Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 2244-2251 | ISSN:2251-6727

Prevalence and Predictive Factors for the Development of Maternal Near Miss. A Retrospective Analysis.

Jyotsna Pathak[1], Ranjana[2], Neeru Goel[3], Abha Kiran[4]

[1]Assistant Professor, Department of Obstetrics and Gynaecology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

[2]Associate Professor, Department of Obstetrics and Gynaecology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

[3] Professor, Department of Obstetrics and Gynaecology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

[4]Senior Resident, Department of Obstetrics and Gynaecology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India

Corresponding Author: Jyotsna Pathak

(Received: 04 February 2024 Revised: 11 March 2024 Accepted: 08 April 2024)

KEYWORDS

Maternal near miss, Maternal death, Live birth, Maternal mortality ratio

ABSTRACT:

Introduction: Maternal mortality is a critical indicator to assess the quality of health services. Analysis of pregnant women with severe maternal outcome (SMO), comprising of maternal near miss (MNM) and maternal death (MD), are likely to identify factors associated with it and help us to take corrective measures to reduce severe maternal outcome. Information on MNM in Bihar is inadequate.

Objectives: To estimate prevalence of MNM cases and to determine contributory and predictive factors responsible for the occurrence of MNM.

Material and methods: All the patients admitted in the labour room during the study period from July 2021 to December 2023 were included. Near-miss cases were noted based on the WHO near-miss criteria on identifying a) Severe maternal complications b) Critical interventions or intensive care unit use and c) Life-threatening organ dysfunction.

Result: The MNM incidence ratio was 80.06/1000 live births, the MNM to mortality ratio was 3.1:1, and the mortality index was 17.33%. Pre-eclampsia and eclampsia were the most common causes of near-miss events 21 (18.4%) and sepsis was the most common cause 21(58.3%) responsible for maternal death. Presence of acute kidney injury, sepsis and blood transfusions were found to be significantly correlated with maternal death.

Conclusion: MNM is an important indicator to assess the quality of health services. Timely recognition and appropriate intervention of this condition is important to prevent maternal death.

Introduction:

Maternal mortality is a critical indicator to assess the quality of services. United Nations Sustainable Development Goals aims to achieve maternal mortality ratio (MMR) to 70 per 100,000 live births by year2030.[1] According to sample registration system bulletin, there has been significant decline in the MMR from 130 per lakh live birth (LB) in 2014-16 to 97 per lakh LB in 2018-20 in India. However, MMR in Bihar is still 118 per lakh LB which is significantly higher than national average.[2] In any setting, women who develop severe acute complications during pregnancy share many pathological and circumstantial factors. While some of these women die, a proportion of them narrowly escape death. Analysis of pregnant women with severe maternal outcome (SMO), comprising of maternal near miss

Journal of Chemical Health Risks

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JCHR (2024) 14(3), 2244-2251 | ISSN:2251-6727

(MNM) and maternal death (MD), are likely to identify factors associated with it and help us to take corrective measures to reduce severe maternal outcome. [3].

World Health Organisation (WHO) defined MNM as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy." [3] Incidence of MNM reported in studies ranges from 4.2-120 per 1000 live births.[4] Adequate information regarding the causes of MNM cases is not available in Bihar as per our knowledge. Therefore, a retrospective analysis of MNM cases in Indira Gandhi institute of medical sciences (IGIMS) which is a tertiary level hospital in Bihar was carried out.

Objectives of the study

1. To estimate prevalence of MNM cases
2. To determine the various contributory and predictive factors responsible for the occurrence of MNM and compared it with factors associated with maternal death.

