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Original Research Article

Determinants of maternal near miss events: a facility based case-control study

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ABSTRACT

Background: Worldwide, approximately 830 women died every single day due to complications during pregnancy or childbirth in 2015. Many researchers revealed that the quality of health care delivery in a system can be identified by studies on maternal deaths. In recent years, women who survived the critical events during pregnancy and childbirth, called as maternal near miss cases, are explored as an adjunct to maternal death inquiries, as these cases occur more frequently than maternal deaths and can identify problems that had to be overcome for the provision of better healthcare services. This study aims at evaluating determinants of such maternal near miss events among postnatal women admitted in KIMS Hospital, Hubli.

Methods: A case-control study was done on postnatal women admitted in the KIMS Hospital. A structured pre-tested questionnaire was administered to 82 participants (27 cases and 55 controls). Information about biodata, sociodemographic characteristics, medical illnesses, previous pregnancies and the current pregnancy with its outcomes and complications was collected.

Results: Most women were satisfying the criterion for admission to ICU followed by hypertensive complications and severe anemia, to be considered as cases. The study showed height, type of family, religion, presence of danger signs during pregnancy as significant determinants of maternal near miss events.

Conclusions: The factors showing significance in our study are non-modifiable risk factors of maternal near miss events. With early identification of such cases and appropriate antenatal care, such events can be prevented and reduced.

Keywords: Maternal near-miss events, Type of family, Case-control study, Admission to ICU

INTRODUCTION

Pregnancy and childbirth is the most important and critical event occurring in a woman's life. Changes during pregnancy and childbirth can pose a serious risk to the woman's life and may also cause the death of the woman. Pregnancy, which used to occur as a normal physiologic process of reproduction has now become a condition which requires the high amount of medical care. As the number of interventions has increased for the provision of better obstetric health care, so do the complications related to it. Complications during pregnancy and childbirth remain a leading cause of critical illness and death among women of reproductive age in many low-income countries.[1]

Worldwide, approximately 830 women died every single day due to complications during pregnancy or childbirth in 2015.[2] Millennium Development Goal (MDG) 5 was to improve maternal health and Target 6 of MDG 5 was to

reduce the maternal mortality ratio by three-quarters, between 1990 and 2015.[2]

Globally, the maternal mortality ratio (MMR) has fallen by nearly 44% over the past 25 years, to an estimated 216 maternal deaths per 100,000 live births in 2015.[3] India alone contributes to about 15% of maternal deaths worldwide and recent statistics on the maternal mortality rate of India is 167 per lakh live births compared to 374 per lakh live births in the year 2000, which has fallen by 44.6%.[3]

The status of women and their health care system can be assessed by a country's maternal health situation. For many years, evaluation of maternal healthcare services aimed at improving the quality of obstetric care has traditionally relied on inquiries into maternal deaths.[4] Despite the positive contribution of this approach, it has limitations, particularly in low mortality settings or at the health service level, where the amount of maternal deaths is generally insufficient to provide useful information.[4] In the last 20 years, the concept of maternal near miss has been explored in maternal health as an adjunct to maternal-death confidential inquiries.[4]

Maternal near-miss (MNM) is recognized as a new concept that has emerged as an adjunct to the investigation of maternal deaths leading to the severe maternal outcome.[5] The WHO published MNM criteria based on markers of clinical management, and organ dysfunction, which would enable identification and systematic data collection on near‑miss.[5]

The maternal near-miss case is defined as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy".[6] In practical terms, women are considered near- miss cases when they survive life-threatening conditions (i.e. organ dysfunction). Severe maternal outcomes are maternal near miss and maternal death.[7]

Advantages of investigating near-miss events are a) near miss cases are more common than maternal deaths, b) the major reasons and causes are the same for both maternal near-miss and maternal death, so the review of maternal near-miss cases is likely to yield valuable information regarding severe morbidity, which could lead to the death of the mother, if not intervened properly and in time, c) investigating the instances of severe morbidity may be less threatening to providers because the woman survived, d) one can learn from the women themselves since they survived and are available for interview about the care they received, e) all near misses should be interpreted as free lessons and opportunities to improve the quality of service provision.[8]

The studies on near misses have been scarce in this region of India despite high maternal death burden. Therefore, this study on maternal mortality related events like near miss and perinatal outcomes is necessary for further understanding of associated issues and to provide an evidence-based platform for appropriate interventions. Our study aimed to highlight the determinants of maternal near-miss to contribute effectively to the adoption of measures to reduce maternal morbidity and mortality.

