU stay was 2.81± 1.4 days, and ranged from 1 day to 9 days.

Table 10: Type of admission

|  | MNM | Mortality |
|--|-----|-----------|
|--|-----|-----------|

| Type of Admission   | No. of cases | %  | No. of Cases | %     |
|---|--------------|----|--------------|-------|
| <b>A</b> (Patient admitted in hospital with severe illness) | 73           | 73 | 10           | 71.42 |
| <b>B</b> Admitted with no disorder, became near miss)       | 10           | 10 | 02           | 14.28 |
| <b>C</b> (Admitted with disorder, became near miss)         | 17           | 17 | 02           | 14.28 |
| <b>Total</b>  | 100          |    | 14           |       |

The above table 9 shows that, majority 73% in the MNM group were admitted with severe illness. 10% patients were admitted without any disorder and later became near-miss. And 17% admitted with disorders and became near miss. In mortality group 71.42% were admitted with severe illness, 14.28% patients were admitted without any disorder and 14.28% admitted with disorders.

**Table 11: Underlying disorder at the time of admission**

| Underlying disorder                       | MNM          |    | Mortality    |      |
|---|--------------|----|--------------|------|
|   | No. of cases | %  | No. of cases | %    |
| <b>Hemorrhage</b>                         | 53           | 53 | 04           | 28.5 |
| <b>Hypertensive disorder of pregnancy</b> | 17           | 17 | 07           | 50   |
| <b>Medical disorders</b>                  | 36           | 36 | 09           | 64.2 |
| <b>Surgical causes</b>                    | -            | -  | -            | -    |

Above table 10 shows that, Among MNM group, 53% of MNM cases had hemorrhage and 36% had severe medical disorders, 17% had Hypertensive disorder of pregnancy. In mortality group, 64.2% cases had severe medical disorders at the time of admission.

**Table 12: Underlying disorder-Hemorrhage**

| Haemorrhage            | MNM          |    | Mortality    |       |
|------------------------|--------------|----|--------------|-------|
|                        | No. of cases | %  | No. of Cases | %     |
|                        | 53           | 53 | 04           | 28.56 |
| <b>Early pregnancy</b> | 22           | 22 |              |       |
| <b>Ectopic</b>         | 18           | 18 | -            | -     |
| <b>Abortion</b>        | 04           | 4  | -            | -     |

|  |    |    |    |       |
|--|----|----|----|-------|
| <b>Late pregnancy<br/>Antepartum<br/>Haemorrhage</b> | 14 | 14 | 02 | 14.28 |
| <b>&gt;Placenta previa</b>                           | 08 | 8  | 01 | 7.14  |
| <b>&gt;Placenta abruption</b>                        | 06 | 6  | 01 | 7.14  |
| <b>Postpartum haemorrhage</b>                        | 17 | 17 | 02 | 14.28 |

majority of the MNM cases were in early trimester due to ectopic pregnancy ie., 18% followed by PPH ie., 17% and in mortality group APH & PPH constituting 14.28%.

**Table 13: Underlying disorder: Hypertensive disorder of pregnancy**

| <b>Hypertensive disorder of pregnancy</b> | <b>MNM</b>         |          | <b>Mortality</b>   |          |
|---|--------------------|----------|--------------------|----------|
|   | <b>No of cases</b> | <b>%</b> | <b>No of cases</b> | <b>%</b> |
|   | 17                 | 17       | 07                 | 50       |
| Severe Preeclampsia                       | 04                 | 4        | 4                  | 28.57    |
| Antepartum eclampsia                      | 10                 | 10       | 03                 | 21.42    |
| Postpartum eclampsia                      | 01                 | 1        | 0                  | 0        |
| HELLP syndrome                            | 02                 | 2        | -                  | -        |

Among hypertensive women, most common presentation was antepartum eclampsia followed by severe preeclampsia, together constituting 14(14%) of MNM cases. Two had HELLP syndrome. 4 (28.57%) cases of mortality group had Severe Preeclampsia, 3 (21.42%) cases admitted with antepartum eclampsia.