Material and methods:

It was a single centre retrospective observational study done at IGIMS, Patna. Approval from Institutional Ethical committee (1390/IEC/IGIMS/2024) was taken before starting study. All the patients admitted in the labour room during the study period from July 2021 to December 2023 were included. Among them, those with severe maternal outcome (SMO)in the antenatal, intra-natal, and postnatal period up-to six weeks were identified as MNM using the WHO near-miss criteria. After identifying the patients of MNM, the files were retrieved from medical record department and all the relevant data were recorded.
The WHO near-miss criteria are based on identifying (3)

a) Severe maternal complications

b) Critical interventions or intensive care unit use and

c)Life-threatening organ dysfunction

Severe maternal complications comprised of the following:

I. Severe post-partum haemorrhage described as genital bleeding after delivery, with either perceived abnormal bleeding (1000 ml or more) or any bleeding with hypotension or blood transfusion,
II. Severe pre-eclampsia,
III. Eclampsia,
IV. Severe systemic infection or sepsis,
V. Uterine rupture and
VI. Severe complications of abortion

Critical interventions included interventional radiology, laparotomy (included hysterectomy, excluded caesarean section), use of blood products and admission to intensive care unit. Life threatening organ dysfunction (near miss criteria) included cardiovascular, respiratory, renal, haematologic, hepatic, neurologic, or uterine dysfunction. Maternal Death (MD) was defined as death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (3)

Presenting complaint, sociodemographic (e.g. socioeconomic status, area of residence, education, financial status), obstetric history (e.g. gravida, parity, adequate antenatal care, history of caesarean section and abortion), past medical history, notes regarding blood transfusion, causes of intensive care unit (ICU) admission, use of cardiotonic drugs, types and number of organ dysfunction and condition of baby were be noted.

Following MNM indicators were calculated [3]

- MNM ratio (MNMR) refers to the number of maternal near-miss cases per 1000 live births (MNMR = MNM/LB).
- Maternal near-miss mortality ratio (MNM : 1 MD) refers to the ratio between maternal near miss cases and maternal deaths.
- Severe maternal outcome ratio (SMOR) refers to the number of women with life-threatening conditions (MNM + MD) per 1000 live births (LB). This indicator gives an estimate of the amount of care and resources that would be needed in an area or facility [SMOR = (MNM + MD)/LB].
- 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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JCHR (2024) 14(3), 2244-2251 | ISSN:2251-6727

Statistical analysis

Quantitative data were expressed as mean ± standard deviation or median (range). Comparisons between the two groups were done using independent sample t test for normally distributed and Mann-Whitney U test for nonnormally distributed continuous data or for comparison of ordinal data. Qualitative data were expressed as percentage and analysed using Fisher's exact test. Bivariate analysis was performed to predict the factors associated with maternal death. Variables found significant on bivariate analysis were entered into multivariate analysis by the backward conditional method to determine the factors independently predict the maternal mortality. Statistical analysis was done using the SPSS 20.0 statistical package (IBM)

Result

In the study period of two and a half year from July 2021 to December 2023, the total number of deliveries and the total live births were 1489 and 1424 respectively. The total number of near-miss cases was 114, and 36 maternal mortalities occurred during the study period. Severe Maternal Outcome Ratio was 105.3 per 1000 live births. The maternal near-miss incidence ratio was 105.3/1000 live births, maternal near-miss to mortality ratio was 3.1:1, and the mortality index was 17.33% as shown in table 1.

Most of the women belonged to the age group of 21 to 25 years in both MNM and MD groups, but this number was significantly higher in MD groups (84.41% and 67.3%, p = 0.05) as shown in table 2. 63 (55.3%)belonged to the non-BPL category in MNM group whereas financial status was not known in 19 (52.8%) patients of MD group. Educational status and place of residence (urban/ rural) was not mentioned in majority of the patients in both the groups. Table 3 showed that previous history of caesarean was more in MD group and this was statistically significant. Multiparous women were more in number in both MNM and MD group. 46(40.4%) of the patients in MNM group had their delivery at this centre. 8(22.2%) patients who were operated at IGIMS due to various reasons died (p<0.001). 80 (70.2%)patients of MNM group presented in the antepartum period as compared to only 7(19.4%) in the MD group (p-value 0.001).