METHODS

This was a retrospective facility-based case-control study conducted by Department of Community Medicine, Karnataka Institute of Medical Sciences (KIMS) Hubballi. Based on the previous study, the proportion of hypertensives among cases and controls were 53.6% and 22.1% respectively.[6] Considering alpha error of 5% and 80% power of the test with 1:2 ratio for cases and controls, the Final sample size was 82, of which 27 were cases and 55 were controls between April to May 2018.

Definitions for cases and controls

All postnatal women admitted to the hospital during the study period were included in the study. Postnatal women fulfilling the criteria of maternal near miss as defined by WHO near-miss approach were considered as cases.[8] Postnatal women who did not fulfill the criteria for MNM were taken as controls. Matching was done based on age and gestational age at the time of delivery.

Study tool

A structured pre-tested questionnaire was used to collect patient's information, comprising of the following parts:

Part-I of the questionnaire obtained information regarding the patient's bio-data.

Part-II extracted information about various socio-demographic characteristics of the mother, past history of medical illnesses, previous pregnancies and antenatal period of the current pregnancy.

Part-III included information about the mother during the natal and postnatal period, including the criteria for screening of MNM. Also, information was collected about the outcome of pregnancy and neonatal outcome.

Data collection

A structured interviewer-administered questionnaire was used to collect patient's information after taking informed consent. Relevant data related to the condition of the patient and reports of investigations was extracted from the participant's medical records. Information regarding contributing factors to maternal near miss was collected using WHO sample data collection form.[7] The data was collected from obstetrics ward, intensive care units and emergency obstetric ward (casualty) of the hospital.

Data analysis

Data was entered and edited in Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 21. Continuous data was expressed as the mean and standard deviation. Categorical data was expressed as proportions. Students t-test was used to test the significance of continuous variables. Categorical data was analyzed using Chi-square test. A $p<0.05$ was considered significant. Variable with $p<0.05$ in univariate analysis was considered for multivariate logistic regression analysis.

RESULTS

Out of 82 members enrolled in the study, 27 were cases (MNM) and 55 were controls. Most of the women were having non-consanguineous marriage in both the groups. The proportion of multiparous women was high in both the groups which was significant ($p<0.05$). The proportion of cases living in the Joint family was significantly higher than in controls (67% vs. 38%, $p<0.05$). The near-miss group was significantly different from the control group in terms of maternal education, religion, and presence of danger signs during pregnancy. Most of the women in the study were literate, however, the proportion of illiterate women was significantly higher among near-miss cases than controls (26% vs. 2.27%, $p<0.05$). A higher proportion of near-miss cases belonged to Muslim religion in comparison to control group (74% vs. 42%, $p<0.05$). Presence of danger signs during pregnancy showed a significant difference between near-miss group and control group (26% vs.5%, $p<0.05$). There was no significant difference between the two groups in terms of consanguinity, mother's occupation, socioeconomic status, husband's education and occupation, alcohol intake by the husband, mode of delivery and presence of pregnancy-induced hypertension (Table 1).

Table 1: Comparison of socio-demographic and maternal health characteristics.

