Obstetric Near-Miss Cases – Data from The First Nine Years of a New Portuguese Hospital

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Abstract

Aim: The concept of monitoring "near-miss" events or severe maternal morbidity has been implemented to gather essential insights into the quality of obstetric care. Our aim is to determine and analyze the maternal near-miss cases among women admitted to the intensive/intermediate care unit at our institution and determine the maternal near-miss to mortality ratio.

Methods: This is a retrospective observational non-interventional study. An audit was made of pregnant women or women within 42 days after the termination of pregnancy that were admitted to the intensive/intermediate care unit at our institution, between January 2012 and December 2020. A near-miss case was defined according to organ dysfunction-based criteria, which include the clinical, laboratory, and management-based criteria laid down by WHO 2009. A descriptive analysis of the results was conducted. Maternal near-miss cases were classified based on their primary underlying cause. Maternal mortality during the same period was also analyzed.

Results: During the study period, there were a total of 128 women admitted to the intensive/intermediate care unit. There were a total of 68 near-misses and two maternal deaths. The near-miss to mortality ratio was 34:1. Among the underlying causes of near-miss events, obstetric hemorrhage (mostly post-partum hemorrhage) and hypertensive disorders were the leading causes. They were followed by medical/surgical/mental disease or complication, other obstetric disease or complication, coincidental conditions and pregnancy-related infection.

Conclusion: Hemorrhage and hypertensive disorders were the leading causes of near-miss events. Identifying near-miss cases would improve data quality and enable comparisons across institutions and countries.

Keywords: Maternal Near-Miss, Maternal Death, Maternal Morbidity, Obstetric Hemorrhage, Hypertensive Disorders

1. Introduction

Over the last century, maternal mortality in Portugal has markedly decreased, declining from 115.5 per 100,000 births in 1960 to 10.4 per 100,000 births in 2019 [1]. This significant improvement is credited to several factors, including the availability of antibiotics and blood transfusion facilities, advancements in women's education and socioeconomic status, and enhanced healthcare services. With declining maternal mortality rates in developed countries, cases of maternal death, particularly within a single institution, have become uncommon. Therefore, assessing the quality of maternal care within the healthcare system through an audit of maternal deaths is difficult.

In this context of low maternal mortality, monitoring "near-miss" events or severe maternal morbidity has been introduced to gather valuable insights into the quality of obstetric care. This approach is now considered a more effective indicator of maternity care quality than mortality alone [2-8]. The advantage of assessing near-miss cases relates to the fact that maternal near-miss cases and maternal death cases share similar pathologic pathways [2]. Additionally, near-miss events occur more frequently than maternal deaths, offering greater potential to identify and understand limitations within the healthcare system. [9].

Until recently, no standardized criteria existed for routinely identifying these cases [10]. However, in 2009, the World Health Organization (WHO) introduced near-miss criteria to establish a consistent and standardized approach for identifying such cases [11]. A maternal near-miss 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" [11]. In our study, we aimed to determine and analyze the maternal near-miss cases among women admitted to the intensive/intermediate care unit at Hospital Beatriz Ângelo, in Portugal, and also determine the maternal near-miss to mortality ratio.

2. Material and Methods

This was a retrospective observational non-interventional study, conducted at Hospital Beatriz Ângelo, in Portugal. All pregnant women or women within 42 days after the termination of pregnancy that were admitted to the intensive/intermediate care unit at our institution, between January 2012 and December 2020, were elegible for inclusion. A database was constructed and the electronic records of each potential near-miss case were reviewed.

In our study, a near-miss case was defined according to organ dysfunction-based criteria, which include the clinical, laboratory, and management-based criteria laid down by WHO 2009. Whenever any of the clinical, laboratory, or management criteria were fulfilled, a structured data form was completed, including age, parity, previous medical history, the reason for hospital admission, gestational age at admission/termination of pregnancy, newborn Apgar score, and weight, duration of intensive care stay, duration of hospital stay, mode of pregnancy termination/delivery, severe maternal complications, critical interventions (laparotomy, use of blood products, interventional radiology), and type of treatment.

All data was incorporated into an Excel spreadsheet. A descriptive analysis of the results was conducted. Cases of maternal near-miss were classified according to the primary underlying cause, defined as the disease process most likely leading to the near-miss, and included: obstetric hemorrhage, hypertensive disorders, infection related to pregnancy, another disease or obstetric complication, medical/surgical/mental disease or complication, coincident conditions or unknown condition. Maternal mortality during the same period was also analyzed. We also estimated the maternal near-miss to mortality ratio, defined as the number of maternal near-miss cases in relation to the number of maternal deaths.