In MNM group 40 (35.1%) patients delivered vaginally and caesarean section was done in 55 (48.2%) patients. Laparotomy was done in 6(5.4%) and 1 (0.9%) patient for rupture ectopic and scar ectopic respectively. 2(1.8%) and 1(.9%) patient underwent laparotomy for rupture uterus and pyoperitonium respectively. Dilatation and evacuation (D&E) were done in 3 (3.5%) patients referred from HDU and D & E with laparotomy was done for heterotopic pregnancy in 2 (1.8%) patients. Total abdominal hysterectomy was done for 2(1.8%) patients with puerperal sepsis in which delivery has occurred outside IGIMS and 2(1.8%) patients underwent caesarean hysterectomy for placenta previa with percreta. In MD group,19(52.7 %) patients underwent caesarean section and in 3(8.3%) patients, caesarean hysterectomy was done.

Pre-eclampsia and eclampsia 21(18.4%) were most commonly associated with maternal near miss. Sepsis was seen in 12 (10.5%) patients. Other causes included invasive mole in 2 cases, uterine rupture in 2 cases, rectus sheath hematoma in 1 case and chronic myeloid leukaemia necessitating immediate laparotomy in 1 case. Underlying medical problems such as heart disease, respiratory disease (bronchial asthma, pleural effusion), hepatic disease, diabetes, neurological disease and SLE was seen in 28 (24.6%), 2 (1.8%), 2(1.8%),3 (2.7%) and 1(.9%) patient respectively which may increase the probability of development of maternal near miss. Incidence of Sepsis, acute kidney injury and haemorrhage were found to be significantly higher in MD group. Placenta praevia with percreta, acute fatty liver of pregnancy, superior vena cava thrombosis and Guillain Barre Syndrome contributed to maternal death in 3, 3, 1 and 1 patient respectively. ICU admission, need for blood transfusion and use of cardiotonic drugs was significantly higher in MD group.

We did bbivariate analysis to determine the predictive factors associated with maternal death. It showed presence of AKI ($p < 0.001$), sepsis ($p < 0.001$), timing of development of complications ($p < 0.029$), place of residence ($p < 0.001$), gravidae/parity ($p < 0.001$), previous caesarean section ($p < 0.001$), hemorrhagic dysfunction ($p < 0.001$), blood and FFP transfusion ($p < 0.001$), place of surgery ($p < 0.001$) and ICU admission ($p < 0.001$) were significantly associated with maternal death. However, only presence of AKI, sepsis and blood

Journal of Chemical Health Risks

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JCHR (2024) 14(3), 2244-2251 | ISSN:2251-6727

transfusions were found to be significantly correlated with maternal death on multivariate analysis.

Discussion

The incidence of MNM described in the literature varies widely due to variations in criteria used to identify MNM cases. With the standardization of MNM criteria proposed by the WHO in 2009, the chances of missing a case were minimized as it considered all the clinical, laboratory and management-based criteria. We used this criterion in our study.MMR in our study was 2528 per 100,000 live birth which is exceptionally high. This may be due to fact that our centre is only few among the referral hospital in Bihar which take patients with significant comorbidities due to availability of super-speciality facility. The MMR in other studies by Kulkarni et al, Bhaskar et al, Visi V et al and Rathod et al was 903, 430, 38 and 299 per lakh LB respectively. [4,5,6,7] MNM incidence ratio in our study was 80.06 which was very much higher than the studies by Kulkarni et al, Bhaskar et al, Visi V et al and Rathod AD et al, which was 11,13,4.6 and 7.56 respectively. [4,5,6,7] Maternal near-miss to mortality ratio (MNM: 1 MD) was 3.1:1 in our study, which is comparable to studies by Bhaskar et al (3.16:1) and Rathod et al (3.43:1). [5,7] Kulkarni et al showed relatively lower MNM: 1 MD ration (1.2:1), whereas Visi V et al showed higher (MNM: 1 MD) (12.2:1) ratios. [4,6]. MNM: 1 MD ration indicate better obstetric care.

The mortality index (MI) was 17.33% in our study whereas it was 45.2%, 24%, 7.5% and 29.07% respectively in studies by Kulkarni et al, Bhaskar et al, Visi V et al and Rathod et al. [4,5,6,7]. Higher index indicated low quality of obstetric care, whereas lower index indicated better quality of care.