Characteristics	Category	MNM	Control	Total	P value
		N (%)	N (%)	N (%)	
Consanguinity	Consanguineous	9 (33.33)	14 (25.45)	23 (28.05)	0.455
	Nonconsanguineous	18 (66.67)	41 (74.55)	59 (71.95)	
	Total	27 (100)	55 (100)	82 (100)	
Parity	Primiparous	9 (33.33)	6 (10.91)	15 (18.29)	0.014*
	Multiparous	18 (66.67)	49 (89.09)	67 (81.71)	
	Total	27 (100)	55 (100)	82 (100)	
Type of family	Nuclear	9 (33.33)	34 (61.82)	43 (52.44)	0.015*
	Joint	18 (66.67)	21 (38.18)	39 (47.56)	
	Total	27 (100)	55 (100)	82 (100)	
Mother's education	Illiterate	7 (25.93)	4 (7.27)	11 (13.41)	0.02*
	Literate	20 (74.07)	51 (92.73)	71 (86.59)	
	Total	27 (100)	55 (100)	82 (100)	
Mother's occupation	Working	1 (3.7)	7 (12.73)	8 (9.76)	0.196
	Not working	26 (96.3)	48 (87.27)	74 (90.24)	
	Total	27 (100)	55 (100)	82 (100)	
Religion	Hindu	7 (25.93)	32 (58.18)	39 (47.56)	0.006*
	Muslim	20 (74.07)	23 (41.82)	43 (52.44)	
	Total	27 (100)	55 (100)	82 (100)	
Danger signs	Absent	20 (74.07)	52 (94.55)	72 (87.8)	0.008*
	Present	7 (25.93)	3 (5.45)	10 (12.2)	
	Total	27 (100)	55 (100)	82 (100)	
Socio economic status	Lower	11 (40.74)	22 (40)	33 (40.24)	0.949
	Upper/Middle	16 (59.26)	33 (60)	49 (59.76)	
	Total	27 (100)	55 (100)	82 (100)	
Husbands education	Illiterate	4 (14.81)	9 (16.36)	13 (15.85)	0.499
	Primary	5 (18.52)	17 (30.91)	22 (26.83)	
	High school	9 (33.33)	15 (27.27)	24 (29.27)	
	PUC	5 (18.52)	4 (7.27)	9 (10.98)	
	Graduate	4 (14.81)	8 (14.55)	12 (14.63)	
	PG/Diploma	0 (0)	2 (3.64)	2 (2.44)	
	Total	27 (100)	55 (100)	82 (100)	

Continued.

Characteristics	Category	MNM	Control	Total	P value
		N (%)	N (%)	N (%)	
Husband's occupation	Unskilled	4 (14.81)	17 (30.91)	21 (25.61)	0.101
	Semi-skilled	10 (37.04)	21 (38.18)	31 (37.8)	
	Skilled	2 (7.41)	8 (14.55)	10 (12.2)	
	Business/managerial	10 (37.04)	7 (12.73)	17 (20.73)	
	Professional	1 (3.7)	2 (3.64)	3 (3.66)	
	Total	27 (100)	55 (100)	82 (100)	
Alcohol intake by husband	No	23 (85.19)	50 (90.91)	73 (89.02)	0.436
	Yes	4 (14.81)	5 (9.09)	9 (10.98)	
	Total	27 (100)	55 (100)	82 (100)	
Mode of delivery	Vaginal	9 (33.33)	18 (32.73)	27 (32.93)	0.956
	LSCS	18 (66.67)	37 (67.27)	55 (67.07)	
	Total	27 (100)	55 (100)	82 (100)	
Pregnancy induced hypertension	Yes	6 (22.22)	6 (10.91)	12 (14.63)	0.173
	No	21 (77.78)	49 (89.09)	70 (85.37)	
	Total	27 (100)	55 (100)	82 (100)	

*Significant. MNM: Maternal near misses.

Table 2: Comparison of maternal characteristics and antenatal monitoring.

Characteristics	Groups	N	Mean	Std. derivation	Difference	t value	P value
Age (in years)	MNM	27	24.41	4.70	0.39	0.472	0.638
	Control	55	24.02	2.75			
Height (cms)	MNM	27	152.22	3.85	3.72	3.28	0.002*
	Control	55	155.95	5.23			
Weight gain (kgs)	MNM	27	8.81	4.27	0.188	0.239	0.81
	Control	55	9.00	2.82			
Age at marriage (in years)	MNM	27	19.52	2.712	0.736	1.32	0.19
	Control	55	20.25	2.19			
No. of ANC visits	MNM	27	7.41	1.39	0.135	0.396	0.693
	Control	55	7.55	1.53			

*Significant. MNM: maternal near misses.

Of the total 27 near-miss cases and 55 controls, the mean ages were 24.41 years and 24.02 years with the standard deviations of 4.70 years and 2.75 years respectively. There was a significant difference between the mean heights of the two groups (152 cms vs. 156 cms, p=0.002). The mean height in the control group was higher than the near-miss group. The average weight gain during pregnancy was 8.81 kgs and 9 kgs with the standard deviation of 4.27 kgs and 2.82 kgs for the cases and controls respectively. However, there was no significant difference in average weight gain during pregnancy between the two groups. Also, the two groups did not show a significant difference in terms of age at marriage and number of antenatal visits during pregnancy. The average age at marriage for cases and controls was 19.52 years and 20.25 years with the standard deviation of 2.71 years and 2.19 years respectively. The average number of ANC visits was similar in cases and controls (7.41 vs. 7.55) (Table 2).