**Table 14: Underlying disorder – Medical and Surgical disorders**

| <b>Others</b>              |    |   |   |   |
|----------------------------|----|---|---|---|
| CVA                        | 02 | 2 | - | - |
| Cortical venous thrombosis | -  | - | - | - |
| Thrombocytopenia           | 3  | 3 | - | - |
| Cerebral malaria           | -  | - | - | - |
| Anemia                     | 9  | 9 | - | - |

Cardiac and respiratory disorders constituted for 12% of MNM cases. 6% of MNM group were of sepsis. Among mortality group, major cause of death was acute respiratory distress syndrome (21.42%).

**Table 15: Postpartum Hemorrhage**

|                                |    |
|--------------------------------|----|
| Atonic PPH                     | 14 |
| Traumatic PPH                  | 03 |
| Total                          | 17 |
| Surgical management            |    |
| Balloon tamponade              | 03 |
| B Lynch                        | 02 |
| Step wise<br>Devascularization | 05 |
| Obstetric Hysterectomy         |    |
| Morbidly adherent Placenta     | 02 |
| Rupture uterus                 | 04 |
| Placenta previa                | 02 |

Atonicity was the predominant cause of PPH. Among 17 patients, Surgical Management was done in 10 cases. Balloon tamponade was done in 3 cases, B- Lynch was done in 2 cases and Step wise devascularization was done in 5 cases. Emergency obstetric hysterectomy was done for 8 cases. Of these 2 cases were of morbidly adherent Placenta, 2 cases were placenta previa and 4 cases with rupture uterus.

**Table 16: Delivery details of all the cases**

| Procedure/Delivery<br>Details | MNM          |    | Mortality    |       |
|-------------------------------|--------------|----|--------------|-------|
|                               | No. of cases | %  | No. of cases | %     |
| Elective LSCS                 | 03           | 03 | -            |       |
| Emergency LSCS                | 29           | 29 | 04           | 28.56 |
| Laparotomy                    | 18           | 18 | -            |       |
| FTVD                          | 17           | 17 | 01           | 7.14  |
| PTVD                          | 06           | 6  | -            | -     |
| Hysterotomy                   | 02           | 2  | -            | -     |
| Hysterectomy                  | 04           | 4  | 02           | 14.28 |
| Peri partum<br>hysterectomy   | 04           | 4  | -            | -     |
| Peri mortem CS                | -            | -  | 02           | 14.28 |
| Delivered outside             | 16           | 16 | 01           | 7.14  |
| EVACUATION                    | 10           | 10 |              |       |
|                               |              |    |              |       |

|      |    |   |   |  |
|------|----|---|---|--|
| MRP  | 07 | 7 |   |  |
| VBAC | 1  |   | 1 |  |

Morbidity was high among women delivered by caesarean section (32%). In mortality group, 4 (28.56%) cases were delivered by LSCS & Obstetric Hysterectomy was done for 4 (28.56%) cases.

**Table 17: Organ dysfunction**

|                          |            | % |                  | %     |
|--------------------------|------------|---|------------------|-------|
| <b>Organ dysfunction</b> | <b>MNM</b> |   | <b>Mortality</b> |       |
| <b>Cardiac</b>           | 02         | 2 | 02               | 14.28 |
| <b>Respiratory</b>       | 09         | 9 | 04               | 28.56 |
| <b>Coagulation</b>       | -          | - | 03               | 21.42 |
| <b>Renal</b>             | 02         | 2 | 01               | 7.14  |
| <b>Haematological</b>    | 01         | 1 | -                | -     |
| <b>Hepatic</b>           | -          | - | 01               | 7.14  |
| <b>Neurological</b>      | 02         | 2 | -                | -     |

Above table 16 shows that, Majority of the MNM cases were of respiratory dysfunction constituting for 9% followed by cardiac, renal, neurological dysfunction in 2%. Haematological dysfunction in 1% of cases. Whereas in mortality group, majority were respiratory dysfunction 28.56% followed by coagulation dysfunction 21.42%.

