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Maternal nearmiss and related conditions in care at a high-risk referral hospital in Southern Brazil

Abstract

Background: Maternal Near Miss (MNM) refers to women who survive life-threatening obstetric complications during pregnancy, childbirth, or the puerperium. Monitoring MNM cases provides valuable information regarding the quality of obstetric care and maternal health outcomes.

Objective: To describe and analyze maternal near miss cases and related conditions in a high-risk referral hospital in Southern Brazil.

Methods: A retrospective descriptive observational study was conducted using electronic medical records of women admitted to a tertiary referral hospital between August 2023 and August 2024. Cases were identified according to the World Health Organization maternal near miss criteria. Sociodemographic, clinical, obstetric, and outcome variables were analyzed. Maternal near miss indicators and mortality indices were calculated according to WHO recommendations.

Results: Among 3,463 births, 55 maternal near miss cases and 9 maternal deaths were identified. The maternal near miss ratio was 16.03 per 1,000 live births, while the severe maternal outcome ratio was 18.65 per 1,000 live births. Hypertensive disorders were the leading cause of severe maternal outcomes (37.5%), followed by hemorrhagic complications (28.1%). All patients required intensive care admission. Emergency hysterectomy was performed in 15.62% of cases, and 29.68% required blood transfusion. Maternal mortality was mainly associated with hemorrhage and cardiac disease.

Conclusion: Hypertensive disorders and obstetric hemorrhage were the principal conditions associated with severe maternal outcomes. The evaluation of maternal near miss events represents an important strategy for identifying opportunities to improve obstetric care and reduce maternal mortality in high-risk settings.

Keywords: maternal near miss; maternal mortality; severe maternal morbidity; obstetric hemorrhage; hypertensive disorders of pregnancy

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Introduction

Maternal morbidity and mortality are important markers of a nation's health quality and can be used to measure the service offered by health facilities. Maternal Near Miss (MMN), defined by the World Health Organization (WHO) as a condition in which a woman survives a serious, life-threatening obstetric complication, represents a unique opportunity to study the critical factors involved in obstetric care and the prevention of maternal mortality.[1] The concept of MNM has gained special attention in global public health, as reducing the maternal mortality rate was one of the Millennium Development Goals established by the United Nations.[2]

Comparing results from studies of severe maternal morbidity is extremely important, but in the past it has been a major challenge due to the use of different identification criteria. Therefore, in order to unify the criteria for definition, in 2009 the WHO developed the maternal near miss tool to introduce a universal approach to comparing the quality of maternity care between different countries.[3] Table 1 shows the defining criteria.

Table 1 Diagnostic criteria for maternal near miss

Clinical criteria	Laboratory criteria	Management criteria
Acute cyanosis	O☐ saturation < 90% for > 60 min	Continuous use of vasoactive drugs
Gasping	Lactate > 5	Dialysis for acute renal failure
Respiratory rate > 40 or < 6/min	Creatinine ≥ 300 µmol/L or ≥ 3.5 mg/dL	Cardiopulmonary resuscitation
Absence of pulse or heartbeat	Presence of glucose and ketones in urine	Transfusion of ≥ 5 units of packed red blood cells
Oliguria unresponsive to fluids or diuretics	Acute thrombocytopenia (< 50,000 platelets)	Intubation and ventilation > 60 min not related to anesthesia
Stroke	pH < 7.1	Peripartum hysterectomy
Shock	Bilirubin > 100 µmol/L or > 6.0 mg/dL	
Loss of consciousness ≥ 12 h	PaO☐/FiO☐ < 200 mmHg	
Coagulation disorders		
Jaundice in the presence of preeclampsia		
Uncontrolled seizures / total paralysis		

According to the World Health Organization (WHO) proposal, a woman presenting any of the conditions above and surviving complications occurring during pregnancy, childbirth, or within 42 days after the end of pregnancy should be considered a case of maternal near miss.