The variables (characteristics) found significant on univariate analysis were considered for analysis by multivariate binary logistic regression. This analysis included height, parity, type of family, education, religion and presence of danger signs during pregnancy which was found to be significant in univariate analysis. Height, type of family, religion, and presence of danger signs during pregnancy were the main determinants of our samples after multivariate analysis (Table 3).

Table 3: Analysis of maternal near-miss determinants using multivariate binary logistic regression.

	P value	Adjusted odds ratio (95% CI)
Height	0.001*	0.741 (0.618–0.889)
Parity	0.14	3.146 (0.688–14.391)
Type of family	0.008*	6.753 (1.633–27.921)
Education	0.084	9.026 (0.746–109.206)
Religion	0.032*	4.26 (1.133–16.009)
Danger signs	0.039*	14.496 (1.146–183.349)

*Significant.

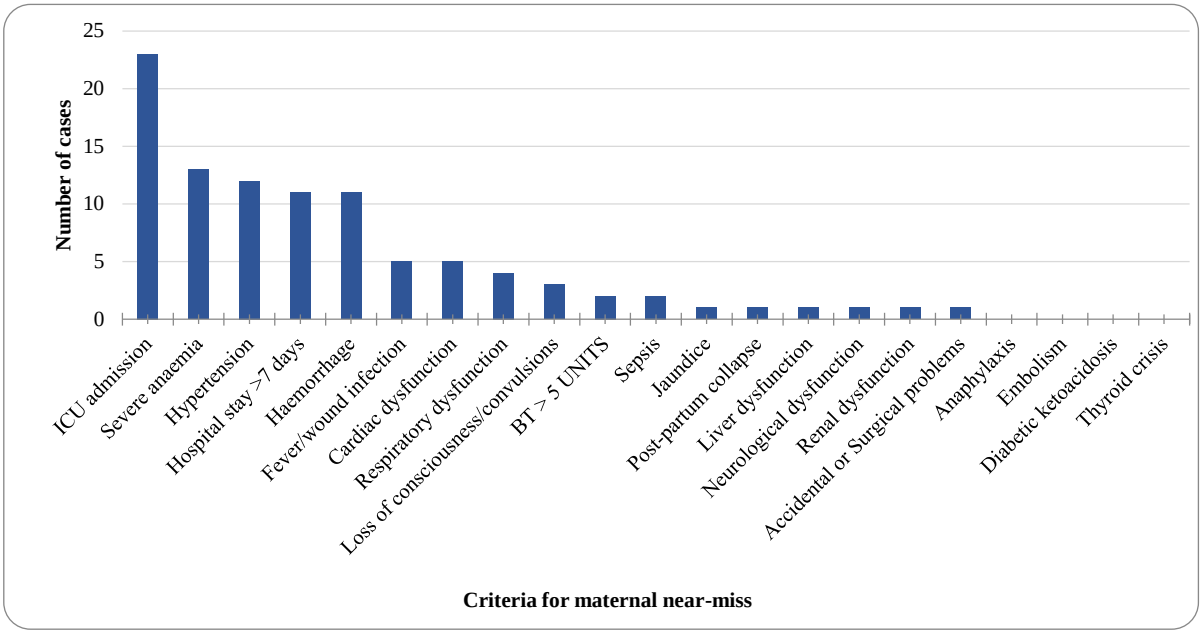

Figure 1: MNM criteria fulfilled by the cases.

Among 27 cases of near miss, majority of the cases had ICU admissions (23, 85%) as the criterion for considering as a near miss, followed by severe anaemia (13), hypertensive complications (12), hospital stay for >7 days due to complications (11) and haemorrhage (11). Other criteria fulfilled by the cases include fever and wound infection, cardiac dysfunction, respiratory dysfunction, loss of consciousness/ convulsions, massive blood transfusion, sepsis, jaundice, postpartum collapse, liver dysfunction, neurological dysfunction, renal dysfunction and surgical problems (Figure 1).

DISCUSSION

Near miss, criteria were in vogue for some years, yet lack of uniformity was the hindrance. WHO criteria 2009 considered clinical as well as laboratory and management based criteria.[9] The study of determinants of maternal near miss events helps us to recommend and adopt appropriate measures to reduce maternal near misses and maternal deaths. Such information can then be used in devising modules to eliminate these obstacles. The present study assessed such determinants among the postnatal women admitted to KIMS Hospital, Hubballi.