**Table 18: Blood transfusion**

|                        | <b>MNM</b>  |    | <b>Mortality</b> |       |
|------------------------|-------------|----|------------------|-------|
| <b>Required</b>        | No. ofcases | %  | No. ofcases      | %     |
|                        | 76          | 76 | 06               | 42.85 |
| <b>Components</b>      |             |    |                  |       |
| <b>PRBC's</b>          | 76          | 76 | 06               | 42.85 |
| <b>FFP</b>             | 34          | 34 | 04               | 28.5  |
| <b>Platelets</b>       | 26          | 26 | 04               | 28.5  |
| <b>cryoprecipitate</b> | -           | -  | -                | -     |

Above table shows that, 76% and 42.85% respectively, in the MNM and mortality group required blood and blood components transfusion. 76% of MNM cases received packed cell transfusion. Platelets transfusion was done in 26% and 28.5% in MNM and mortality groups

respectively.

### ICU ADMISSIONS:

**Table 19: Total number of admission to ICU were 41**

| MNM  |               |
|--|---------------|
|  | N = 27        |
| <b>Age in years</b>                            | 25.57 ± 5.126 |
| <b>Gravida</b>                                 | 1.97± 1.406   |
| <b>Parity</b>                                  | 1.05± 0.920   |
| <b>GA in weeks</b>                             | 27.59± 9.046  |
| <b>Average duration of ICU stay(days)</b>      | 2.81± 1.45    |
| <b>No of days ventilated</b>                   | 1.92± 1.223   |
| <b>Average duration of hospital stay(days)</b> | 9± 3.83       |

There were total 41 cases admitted to ICU. Of these 27 cases were from MNM group and 14 from the mortality group. They were similar in respect to age, parity, gestational age and average duration of stay in ICU and hospital. In the MNM group, the mean (SD) duration of hospital stay was 9± 3.83 days, and ranged from 3 days to 35 days. The mean (SD) duration of ICU stay was 2.81±1.4 days, and ranged from 1 day to 9 days.

**Table 20: Underlying disorder necessitating ICU admission**

| Underlying Disorder (ICU)            | MNM          |       | Mortality    |       |
|--------------------------------------|--------------|-------|--------------|-------|
|                                      | No. of cases | %     | No. of cases | %     |
| Hypertensive disorder of pregnancy   | 13           | 44.8  | 07           | 50    |
| <b>Hemorrhage</b>                    | 08           | 27.5  | 03           | 21.4  |
| <b>Respiratory and cardiaccauses</b> | 03           | 10.3  | 02           | 14.28 |
| <b>Surgical causes</b>               | -            | -     | -            | -     |
| <b>Others</b>                        | 05           | 17.24 | 02           | 14.28 |

In table 19, majority ICU admissions in MNM group were of Hypertensive disorders 44.8%. Hemorrhage Constitute 27.5%. Majority of ICU admissions in mortality group (50%) were of Hypertensive disorder of pregnancy.

## INVESTIGATIONS:

**Table 21: Haemoglobin**

| Haemoglobin (gm %)      | MNM         |            |
|-------------------------|-------------|------------|
|                         | No. ofcases | Percentage |
| <b>Normal (&gt;11)</b>  | 17          | 17         |
| <b>Mild (9.1-11)</b>    | 18          | 18         |
| <b>Moderate (7.1-9)</b> | 24          | 24         |
| <b>Severe (&lt;7)</b>   | 41          | 41         |

In present study, majority 83% of MNM cases were anemic of which 18% had mild, 24% had moderate anemia and 41% had severe anemia. In mortality group, all were anemic.