This project was approved by the Ethics Committee of our institution - Hospital Beatriz Ângelo's Health Ethics Committee (Reference number 3690/2021_MJHMAB/FB). No identifying information is included in the article.

3. Results

During the study period, there were a total of 128 women admitted to the intensive/intermediate care unit. There was a total of 68 near-misses and two maternal deaths, and therefore the near-miss to mortality ratio was 34.1. The mean age at the time of near-miss diagnosis was 31.8 years. Forty-seven percent of the women classified as near-miss were nulliparous and 52.9% were multiparous. Table I shows the reason for hospital admission of the near-miss cases and table II shows the relevant medical history.

Table 1: Reason for Hospital Admission of the Obstetrics Near-Miss Cases

REASON FOR HOSPITAL ADMISSION	n (%)
Spontaneous labor	11 (16,2%)
Hypertensive disorders	11 (16,2%)
Induction of labor	10 (14,7%)
2nd/3rd trimester bleeding	5 (7,4%)
Fetal growth restriction	4 (5,9%)
Elective cesarean section	4 (5,9%)
Pneumonia	4 (5,9%)
Preterm premature rupture of membranes	4 (5,9%)
Pyelonephritis	2 (2,9%)
Shock	2 (2,9%)
Post-partum bleeding	2 (2,9%)
Fetal death	1 (1,5%)
Endometritis	1 (1,5%)
Threat of preterm birth	1 (1,5%)
Acute abdomen	1 (1,5%)
Hyperemesis gravidarum	1 (1,5%)
Pericarditis	1 (1,5%)
Vasocclusive crisis	1 (1,5%)
Premature rupture of membranes	1 (1,5%)
Non-reassuring CTG	1 (1,5%)

Table 2: Medical History of the Obstetrics Near-Miss Cases

MEDICAL HISTORY	n (%)
Preeclampsia	9 (13,2%)
Chronic hypertension	8 (11,8%)
Hematologic disease	6 (8,8%)
Gestational diabetes	3 (4,4%)
Gestational hypertension	3 (4,4%)
Obesity	3 (4,4%)
Asthma	2 (2,9%)
Renal disease	2 (2,9%)
Thyroid disease	2 (2,9%)
Cardiac disease	1 (1,5%)
Diabetes mellitus	1 (1,5%)
Lupus	1 (1,5%)
Others	7 (10,3%)

Regarding the gestational age at the time of near-miss diagnosis, 1.5% of the women were below 12 weeks, 10.3% of the women were between 13 and 28 weeks, 85.3% of the women were more than 28 weeks and 2.8% of the cases were puerperal women. The mean gestational age was 34.3 weeks. Figure 1 shows the final mode of pregnancy termination for the near-miss cases.
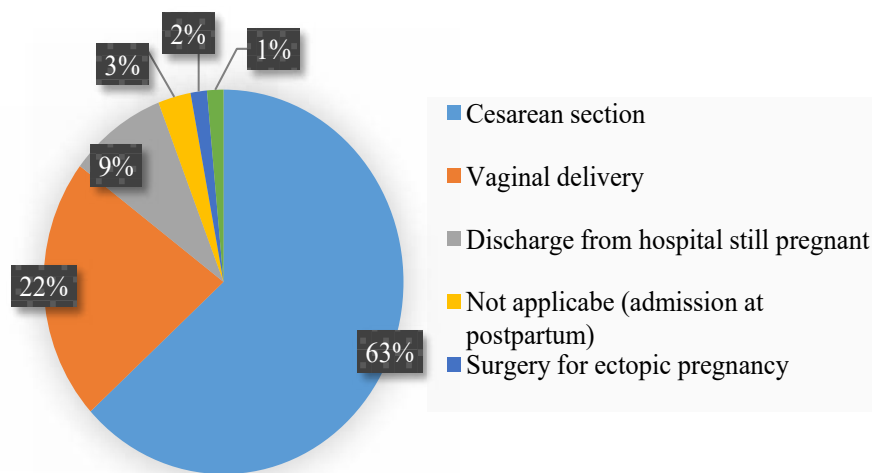

Figure 1: Final Mode of Pregnancy Termination for Obstetrics Near-Miss Cases

From the group of women who terminated the pregnancy with a delivery, the majority had a cesarean section (74.1%), 17.2% had an eutocic delivery, 5.2% had a vacuum delivery and 3.4% had a forceps delivery. The majority of the deliveries were preterm (58%).We registered four fetal deaths: two of them were due to placental abruption, at 33+2/7 weeks and 33+6/7 weeks; one of them was due to HELLP syndrome with evolution to eclampsia at 27+2/7 weeks and the other was related to placenta previa with severe hemorrhage and anhydramnios at 26 weeks of the 62 alive newborns, the mean Apgar score at the first minute was 7.5 and at the fifth minute was 9.0.Table III shows the distribution of organ dysfunction criteria. Figure 2 shows the distribution of severe maternal complications.

