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Maternal near-miss patients and maternal mortality cases in a Turkish tertiary referral hospital

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ABSTRACT

Objectives: This study aimed to estimate the incidence of maternal near-miss (MNM) morbidity in a tertiary hospital setting in Turkey.

Material and methods: In this retrospective study, we concluded 125 MNM patients who delivered between January 2017 and December 2017 and fulfilled the WHO management-based criteria and severe pre-eclamptic and HELLP patients which is the top three highest mortality rates due to pregnancy. Two maternal death cases were also included. The indicators to monitor the quality of obstetric care using MNM patients and maternal deaths were calculated. Demographic characteristics of the patients, the primary diagnoses causing MNM and maternal deaths, clinical and surgical interventions in MNM patients, shock index (SI) value of the patients with obstetric hemorrhage and maternal death cases were evaluated.

Results: The MNM ratio was 5.06 patients per 1000 live births. Maternal mortality (MM) ratio was 8.1 maternal deaths per 100 000 live births. SMOR was 5.14 per 1000 live births. The MI was 1.57%, and the MNM/maternal death ratio was 62.4:1. The SI of MNM patients with obstetric hemorrhage was 1.36 ± 0.43, and the SI of the patient who died due to PPH was 1.74.

Conclusions: The MNM rates and MM rates in our hospital were higher than high-income countries but were lower than in low- and middle-income countries. Hypertensive disorders and obstetric hemorrhage were the leading conditions related to MNM and MM. However, the MIs for these causes were low, reflecting the good quality of maternal care and well-resourced units. Adopting the MNM concept into the health system and use as an indicator for evaluating maternal health facilities is crucial to prevent MM.

Key words: maternal near-miss; maternal mortality; mortality index

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INTRODUCTION

Maternal mortality (MM) is still unacceptably high and remains a public health problem worldwide. It was reported that approximately 830 women die every day due to preventable causes related to pregnancy and childbirth-related complications, and the majority of these deaths occur in low- and middle-income countries [1]. Following the United Nations Millenium Development Goals signed in 2005, the goal of 'improving maternal health', which aims to reduce MM by 75% between 1990 and 2015, has been determined [2]. The number of maternal deaths, which was 390 000 in 1990, was 275 000 in 2015 with a decrease of 30% [3]. Although this target could not be met, it was stated that the reduction in maternal mortality has accelerated in many countries of the world after 2005. In Turkey, the maternal mortality rate was reported as 38.3 per 100 000 live births in 2005 and 14.7 per 100 000 live births in 2015 [4]. This remarkable improvement has been associated with several factors, such as increased birth rates in healthcare facilities, more available access to antibiotics and blood products, increased education and socioeconomic prosperity of women, and improvements in the provision of health care.

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The Sustainable Development Goals (SDGs), which adopted by all United Nations Member States in 2015, has the purpose of ending preventable maternal death by reducing the MM ratio by two-thirds by 2030 [5]. Since maternal deaths are rare even in facilites with comparatively high MM, the number of deaths is frequently insufficient to assess interventions aiming to improve maternal outcomes [6]. Also, maternal deaths are considered the 'tip of an iceberg' of severe maternal morbidity, in that for every women who dies many more women will survive serious pregnancy complications [7]. Therefore, maternal morbidity is a component of continuity that may reach from good maternal health to MM. In 2009, the WHO recommended the concept of maternal near-miss (MNM) for assessing the quality of maternal care for life-threatening pregnancy complications [8]. MNM patients have similar demographic characteristics and pathological processes as maternal deaths, with the advantages of giving a more significant number of cases for analysis, higher acceptability of individuals and facilities since death did not occur, and the opportunity of questioning the patient herself [9].