In Latin America, maternal morbidity and mortality is a significant problem, despite WHO data showing a reduction in the maternal mortality rate of approximately 60% between 1990 and 2008. In Brazil, where the maternal mortality ratio remains above WHO recommended levels, reaching a maternal mortality rate of 67.8 in 2010, MNM (maternal near miss) events offer valuable data for identifying weaknesses in health services, as well as for evaluating the quality and effectiveness of implemented obstetric interventions.[4] The importance of addressing this issue lies in assisting in the formulation of policies and protocols aimed at improving maternal health care and reducing adverse outcomes in highly complex settings. Monitoring these MNM events provides insights into the quality of obstetric care offered, including the strengths and weaknesses of the referral system and the availability of clinical interventions, which may suggest improvements to reduce serious maternal complications. As maternal mortality rates are declining globally, validation of criteria across multiple settings is necessary to allow comparisons and identify areas for improvement.[5]

To determine the MNM rate, this study was conducted in a referral hospital for obstetric care in southern Brazil, where the complexity of cases allows for an in-depth analysis of the characteristics and determinants associated with Maternal Near Miss. Analyzing cases in this setting provides a detailed view of the clinical, sociodemographic, and structural factors that contribute to such events, as well as allowing for a critical evaluation of the response capacity of healthcare teams in obstetric emergencies. Thus, the objective of this study was to describe and analyze the MNM cases registered at the aforementioned hospital, identify the main associated factors, and evaluate possible interventions and areas for improvement in the management of serious complications. It is expected that the results presented will contribute to the improvement of obstetric practices and to the formulation of recommendations that can be applied in similar settings, both in Brazil and in other countries with similar healthcare contexts.

Methods

This study used a retrospective descriptive observational design, based on data collection from electronic medical records identified by the WHO's MNM criteria, selected from a cohort of women with potentially fatal conditions admitted to a referral hospital in southern Brazil between August 2023 and August 2024. The setting was Hospital do Rocio, located in Campo Largo, near the capital of the state of Paraná. The hospital's obstetrics service serves approximately twenty-five municipalities throughout the state and manages 3,000 to 4,000 births annually. Tertiary care is also provided to women with high-risk pregnancies, from prenatal management to conception. The vast majority of patients receive primary care in their city of origin.

Data collection was performed exclusively through the analysis of patients' electronic medical records, extracting information on sociodemographic variables, such as age and parity, clinical variables, and case management. Additionally, data regarding maternal and neonatal outcomes were analyzed to characterize the impact of obstetric complications on the patients' clinical conditions.

The data obtained were organized into tables and subjected to statistical analysis. Categorical variables were described in absolute and relative frequencies, while continuous variables were analyzed using measures of central tendency and dispersion. Comparative analysis was performed to identify factors associated with MNM cases, using appropriate association tests, with a significance level of 5% ($p < 0.05$). First, the number of women with severe maternal outcomes (those who had a life-threatening event) and near-miss maternal outcomes was determined using the severity indicators proposed in the WHO tool. The baseline characteristics of the women, the various potentially fatal conditions, and the outcomes obtained were presented as frequencies and percentages. The case fatality rate was expressed according to the data obtained in the collection, being calculated by the frequency among the total number of deaths.

The following indicators were calculated: (1) maternal near miss ratio per 1000 live births, calculated from: [(number of maternal near misses diagnosed using the criteria ÷ total number of live births) × 1000]; (2) severe maternal outcome ratio per 1000 live births, calculated as: [(number of maternal deaths + number of maternal near misses) ÷ total number of live births × 1000]; (3) maternal near miss to maternal death ratio (number of maternal near miss cases

÷ number of maternal deaths); and (4) mortality rate calculated from: [number of maternal deaths ÷ (number of women with maternal near misses)]. The mortality rate and the ratio between near misses and maternal mortality indicate the quality of care; the lower the mortality rate and the higher the ratio between near misses and maternal death, the higher the quality of care.

The study was approved by the hospital's Research Ethics Committee, and the data were treated anonymously and confidentially, respecting the ethical guidelines in force in Brazil and the principles of the Declaration of Helsinki. No participant was subjected to interventions or approaches by the study team.

Results

During the period described, the total number of births at the hospital was 3463. A total of 55 patients were identified with criteria corresponding to MNM, and nine maternal deaths were recorded, one of which was due to an abortion. The indicators for monitoring the quality of obstetric care using MNM and maternal deaths are summarized in Table 2.

Table 2 maternal near miss indicator

Total births	**3463**
Patients classified as MNM	55
Maternal deaths	9
Women with life-threatening conditions	64
Fetal deaths	32
MNM ratio per 1,000 live births	16.03
MNM ratio per 100,000 live births	1603
Maternal mortality ratio per 100,000 live births	262.35
Severe maternal outcome ratio	18.65
Mortality index	14.06%

The calculated near-miss rate was 16.03 per 1000 live births. The maternal mortality ratio was 262.35 maternal deaths per 100,000 live births, and the severe maternal outcome rate was 18.65 per 1000 live births. The mortality rate calculated for the period was 14.06%. Analyzing the profile of patients classified as NMN (Maternal Near Miss), the average age was 32 years, with the oldest being 43 years old and the youngest 13 years old. The average length of hospital stay was 10 days.