**Table 22: Other investigations**

| TLC                               | MNM         |    |
|-----------------------------------|-------------|----|
|                                   | No. ofcases | %  |
| <b>Increased</b>                  | 11          | 11 |
| <b>RFT</b>                        |             |    |
| <b>Increased</b>                  | 02          | 2  |
| <b>LFT</b>                        |             |    |
| <b>Increased</b>                  | 09          | 9  |
| <b>Platelet Count</b>             |             |    |
| <b>&lt;50000</b>                  | 03          | 3  |
| <b>50000-100000</b>               | 02          | 2  |
| <b>Altered coagulationfactors</b> |             |    |
| <b>Altered</b>                    | 0           | 0  |
| <b>FDP+D-dimer</b>                |             |    |
| <b>Positive</b>                   | 0           | 0  |



Leucocytosis was present in 11%, LFT and RFT were raised in 9% and 2%, thrombocytopenia was present in 5% of which 3% had <50000 platelets.

**Table 23: Intervention details**

| Intervention Details   | MNM          |    | Mortality    |       |
|--|--------------|----|--------------|-------|
|  | No. of cases | %  | No. of cases | %     |
| <b>Mechanical Ventilation</b>  | 14           | 14 | 14           | 100   |
| <b>Dialysis</b>  | -            | -  | -            | -     |
| <b>Laparotomy with procedures – B lynch, step wise Devascularization</b> | 07           | 7  | -            | -     |
| <b>Re laparotomy</b>   | -            | -  | -            | -     |
| <b>Hysterectomy</b>  | 08           | 8  | 02           | 14.28 |
| <b>Massive blood transfusion (&gt;=5PC)</b>                              | 15           | 15 | 02           | 14.28 |

14 cases required mechanical ventilation in MNM group, & in mortality group all cases required mechanical ventilation.

**Table 23: Near Miss cases and Mortality index**

| The mortality index of near-miss events    |                        |                            |                                  |                 |
|--|------------------------|----------------------------|----------------------------------|-----------------|
| Event                                      | Near miss events n (%) | Near miss/1000 live births | Number of woman died (mortality) | Mortality index |
| <b>Hypertensive disorders Of pregnancy</b> | 17%                    | 1.6                        | 03                               | 15%             |
| <b>Severe Hemorrhage</b>                   | 53%                    | 5.19                       | 03                               | 5.3%            |
| <b>Sepsis</b>                              | 6%                     | 0.58                       | 03                               | 33.3%           |
| <b>Cardiac</b>                             | 5%                     | 0.49                       | 02                               | 28.5%           |
| <b>Respiratory</b>                         | 9%                     | 0.88                       | 03                               | 25%             |
| <b>Hepatic</b>                             | -                      | -                          | -                                | -               |

|               |    |      |   |   |
|---------------|----|------|---|---|
| <b>Renal</b>  | 2% | 0.19 | - | - |
| <b>Others</b> | 8% | 0.78 |   |   |

"Mortality Index-MI"(MI) = maternal deaths / MNM+ Maternal deaths× 100

Present study had 100 near miss cases. Among the causes of near miss events, hemorrhage was the leading cause with 53%, and hypertensive disorders were next at 17%. The other causes included respiratory disorders (9%), others (8%), sepsis (6%), cardiac (5%), renal (2%).

Hypertensive disorders of pregnancy, Severe Hemorrhage, Sepsis, Respiratory were the leading causes of maternal mortality at our setup (3 deaths each), followedby cardiac (2 deaths).

**The overall mortality index for our set-up was 12.2%.**

**Table 24: Maternal near miss indices**

| <b>Maternal near miss indices</b>           | <b>Indices</b>          |
|---|-------------------------|
| Maternal Near MISS (MNM)                    | <b>100</b>              |
| Maternal Death (MD)                         | <b>14</b>               |
| Live Birth (LB)                             | 10200                   |
| Near Miss Ratio (NMR= MNM/LB)               | 9.80/1000 Live births   |
| Mortality Index (MI=MD/MNM+MD)              | 12.2%                   |
| Maternal Near Miss Mortality Ratio (MNM:MD) | 7.14                    |
| Maternal Mortality Ratio (MMR)              | 137/100,000 Live births |

**MNM ratio (MNMR)** refers to the number of MNM cases per 1000 live births (MNMR = MNM/LB). Similarly to the SMOR, this indicator gives an estimation of the amount of care and resources that would be needed in an facility.