The WHO defined an MNM patient as a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy [10]. Also, the WHO developed a tool to identify MNM patients. However, routine implementation and broader utilisation of the MNM concept as a standard tool for developing maternal care has been limited due to the lack of a standard description and unique case-identification criteria. There are three distinct approaches to identifying MNM: clinical criteria related to a specific disease entity, intervention-based criteria, and organ system dysfunction based criteria (Tab. 1) [10]. Depending on the region and the specific criteria used, the prevalence of MNM ranges from 0.5% to more than 40% of all live delivery hospitalizations [11]. However, there is currently no central database for MNM patients in Turkey.

This study aimed to estimate the incidence of MNM morbidity in a tertiary hospital setting in Turkey.

MATERIAL AND METHODS

We concluded 125 MNM patients who delivered at Department of Obstetrics and Gynecology of Diyarbakır Gazi Yaşargil Training and Research Hospital between January 2017 and December 2017 and fulfilled the WHO management-based criteria and severe pre-eclamptic and HELLP patients which is the top three highest mortality rates due to pregnancy [12, 13]. Two maternal death cases were also included. Our hospital is a tertiary center and about 25,000 deliveries per year occurred. The local ethical committee approved this retrospective study. Data were collected from our clinical database.

All patients were followed up in the intensive care unit (ICU) of the hospital. Patients who fulfilled the WHO management-based based criteria for MNM, severe pre-eclamptic patients and patients with HELLP syndrome were enrolled. In the WHO clinical criteria, pre-eclamptic patients with jaundice were classified [12]. Otherwise, we included severe pre-eclamptic patients because severe pre-eclampsia could be complicated. It should be a critical factor for MNM cases in obstetric practice, and it is a potentially life-threatening condition. Mild pre-eclampsia, mild hemorrhage, and other patients who did not meet the WHO criteria were excluded.

Patient characteristics including age, parity, the gestational week at birth, previous cesarean section history, mode of delivery, the primary diagnoses causing MNM and

Table 1. The WHO MNM criteria

Clinical criteria	Laboratory-based criteria	Management-based criteria
Shock	pH < 7.1 (severe acidosis)	Cardio-pulmonary resuscitation (CPR)
Gasping	PaO_2/FiO_2 < 200 mmHg	Continuous use of vasoactive drugs
Acute cyanosis	Lactate > 5	Dialysis for acute renal failure
Clotting failure	Oxygen saturation < 90% for ≥ 60 minutes	Transfusion of ≥ 5 units of red blood cells
Respiratory rate > 40/min (severe tachypnea) or < 6/min (severe bradypnea)	Loss of consciousness and the presence of ketoacids in urine	Intubation and ventilation for ≥ 60 minutes not related to anaesthesia
Oliguria non-responsive to fluids or diuretics	Creatinine ≥ 300 µmol/L or ≥ 3.5mg/dL	Hysterectomy due to infection or hemorrhage
Loss of consciousness lasting ≥ 12 hours	Bilirubin >100 µmol/L or > 6.0 mg/dL	
Loss of consciousness and absence of heart beat	Acute thrombocytopenia (< 50 × 10^3/µL)	
Stroke		
Uncontrollable fit/status epilepticus		
Jaundice in the presence of preeclampsia		

WHO — World Health Organization

maternal death, requiring clinical and surgical interventions, length of ICU stay, and length of hospital stay were recorded. The indicators to monitor the quality of obstetric care using MNM patients and maternal deaths were calculated.

Women with life-threatening conditions (WLTC) refer to all women who either qualified as having MNM or who died (WLTC = MNM + MD). MNM incidence ratio refers to the number of MNM cases per 1,000 live births (MNM IR = MNM/LB). MM ratio refers to the number of maternal death cases per 100 000 live births. Severe Maternal Outcome Ratio (SMOR) refers to the number of women with life-threatening conditions per 1,000 live births [SMOR = (MNM + MD)/LB]. Mortality index refers to the number of maternal deaths divided by the number of patients with life-threatening conditions [MI = MD/(MNM + MD)]. Shock index (SI) defined as the ratio of pulse to systolic blood pressure [14].