Table 3: Organ Dysfunction Criteria Met by the Near-Miss Cases

ORGAN DYSFUNCTION CRITERIA	n (%)
Shock	24 (35,3%)
Intubation or ventilation not related to anesthesia	19 (27,9%)
Massive transfusion of blood or red cells (>5 units)	19 (27,9%)
Severe acute thrombocytopenia (<50 000 platelets/ml)	18 (26,5%)
Failure to form clots	17 (25,0%)
Hypoperfusion (lactate >5mmol or > 45mg/dL)	13 (19,1%)
Use of continuous vasoactive drugs	13 (19,1%)
Uterine hemorrhage or infection leading to hysterectomy	11 (16,2%)
Severe hypoxemia (O2 saturation <90% for >60 minutes)	10 (14,7%)
Oliguria non-responsive to fluids or diuretics	3 (4,4%)
Severe tachypnea (>40 breaths per minute)	2 (2,9%)
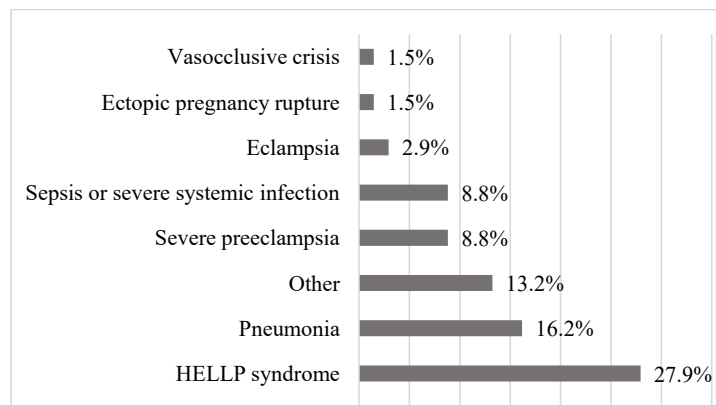
Figure 2: Severe Maternal Complications

We emphasize that three out of the 11 cases of pneumonia that we registered, were cases of pneumonia to the SARS-CoV-2 virus. About the use of interventions, we analyzed the treatment of postpartum hemorrhage, the use of anticonvulsant drugs, anti-hypertensive drugs, antibiotics and fetal lung maturation. We registered the use of oxytocin in 30.9% of the women, misoprostol in 29.4%, sulprostone in 13.2%, tranexamic acid in 17.6%, removal of retained products in 8.8%, balloon tamponade in 10,3%, hemostatic sutures in 2.9% and hysterectomy in 17.6%. Magnesium sulfate was used in about a third of the women (30.9%) and other anticonvulsant drugs in 4.4%. For hypertension, nifedipine was the most used drug (33.8%), followed by intravenous labetalol (22.1%) and methyldopa (13.2%), while there was a necessity to use other drugs in 13.2% of the cases. Prophylactic antibiotics were used in all cesarean sections. Therapeutic antibiotics were used in 36.8% of the women. Fetal lung maturation was made in 35.3% of the cases.

As far as critical interventions are concerned, we registered laparotomy in 20.6% of the women and the use of blood products in more than half of the women (55.9%). The mean duration of the total hospital stay was 9.1 days, and for the intensive/intermediate care unit stay was 3.3 days. We registered three readmissions during the study period and there were two women transferred from another hospital. Among the underlying causes of near-miss events, obstetric hemorrhage (mostly post-partum hemorrhage) and hypertensive disorders were the leading causes with 36.8% and 32.4%, respectively. They were followed by medical/surgical/mental disease or complication in 23.5% (mostly pneumonias), other obstetric disease or complication in 2.9%, coincidental conditions in 2.9% and pregnancy-related infection in 1.5%. We registered an abortive outcome (abortion/ectopic pregnancy) in 2.9% of the cases.