**Maternal near-miss mortality ratio (MNM : 1 MD)** refers to the ratio between MNMcases and maternal deaths. Higher ratios indicate better care.

## **DISCUSSION**

### **Distribution of patients according to Age groups**

In MNM group, the majority of the patients (40%) were in the age group of 20- 24 years, followed by 25-29 years (32%), >35 years (11%), 30-34 years (9%), and <19 years (8%). The mean age is 25.77, and SD is 5.184. In mortality group, the majority of the patients were 25-29 years (35.71%), followed by 20-24 years (28.5%), 30-34 years & > 35 years (each one 14.28%) and <19 years (7.14%). The mean age is 27.35, and SD is 4.202.

Overall, the mean age of the women with MNM ranged between 25-29 years. This is due to early age at marriage, early mother hood, spacing between births is less than 2 years and aversion to contraception. This is universal finding in all studies and related to maternal mortality as well.<sup>6</sup>

#### **Distribution of patients according to Parity**

In present study out of 100 MNM cases, most of the cases were para 1 of about 45%, followed by nulli para (32%) Whereas in mortality group majority were para 1 of about 57.14%, followed by nulli para 35.71%. The mean parity in MNM and mortality group is  $0.76 \pm 0.904$  and  $1.64 \pm 0.929$  respectively. In a similar study conducted by Shrestha NS et al., & Kalra P et al., showed mean parity of 1 to 2 of 48% and 61% respectively.

#### **Distribution of patients according to Educational status**

In present study, among MNM and mortality groups, most of the cases were illiterate 52% and 71.42% respectively followed by primary school (30% and 21.4%), high school (12% and 7.1%), intermediate (5% and 0%) and graduate (1% and 0%). This is comparable to studies conducted by Ali AA et al., and Chhabra P et al., most of the patients were illiterate 53% and 55% respectively.

#### **Distribution of patients according to Type of admissions**

In our study, Majority 73% in the MNM group were admitted with severe illness, 10% patients were admitted without any disorder and later became near- miss, And 17% admitted with disorders and became near-miss. In Mortality group 71.42% were admitted with severe illness, 14.28% patients were admitted without any disorder and 14.28% admitted with disorders.

In a study conducted by Shrestha NS et al., 58% of the patients were admitted in a critical state to hospital. In a similar study conducted by Adisasmita et al., the majorities (70.7%) of near miss in public hospitals were in a critical state at admission but this proportion was much lower in private hospitals (31.9%).

In our study 10 cases were admitted with no disorder and became near miss during hospital stay. 6 cases were due to PPH of which 1 case was managed with balloon tamponade, one case with B-Lynch and 2 cases step wise de-vascularization. 4 cases were due to complications of third stage of labor of which 3 cases due to retained placenta and 1 case due to morbidly adherent placenta for which hysterectomy was done.

#### **Distribution of patients according to Mode of Delivery**

In present study most of the cases were delivered by caesarean section (32%) of which Emergency LSCS was done for 29% of case and Elective LSCS was done for 3% of the cases. 23% of the cases delivered vaginally. In mortality group, 4 (28.56%) cases were delivered by Emergency LSCS which were hypertensive disorders of pregnancy. 1 case delivered vaginally which developed atonic PPH with haemorrhagic shock for which obstetric hysterectomy was done.

## Details of Surgical Intervention

In near miss group laparotomy was done for 18% of the cases of which 17 cases were Ectopic pregnancy and 1 case of uterine inversion. Manual removal of placenta was done for 7 cases of which 5 cases referred from outside, 2 cases delivered vaginally.

Surgical drainage of hematoma was done for 3 cases of vulval hematoma. Suction evacuation was done for 1 case of molar pregnancy which developed pulmonary edema resolved with NIV support. Instrumental evacuation of retained products was done for 6 cases of incomplete abortion. Manual reposition of uterus was done for 1 case of uterine inversion.<sup>7</sup>

In mortality group peri-mortem hysterectomy was done for 2 cases of uncontrolled PPH of which one case delivered vaginally and 1 case during caesareansection for placenta previa.