Statistical analyses

IBM SPSS 21.0 for Windows (SPSS Inc., Chicago, IL, USA) statistical package program was used for statistical evaluation of our research data. A descriptive analysis of the records was performed following completion of the audit. Continuous variables were presented as mean±standard deviation. Categorical variables were presented as frequencies and percentage.

RESULTS

During the study period, there were 25 088 deliveries and 24 693 live births in our hospital. A total of 125 MNM patients and two maternal deaths in the intensive care unit were identified. Therefore, there were 127 women with life-threatening conditions. The indicators to monitor the quality of obstetric care using MNM patients and maternal deaths are summarized in Table 2. The MNM ratio was 5.06 patients per 1000 live births. MM ratio was 8.1 maternal deaths per 100 000 live births. SMOR was 5.14 per 1000 live births. The MI was 1.57%, and the MNM/maternal death ratio was 62.4:1.

Demographic characteristics of the MNM patients and maternal death cases are summarized in Table 3. The maternal age of 70.4% of MNM patients ranged from 19–34 years, and 78.4% of MNM patients had parity between 1–4. Deliveries of 65.6% of the MNM patients were performed by cesarean section.

The primary diagnoses causing MNM and maternal deaths are summarized in Table 4. Severe pre-eclampsia, obstetric hemorrhage and HELLP were the most common primary diagnoses causing MNM, valuing for 54 (43.2%), 58 (46.4%), and 9 (7.2%), respectively. Less frequent diagnoses causing MNM were eclampsia and status epilepticus, valuing for 3 (2.4%), and 1 (0.8%), respectively. The diagnoses of maternal death cases were obstetric hemorrhage (one patient) and severe pre-eclampsia (one patient). Obstetric hemorrhage and hypertensive disorders had very low MI of 1.8% and 1.4%, respectively.

The mean SI value of MNM patients due to severe obstetric bleeding was 1.36 ± 0.43.

Table 5 presents that 125 patients with MNM underwent clinical and surgical interventions. Some MNM patients experienced more than one intervention. All MNM patients were hospitalized in the ICU and followed-up at the ICU until their clinical findings improved. Fifty-four patients underwent ≥five units of red blood cell transfusion, four patients

Table 2. The indicators to monitor the quality of obstetric care using maternal near-miss patients and maternal deaths

Indicators	
Total deliveries, n	25 088
Live births, n	24 693
MNM patients, n	125
Maternal deaths, n	2
MNM ratio, per 1000 live births	5.06
MM ratio, per 100 000 live births	8.1
SMOR, per 1000 live births	5.14
MI, %	1.57
MNM/maternal death ratio	62.4:1

SMOR — severe maternal outcome ratio; MI — mortality index; MNM — maternal near-miss

Table 3. Demographic characteristics of the patients

	MNM patients (n = 125)	Maternal deaths (n = 2)
Maternal age, n (%)		
≤ 18 years	1 (0.8%)	
19–34 years	88 (70.4%)	
≥ 35 years	36 (28.8%)	2 (100%)
Parity, n (%)		
0	19 (15.2%)	
1–4	98 (78.4%)	
≥ 5	8 (6.4%)	2 (100%)
Gestational week, n (%)		
≥ 34 w	72 (57.6%)	
< 34 w	53 (42.4%)	2 (100%)
Previous cesarean, n (%)		
No	79 (63.2%)	2 (100%)
Yes	46 (36.8%)	
Mode of delivery, n (%)		
Vaginal	43 (34.4%)	1 (50%)
Cesarean	82 (65.6%)	1 (50%)

MNM — maternal near-miss

Table 4. The primary diagnoses causing maternal near-miss and maternal deaths

Causes	MNM patients (n = 125)	Maternal deaths (n = 2)	Mortality index
Obstetric hemorrhages, n (%)	54 (43.2%)	1 (50.0%)	1.8%
Shock index, mean ± std	1.36 ± 0.43	1.74	
Hypertensive disorders, n (%)	70 (56.0%)	1 (50%)	1.4%
Severe pre-eclampsia, n (%)	58 (46.4%)	1	1.7%
HELLP, n (%)	9 (7.2%)	–	–
Eclampsia, n (%)	3 (2.4%)	–	–
Status epilepticus, n (%)	1 (0.8%)	–	–