All patients considered in the study were admitted to an intensive care unit. 68.75% underwent antibiotic therapy, with the most frequently used regimen consisting of Ceftriaxone and Meropenem. Ten patients underwent emergency hysterectomy (15.62%), and nineteen patients underwent urgent transfusion (29.68%).

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Analyzing maternal deaths, the youngest was 22 years old and the oldest 41, with an average age of 32.2 years. Of the nine cases, four were primiparous. Among the five multiparous women, four had a previous cesarean section. Investigating the conditions related to death, the main cause was divided between hemorrhage and heart disease. Maternal heart disease affected 3 patients. Hemorrhage was the cause of death in 3 patients, with eclampsia being responsible for one of them, along with sepsis of respiratory origin and metastatic cancer. The patient with metastatic melanoma progressed to brain death during hospitalization. One of the patients who died from heart disease ended up having a miscarriage at 13 weeks.

Of the 64 patients included in the study, the main cause related to severe outcomes was hypertensive disorders, including pre-eclampsia, eclampsia, and HELLP syndrome, affecting 37.5% of patients, followed by bleeding disorders, responsible for 28.1%. Of these, 44.4% had uterine atony as the cause of their bleeding. Sepsis, metastatic cancer, placental disorders, and metabolic disorders such as severe ketoacidosis were also present in the study as factors related to severe outcomes. In addition, 14.06% of patients had a prior diagnosis of gestational diabetes.

When considering the gestational age at which the life-threatening condition developed, 71.41% were in the third trimester, followed by 4.76% in the second and 4.76% in the first trimester. Of the total patients, 7 (10.9%) had the condition identified postpartum. Of the 64 patients, 5 progressed to miscarriage (7.81%), 6 were able to continue with the pregnancy (9.37%), and the remainder required immediate termination (82.81%). Of the 53 women who required termination, the delivery method was emergency cesarean section in 42 of them (79.24%), followed by vaginal delivery in 10 of them (18.86%). Regarding parity, 18.75% of the total were nulliparous. Among multiparous women, 75% had a previous cesarean section. Of the total hospitalizations, 9 women died, one of whom was classified as brain dead.

Discussion

More than half a million maternal deaths occur worldwide each year, an extremely alarming figure. Although rare in developed countries, maternal mortality is higher in less developed countries. Factors that contribute to reducing maternal mortality include improved social conditions, better medical care in cases of serious complications, and family planning.[6] There are several advantages to investigating MNM events compared to events with fatal outcomes, since near-miss events are more common than maternal deaths, and their review could likely yield useful information on the pathways leading to severe morbidity and mortality.[7]

The consequences of MNM are catastrophic, affecting women worldwide. Beyond the impact on the physical health of these patients, recent studies have drawn attention to the negative psychological impact of maternal morbidities. Women experience fear, birth trauma during the immediate emergency, symptoms of anxiety, and flashbacks that ultimately reduce their quality of life.[1] It is estimated that 10 to 20 million women may suffer from mental and physical disabilities as a result of childbirth complications, with a large proportion of them being discharged from the hospital before fully recovering. Most problems related to long-term postpartum complications do not lead to death, but they are significantly disabling and have social consequences and economic impacts on families, communities, and society. An analysis of the global costs of maternal disability estimated annual costs of US$6.8 billion. The economic consequence goes even further, potentially resulting in a dramatic outcome for the entire family, costing more than 34% of annual family expenses.[8]

The combined global prevalence of MNM is 19/1000, ranging from 3 in Europe to 32 per 1000 live births in Africa.[1] Thus, a significant discrepancy in the data is observed according to the region. The importance of quantifying the ratio of maternal mortality to nearmiss cases is noted. Using recently developed screening methods, the present study found an incidence of MNM of 1.6 per 100,000 live births and a mortality ratio of 233 per 100,000 live births. When compared with other locations, maternal mortality rates ranged from 70 per 100,000 live births in Zambia to 319 per 100,000 in Pakistan, with an average of 155 per 100,000 live births overall. The incidence of near-misses ranged from 0.4% in Nagpur, India, to 8.2% in Pakistan, with an average of 4.0%.[9] When compared to the African continent, the maternal mortality rate was higher in Rwanda, Nigeria, and Uganda, with 325/100,000 live births, 503/100,000 live births, and 1,088/100,000 live births, respectively.[10] In Ethiopia, the rate was 469.1 per 100,000 live births.[11]

In Turkey, the maternal mortality rate was reported as 14.7 per 100,000 live births in 2015. In Tanzania, it was 236. The rate is quite low in high-income countries, including Scotland, the United Kingdom, and Canada, where the mortality rate was 1.34, 1.2, and 0.7, respectively.[12] When compared to Latvia, a European region, analyzing data from a maternity ward assisted by WHO programs, the total annual births were 8152 with a maternal mortality ratio of 32.[13] This demonstrates a significant dominance in the rates obtained by developed countries.