The questionnaire covered various aspects of maternal near miss and their determinants and also compared it with the controls (normal postnatal women). The study determined that the admission to ICU (23 cases) was the main criteria in our study to consider a woman as maternal near miss, followed by severe anemia (13 cases) and hypertensive complications (12 cases).

On univariate analysis of the information gathered it was found that height, parity, type (joint) of the family, the educational status of the woman, religion, the presence of danger signs during pregnancy was found to be significantly associated with the maternal near-miss events. Significant determinants of univariate analysis were subjected to Multivariate binary logistic regression analysis. The height of the women showed significant differences on univariate (p=0.002) and on multivariate analysis (p=0.001, AOR-0.741; CI: 0.618–0.889). A study in Kaduna state showed that height is an important determinant of maternal near miss.[10] This could be attributed to more number of obstetric interventions in short-statured women.

Parity was found significant on univariate analysis (p=0.014). On multivariate analysis, parity did not show any significant differences between cases and controls (p=0.14, AOR-3.146; CI: 0.688 – 14.391). A study done in Morocco also showed similar results.[11] A study in Uganda showed that increased maternal near miss events among primiparous women than the women whose parity is more than 1.[12] A study in Jharkhand, India found that maternal near miss events occurring more in the women with parity between 1 and 2, which is not in accordance with our study.[9] Increased maternal near-miss events in primiparous women could be attributed to factors including a lack of knowledge, poor nutrition, poor access to care, and inexperience with childbirth. However, it was found that primiparous women had 3 times (AOR-3.146) more risk of progressing to maternal near miss.

Type of family showed a significant difference (p=0.008, AOR-6.753; CI: 1.633–27.921) between cases and controls. Women who lived in joint families were found to have 6 times more risk for maternal near miss. This is a new finding in our study which has not been proved significant in any of the previous studies.

Educational status of the woman showed a significant difference (p=0.02) between cases and controls on univariate analysis, was not found significant on multivariate analysis. Maternal near miss occurred 9 times (AOR-9.026; CI: 0.746–109.206) more in those who were illiterate. This finding of our study did not go in accordance with the finding of the educational status of the woman in a study conducted in Maharashtra, India which showed that 54% of the women who were illiterate were having a poor outcome of the pregnancy.[13] Another study in Brazil on determinants of maternal near miss showed that lower education was associated with significantly with maternal near miss.[14] The reason for this could be the poor understanding of the illiterate woman about the pregnancy care, nutrition, and complications.

Religion also had a significant (p=0.032, AOR-4.26; CI: 1.133–16.009) impact on the occurrence of maternal near miss. In our study, most of the cases belonged to the Muslim religion. The previously stated study in Uganda also shows a similar finding of an association of religion and ethnicity with the maternal near-miss events.[12] The reason attributed for this finding could be the difference in the nutritional habits and the genetic differences among the people of different religions.

Danger signs during pregnancy which included vomiting, headache, blurring of vision, fever, abdominal pain, contractions in early third trimester, swelling of feet etc were found to have significant (p=0.039, AOR-14.496; CI: 1.146–183.349) association with the maternal near miss which were present in 7 (>25%) of the cases. A study conducted in Ethiopia states that the presence of hypertension during antenatal period contributes to the maximum number of cases of maternal near miss.[15] The reason for this may be because hypertension during pregnancy acts as a stimulator or initiator of the other complications which would lead to maternal near miss.

This study has certain limitations. The follow-up time used by WHO to define maternal near miss as a duration of 42 days postpartum. However, because of feasibility concerns, our follow up time was limited to only the length of the hospital stay. Determinants related to obstetric interventions could not be found out as we did not evaluate in detail about such interventions.

CONCLUSION

The present study findings show us that the maternal near miss is caused by multiple factors including socio-demographic and health-related factors. Most of the factors showing significance in our study are non-modifiable risk factors of maternal near miss. Hence such problems can be overcome by regular and extra antenatal check-ups by the women who are at risk. Early identification of such risk factors and appropriate intervention can reduce maternal mortality and morbidity significantly. Health workers and ASHAs should be educated about the identification of such risk factors early in the community. Lessons learned from cases of near misses can be useful in developing and implementing various programs to reduce the occurrence of such events.

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