**Underlying Disorder:** On admission, haemorrhage and hypertensive disorder of pregnancy were the most common underlying disorders, 53% and 17% respectively followed by indirect causes. In indirect cause, respiratory causes, sepsis, cardiac and renal were the most common.

Severe haemorrhage (53%) as a cause of MNM is the major determinant which is similar to other studies. Hemorrhage was the commonest cause, ranging from 40 to 50% in different studies., in a similar study conducted by Doreswamy et al., has 85.2% in severe haemorrhage group.

Majority of the hemorrhage cases were referred from outside in critical condition. Hypertensive disorders of pregnancy (17%) is the next common cause of MNM in our study. It is similar to Shrestha et al.,(27.7%) Kathmandu, AbdelAzim A Ali et al.,(18%)Sudan, Roopa PS et al., (23.6%) Manipal. Highest incidence of MNM was due to hypertensive disorders in study conducted by Patankar et al.,

In our study, third common cause of MNM is respiratory cause (9%), followed by sepsis (6%), cardiac (5%) and renal dysfunction (2%).

In present study MNM cases due to PPH were 17%. Atonicity was the predominant cause of PPH. Among 17 patients, Surgical Management was done in 10 cases. Balloon tamponade was done in 3 cases, B- Lynch was done in 2 cases and Step wise de-vascularization was done in 5 cases. 3 cases of traumatic PPH (vulval hematoma) was managed with surgical evacuation of hematoma. All these cases were transfused blood and blood products.

Emergency obstetric hysterectomy was done for 8 cases. Of these 2 cases were of morbidly adherent Placenta, 2 cases were placenta previa and 4 cases with rupture uterus Ruptured ectopic pregnancy with intra peritoneal haemorrhage (18%) was the main cause of early pregnancy haemorrhage, laparotomy was done for all cases.<sup>8</sup>

In present study, in hypertensive disorders the most common presentation of underlying disorder is eclampsia 11%. This is comparable to other studies done by Shrestha et al., Kathmandu and Roopa PS et al., Manipal 13.8% and 10.6% respectively.

In study conducted by Abdel Azim A Ali et al., the most common presentation of underlying

disorder was severe pre eclampsia 12.3% and low incidence of eclampsia (5.7%). In our study all the above cases received magnesium sulphate (Pritchard regimen).

In our study, Majority of the MNM cases were of respiratory dysfunction constituting for 9% followed by cardiac (3%), renal (2%), neurological dysfunction (2%). Haematological dysfunction in 1% of cases.

Respiratory dysfunction is most common under lying organ dysfunction in Shrestha et al., Kathmandu (27.5%), Uma Jain et al., shivapuri (7%). In study conducted by Patankar et al., Maharashtra the most common underlying dysfunction was haematological dysfunction (28.5) followed by cardiac (21%) and respiratory (19.3%).

### **Respiratory dysfunction (n = 9)**

There were 9 cases of respiratory disorders of these 6 cases developed pulmonary oedema of which 5 cases had hypertensive disorder and 1 case was molar pregnancy. These cases required ICU admission and Ventilatory support 3 cases developed ARDS, of which 2 cases had hypertensive disorder and 1 case referred from outside with breathlessness and required ICU stay and ventilator support.

### **Cardiac dysfunction (n =3)**

There were 3 cases of cardiac disorders of which 2 cases had PIH who developed postpartum cardiomyopathy and required NIV support, and one case had pre existing cardiac disease (Rheumatic Heart Disease), admitted in ICU for observation.

### **Renal dysfunction (n = 2)**

There were 2 cases of renal dysfunction both were delivered outside and referred, had PPH and developed AKI, both were managed medically.

### **Neurological dysfunction (n = 2)**

There were 2 postpartum cases of neurological dysfunction (CVA), both were unbooked cases referred from outside, both were admitted to ICU and managed medically

In present study hypertensive disorder of pregnancy is the most frequent cause of maternal mortality followed by haemorrhage and sepsis.