In this study, age group of 21 to 25 years in both MNM and MD groups was most commonly affected which may be due to the fact that it is the most common reproductive age group, so mostly complications occurred in this age group. It is similar to the study done in other parts of India. (5,8,9)

In this study, most of the maternal near-miss cases 80(70.2%) occurred in the antepartum period however, 20(55.6%) patients presented within 1 week of post-partum period in MD group. This is similar to the study done by Mansuri et al. and Roopa et al. [10,11] Such results reiterate the need for timely referral of antenatal cases to tertiary care centre to improve the quality of obstetric care.

The most common cause of a maternal near-miss was hypertensive disorder in this study 21(18.4%) which was similar to the study. Hypertensive disorder as a cause of MNM varied from 26.5% to 45.8% in other recently published studies. [5,9,12] Studies by Bansal et al, Mansuri et al. and Roopa et al. showed hemorrhage as the most common cause of maternal near miss followed by hypertensive disorders in pregnancy. [8,10,11] In our study, hypertensive and underlying heart diseases were the common contributory factor for development of maternal near miss. However, sepsis, AKI and haemorrhage were the most important factors resulting in maternal death.

Main limitation of this study was its retrospective study design and thus few records were not available and therefore prospective study is needed for better analysis. Results of this study may not be generalised as our hospital is a tertiary care centre so, chances of referral bias cannot be excluded

Conclusion

Maternal Near miss cases audit and maternal death review must be done at all institutions to provide best obstetric care to pregnant women so as to achieve the MMR at par with the developed countries. The analysis of the MNM cases is likely to yield valuable information regarding severe morbidity, which could lead to death of the mother. Therefore, it is imperative to prevent the prevent the maternal death by timely recognition of these complication and appropriate intervention. A trend of MNM:MD ratio over subsequent years will help in evaluating quality of care given to women in pregnancy.

References:

1. United Nations. 'The Millennium Development Goals Report 2015′ and 'Transforming our world: the 2030 agenda for sustainable development. ' New York, 2015. [http://www.un.org/]. Accessed 18 Oct 2015
2. Sample Registration System, Office of the Registrar General, India. Special bulletin on maternal mortality in India 2016 18. 2020. Available from: https:

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JCHR (2024) 14(3), 2244-2251 | ISSN:2251-6727

//censusindia.gov.in /vital statistics/ SRS_Bulletins/ MMR.pdf. [Last accessed on 2021 Feb 8]. Website link: https://censusindia.gov.in/

3. World Health Organization, Department of Reproductive Health and Research. Evaluating the quality of care for severe pregnancy complications. Geneva: The WHO near-miss approach for maternal health; 2011. p. 1–1
4. Kulkarni R, Chauhan S, Fidvi J et al. Incidence & factors influencing maternal near miss events in tertiary hospitals of Maharashtra, India Indian J Med Res 158, July 2023, pp 66-74 DOI: 10.4103/ijmr.ijmr_2932_21
5. Bhaskar M, Chikkasiddaiah SH, Chethan R, *et al*. Maternal Near-miss in Tertiary Referral Centre: A Prospective Observational Study from Urban Bengaluru. J South Asian Feder Obst Gynae 2023;15(6):683–685 Indian J Med Res 158, July 2023, pp 66-74.DOI: 10.4103/ijmr.ijmr_2932_21
6. Visi V, Akoijam BS. A review of maternal near miss cases in selected Hospitals in North-East India. Indian J Community Med 2021; 46:421-4
7. Rathod AD, Bhagat PCR, Paja S, Padmawar A, Thool A Analysis of near-miss and maternal mortality at tertiary referral centre of rural India. The Journal of Obstetrics and Gynaecology of India (September–October 2016) 66(S1): S295–S300 DOI 10.1007/s13224-016-0902-210
8. Bansal M, Lagoo J, Pujari K: Study of near miss cases in obstetrics and maternal mortality in Bastar, Chhattisgarh, India. Int J Reprod Contracept Obstet Gynecol. 2016, 5:620-623. 10.18203/2320-1770.ijrcog20160489
9. Jain U: A study on maternal near miss cases in Government Medical College Shivpuri, Madhya Pradesh, India . Int J Reprod Contracept Obstet Gynecol. 2019, 8:3047-3055. 10.18203/2320-1770.ijrcog20193149
10. Mansuri F, Mall A: Analysis of maternal near miss at tertiary level hospitals, Ahmedabad: a valuable indicator for maternal health care. Indian J Community Med. 2019, 44:217-221. 10.4103/ijcm.IJCM_267_18
11. Roopa PS, Verma S, Rai L, Kumar P, Pai MV, Shetty J: “Near miss” obstetric events and maternal deaths in a tertiary care hospital: an audit. J Pregnancy. 2013, 2013:393758. 10.1155/2013/393758
12. Verma V, Kanti V, Vishwakarma S, Gupta UK, Shree P: “Near-miss” obstetric events and maternal deaths in a rural tertiary care center in North India. Cureus. 2020, 12: e11828. 10.7759/cureus.11828