We registered two cases of maternal death during the study period. One of them was 20 weeks pregnant with twins, previously healthy, admitted because of rupture of membranes, with anhydramnios of the first fetus. She refused to terminate the pregnancy. After ten days of clinical and analytical stability, and despite the use of antibiotics, she suddenly progressed to severe sepsis, and a cesarean was performed for maternal aggravation, during which the woman and both fetuses died. The other case was a 39 weeks pregnant woman admitted for induction of labor due to chronic hypertension; after a spontaneous vaginal delivery, she evolved into a shock state after an acute episode of epigastric pain; she was submitted to exploratory laparotomy and it was noted persistent hemorrhage in the left hypochondrium near the splenic hilum with extensive hemoperitoneum and retroperitoneal hematoma. Splenectomy and hemostatic packing were performed 14 blood units were used in total. The woman died short after the surgery, due to a fulminating hypovolemic shock.

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4. Discussion

In this study, we registered 68 near-miss cases among women admitted to intensive/intermediate care units in our institution. The main causes were obstetric hemorrhage (mostly post-partum hemorrhage) and hypertensive disorders of pregnancy, as reported in other studies [1, 8, 12,13]. Post-partum hemorrhage was found to be the most common obstetrics cause of near-miss, reinforcing the need for continuous vigilance in the peripartum period.

A WHO systematic review on the global causes of maternal mortality found that obstetrics hemorrhage was the leading cause, with post-partum hemorrhage accounting for two-thirds of all such deaths [14]. Blood transfusion services are of paramount importance to prevent death from hemorrhage. The mean age of 32 years detected in this study for near-miss cases was similar to the mean age reported in the literature [1,8]. As more women choose to postpone childbearing, the heightened risks associated with pregnancy in older women have posed challenges for the healthcare system. [15].

In our study, we had a cesarean rate of 74.1%, which is a much higher rate than the general cesarean rate in Portuguese hospitals (37.8% in 2022) [16]. Although women who undergo a cesarean section face a higher risk of becoming a near-miss compared to those who deliver vaginally [17,18], a cesarean may also result from an underlying potentially life-threatening condition for which the mother was admitted. Nonetheless, cesarean delivery remains an independent risk factor for maternal morbidity and mortality compared to vaginal delivery, even when performed before labor [19].

Our near-miss to mortality ratio was 34.1, which means that for every 34 life-threatening conditions there was one maternal death. This ratio generally reflects the quality of care within the healthcare facility; a low ratio suggests poorer care, indicated by a high number of near-miss cases leading to maternal deaths. If the near-miss to mortality ratio increases over time, it reflects the improvement achieved in obstetrics care. So, we think it's useful to estimate this ratio periodically, which may help us improve the care provided.

The near-miss to mortality ratio is highly variable among studies, mainly because of the different criteria used to define a near-miss case. In studies where disease-specific criteria were used, the morbidity to mortality ratio in Europe was 117-223:1 [6,10]. In a Scottish study, using organ-dysfunction based criteria, the ratio was 49:1 [5]. In developing countries, the ratio varies between 5-12:1 [20,21]. The type of criteria used to define a near-miss event can massively influence the total number of those cases and therefore the near-miss to mortality ratio. Our study uses organ-dysfunction based criteria only in women admitted to intensive/intermediate care units, which can underestimate the total number of near-miss cases. If we considered that every women admitted to ICU were near-misses, then the near-miss to mortality ratio of our study would be 68.1. These examples underscore the necessity for a dedicated database focused on severe obstetric morbidity, along with continuous and precise monitoring within hospitals to identify and analyze relevant cases. Examining near-miss events also provides an opportunity to gain insights into the circumstances that may have contributed to morbidity.

The limitations of this study include the retrospective design, being a single audit and the enrolment of only the women admitted to intensive/intermediate care units. Some studies concluded that only about one-third of women with severe acute maternal morbidity are transferred to intensive care, possibly because many obstetrics facilities can and do provide a high level of care [1,5]. Therefore, the number of maternal near-miss cases found in this study might be underestimated.

Moreover, extending the audit period would have enabled a more thorough epidemiological analysis of cases to pinpoint potential risk factors. Research has shown that age and socioeconomic status, among other factors, significantly contribute to morbidity, and a larger cohort would help determine whether these associations are evident [22,23].

5. Conclusion

In conclusion, hemorrhage and hypertensive disorders emerged as the leading causes of near-miss events. Reviewing maternal near-miss cases helps in identifying the pattern of severe maternal morbidity and mortality. The WHO near-miss criteria effectively identified cases of severe morbidity and may serve as an appropriate framework for determining maternal near-miss cases in Portugal. Identifying these cases would improve data quality and enable comparisons across institutions and countries.

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