There were 14 cases of maternal mortality , 7 cases were hypertensive disorders of which 5 cases were referred from outside in critical stage, 1 case of 25 weeks IUFD developed Disseminated Intravascular Coagulation (DIC), and 1 case of primi 39 weeks underwent emergency LSCS in view of non-progress of labor and postoperatively she developed ARDS.

4 cases were of haemorrhagic disorders of pregnancy of which 1 case was gravida 3 (G3P2L2) 22 weeks with abruption referred from outside in haemorrhagic shock, she developed MODS. 1 case delivered spontaneously and developed atonic PPH with haemorrhagic shock, underwent obstetric hysterectomy, she received 10 PRBC, 6 FFP, 4 Platelets. 1 case gravida 3 (G3P2L1D1)

with 35 weeks with placenta previa, for which emergent LSCS was done, developed atonic PPH and underwent Obstetric Hysterectomy and 1 case referred from outside after delivery in view of PPH.

3 cases were of sepsis referred from outside in critical stage of which 1 case was admitted in postpartum period with altered sensorium, 1 case of viral pneumonia with breathlessness at 20weeks of GA, 1case of jaundice with AKI in shock at 12weeksof GA.

The above table depicts the frequency and characteristics of MNM cases, Maternal Deaths, MNM to Mortality ratio (MNM : 1 MD) and Mortality Index (MI) of different studies, the MNM ratio (MNMR) refers to the number of MNM cases per 1000 live births (MNMR = MNM/LB). Incidence of MNM is higher in developing countries than in developed countries, it gives an idea about standard of maternal health, it is also higher in referral hospitals where critical patients are referred.

In present study, the MNM ratio is 9.8 per 1000 live births. In the developing countries, it varies anywhere between 10–40 per 1000 live births. In a systematic review of MNM in sub Saharan Africa, the MNM ratio ranged from 1.1 % to 8.3%. The MNM ratio in this study 9.8% which is lower than other studies.<sup>10</sup>

The MNM to Mortality ratio MNM : 1 MD indicates the overall standard of health care provided. In our study the MNM to Mortality ratio is 7.1:1, ie for every maternal death there were 7-8 near miss cases. In Shrestha et al., MNM to Mortality ratio is 7.2:1 which is comparable to our study.

The above table demonstrates the causes of near miss and the maternal mortality index for each specific near miss event.

In our study the overall mortality index is 12.2 which is similar to study conducted by Shrestha et al., 12.1. In study conducted by Ali AA et al., in Sudan showed the overall mortality index was high (19.5). In European countries, it was between 0.5 to 1% and in African countries it varies from 3.4 to 21%. The MI is high in low resource setting.<sup>11</sup>

The mortality index in this study for specific diseases was highest for sepsis (33.3) followed by cardiac (28.5). Although haemorrhage and hypertensive disorders of pregnancy are the most common determinants of acute morbidity, Mortality Index is much lower. In Ali AA et al.,<sup>15</sup> study the MI was highest for sepsis (22.2) followed by dystocia (10), Anaemia (10), Haemorrhage (8.8) and Hypertensive disorders of pregnancy. Roopa PS et al., Manipal had the highest MI for Cardiac disease (40), followed by sepsis (36.3) and indirect causes (11.8).<sup>12</sup>

## CONCLUSION

MNM is a sensitive measure for assessment of maternal health and quality of maternal care. Evaluating near miss events can help in creating safer and more approachable obstetric healthcare for future patients. The majority of cases, 73% in GMC Ananthapur were near miss

on arrival, which attribute to failure of recognition of the seriousness of the condition due to pre hospital delay.

MNM ratio in our study was 9.8/ 1000 live births, comparable with developing countries Hypertensive disorder (50%) is the leading cause of maternal mortality in our study. All cases were un-booked and referred in critical stage. This is due to lack of knowledge and awareness about warning signs of complications, poor antenatal care, and lack of skilled personnel and preparedness for emergencies. There is need for improvement in antenatal care and bring awareness regarding complications and early admission if necessary and need to improve knowledge about the circumstances by conducting simulation in obstetric emergencies. MNM to Mortality ratio (MNM:MD) ratio was 7.1:1.

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