Several factors and conditions influence the prognosis of a case for it to become part of the MNM statistics. In the present study, the main factor associated with mortality cases was hypertensive disorders – including pre-eclampsia, eclampsia, and HELLP syndrome, followed by hemorrhage. This can be explained by the various factors that predispose to these conditions. In the study conducted by Heitkamp et al. in 2021, the following result was obtained: in lower-middle-income countries, the most frequent cause of MNM was hemorrhage, reported in 18 of 40 studies (45%) from 10 countries. Hypertensive disorders of pregnancy were the cause of near miss in 15 studies (38%) from four countries. In upper-middle-income countries, hypertensive disorders of pregnancy were the most common cause of MNM in 15 of 29 studies.[3] In Brazil, the main cause of maternal death is also hypertensive syndromes, which denotes the severity of these situations and their contribution to the morbidity and mortality of women in the pregnancy-puerperium cycle.[14]

Analyzing hypertensive disorders, there is a large disparity within the country itself. In the northern region of Brazil, maternal mortality from these causes is three times higher compared to the southern region.[15] When comparing Brazil with the United Kingdom, one of the best countries with indicators regarding maternal mortality, while in the United Kingdom 2 women die every 4 years from eclampsia, in Brazil, 300 women die per year.[16]

There are also intrinsic conditions in patients that contribute to determining the outcome. Advanced maternal age is associated with serious maternal morbidities, and women should be aware of this if they are planning to postpone pregnancy. The literature indicated that age >30 years is associated with maternal near miss.[17] Cesarean delivery is also associated with severe maternal morbidity in current and future pregnancies.[16] The data found in the literature correspond to the present study, with the average age obtained being 30 years and

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the cesarean section rate among multiparous women being equivalent to 60.78%.

Maternal deaths are considered the "tip of the iceberg" of severe maternal morbidity, because for every woman who dies, many more women will survive serious pregnancy complications. The importance of studying and analyzing MNM cases is notable, in order to address the shortcomings of each service and drastically reduce this number. The more we discuss this, the more professionals can learn globally and intervene. When analyzing scientific publications on this subject, the country that publishes the most is Brazil, followed by the USA. India, the United Kingdom, Uganda, and China follow in this ranking. Given that maternal mortality in low-income countries is higher compared to high-income countries, one would expect high-income countries to be among the top ten in terms of scientific output on maternal mortality.[18]

Analyzing global production, the relevance of the topic for further discussion is reiterated. In 2000, the United Nations (UN) held a conference to establish proposals for the Millennium Development Goals, with objectives to be achieved by 2015, among which was a significant reduction in maternal mortality.

In 2015, a new UN meeting was held, where objectives for sustainable development were determined. The third of these objectives aimed to "Ensure healthy lives and promote well-being for all," and one of its principles included reducing maternal mortality, with the proposal that it should not exceed a rate of 70 women per 100,000 live births by 2030.[19,20]

Conclusion

The rates of maternal mortality and mortality in our hospital were higher than in high-income countries, but lower than in some low- and middle-income countries. Hypertensive disorders and obstetric hemorrhage were the main conditions related to these cases. However, the observed rates for these causes were low, reflecting the good quality of maternal care and well-equipped units. One of the positive aspects of the service is the availability of Intensive Care Units, which provide safety for professionals and allow for better patient management. Adopting the concept of M NMaths) in the health system and using it as an indicator to evaluate maternal health facilities is crucial to prevent maternal deaths.

It is suggested that interventions be implemented to improve care, including audits and feedback collection, involvement of opinion leaders and good management, development and use of local protocols, prospective case identification, reminders and educational activities, and the use of evidence-based checklists. A data system for joint and uniform analysis of nearmiss data should be developed and implemented, with a coordinator in each institution – a suggestion already applied in some locations that demonstrate good results. (SERRUYA et al., 2023)

Thus, the importance of this topic and the discussion of ways to improve MNM cases is noteworthy, in order to reduce the incidence of events that cause poor outcomes, helping to improve maternal morbidity and mortality, an important indicator of the health of a service.

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Conflict of interest

Nothing to declare.

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