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(3), 2244-2251 | ISSN:2251-6727

Table 1:MNM Indicators

MNM indicators	**Numbers**
Number of deliveries	1489
Number of live births	1424
Number of maternal near-miss (MNM)cases	114
Number of maternal deaths (MD)	36
Severe Maternal Outcome Ratio ([MNM+MD]/1000 LB]	105.3
MNMR (MNM/1000 LB)	80.06
MNM-MR (MNM: 1 MD)	3.1:1
Mortality Index	17.33%

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JCHR (2024) 14(3), 2244-2251 | ISSN:2251-6727

Table: 2 Demographic profile of patients with MNM and maternal death

Parameters		**MNM Groups (n = 114)**	**MD Groups (n = 36)**	**P Value**
Age in years	15-20	7 (6.1%)	6 (16.7%)	0.054
	21-25	43 (37.8%)	15 (41.6%)	
	26-30	34 (38.6%)	11 (30.6%)	
	31-35	14 (12.2%)	3 (8.3%)	
	36-40	5 (4.4%)	1 (2.7%)	
	>40	1 (0.9%)	0%	
Socio-economic status	BPL	36 (31.6%)	9 (25%)	0.57
	Non-BPL	63 (55.3)	8 (22.2)	
	Not known	15 (13.2%)	19 (52.8%)	
Educational status	6-12th	14 (13%)	7 (19.4%)	0.018
	>12th	9 (7.9%)	9 (25%)	
	Not known	89 (78.1%)	20 (55.6%)	
Place of residence	Rural	7 (6.1%)	13 (36.1%)	< 0.001
	Urban	3 (2.6%)	3 (8.3%)	
	Not known	104 (91.3%)	20 (55.6%)	
Place of surgery	No surgery done	65 (57%)	9 (25%)	<0.001
	Surgery done in IGIMS	46 (40.4%)	8 (22.2%)	
	Surgery done outside IGIMS	2 (1.8%)	19 (52.8%)	

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Table 3: Obstetric profile of patients with MNM and maternal death

Parameters		**MNM (n =114)**	**Maternal death (n = 36)**	**P value**
Gravida	1	27 (23.7%)	5 (13.9%)	0.42
	2	24 (21.1%)	5 (13.9%)	
	3	22 (19.3%)	3 (8.3%)	
	≥ 4	28 (24.6%)		
	Not known	3 (2.6%)	5 (13.9%)	
Parity	1	5 (4.4%)	10 (27.8%)	
	≥ 2	5 (4.4%)	7 (19.4%)	
	A1	0	1 (2.8%)	
Previous history of abortion		19 (16.7%)	8 (22.2%)	0.30
History of previous caesarian section		23 (20.2%)	21 (58.3%)	< 0.001
Timing at development of complications	Antepartam (≥20 weeks)	80 (70.2%)	7(19.4%)	0.001
	Within 6 hours of delivery	2(1.8%)	5 (13.9%)	
	6 – 24 hours of delivery	1(0.9%)	3(8.3%)	
	24 hours - 1 week	2(1.8%)	20(55.6%)	
	1 – 6 weeks	9(7.9%)	1(2.8%)	
	< 20 weeks of pregnancy	20(17.5%)	0	