MNM — maternal near-miss

Table 5. Clinical and surgical interventions in maternal near-miss patients (n = 125)

Intervention	n (%)
ICU admission	125 (100%)
≥ 5 units of red blood cell	54 (43.2%)
Hysterectomy following hemorrhage	4 (3.2%)
Continuous use of vasoactive drugs	2 (1.6%)
Intubation and ventilation	1 (0.8%)
Dialyses for acute renal failure	1 (0.8%)

ICU — intensive care unit

underwent a peripartum hysterectomy, two patients experienced continuous use of vasoactive drugs, one patient underwent intubation and ventilation, and one patient experienced dialysis for acute renal failure. Also, eight patients with severe postpartum bleeding experienced intrauterine balloon tamponade, and two of the patients who underwent peripartum hysterectomy had simultaneously undergone bilateral internal iliac artery ligation.

The mean duration of ICU stay in MNM patients was 2.6 ± 0.4 days, and the mean length of hospital stay was 5.8 ± 0.6 days.

When we examined maternal death cases, one was a severe postpartum hemorrhage patient due to postpartum atony. The SI of this patient was 1.74 and died to hypovolemic shock despite massive blood transfusion. The other maternal death case had acute respiratory distress syndrome due to severe pre-eclampsia.

DISCUSSION

The present study utilised the WHO MNM standard audit tool for describing and examining MNM patients, as well as calculating proposed indicators. The WHO management-based criteria were strictly followed to classify patients as MNM. However, we modified the WHO list of MNM to include the added categories of severe pre-eclampsia and eclampsia. Since MNM patients are related predominantly to organ system dysfunction, and pre-eclampsia/eclampsia are spread across multiple organ systems, the WHO audit tool cannot define the exact rate of MNM patients.

The MNM ratio may vary due to the wide variation in the identification of MNM patients. Also, the MNM ratio is higher in low- and middle-income countries [15]. This study revealed the incidence of MNM to be 5.03/1000 live births, which is comparable to studies in Australia and the Netherlands, with rates of 7.0, and 7.1, respectively [16, 17]. In a study conducted by Nelissen et al. [18], the MNM ratio in Tanzania was much higher when compared to our study, which reported 23.6/1000 live births. However, our MNM ratio was higher than in various high-income countries, including Scotland, the UK and Canada, where the MNM ratio was 1.34, 1.2, and 0.7, respectively [19]. This result could be explained firstly by the fact that we have a less-developed health system; secondly, we used a more comprehensive description of MNM, which involved severe pre-eclampsia and eclampsia patients.

This study found that hypertensive disorders and obstetric hemorrhages were frequent contributors to MNM, consistent with the literature [20]. Also, these leading underlying causes are similar to the top causes of MM. This similarity proves that the concept of MNM can be a placeholder for MM. The MM ratio in our study was 8.1 per 100 000 live births, which is lower than the national level of 14.7 per 100 000 live births, and lower from worldwide [4]. The ratio of MNM patients to MM was 62.4 to 1. This ratio was 49 to 1 in Scotland, 53 to 1 in the Netherlands, and 117 to 1 in the UK [17, 19]. Therefore, for studies attempting to confirm a notable improvement in outcomes by intervention, the number of subjects required to show a notable difference with MNM as an outcome would be much less than if MM only was the outcome [6]. Also, the higher ratio of MNM events to MM indicates better quality of care. This ratio was observed to be lower in poor resource settings in Asia and Africa when compared to high-income countries [19]. In an Indian study conducted by Abha et al. [21], this ratio was 2 to 1.

The overall MI was 1.57%, which is comparable to the studies from developed countries [19]. The MI was 1.8% for obstetric hemorrhages, and 1.4% for hypertensive disorders. The lower MIs for MNM patients in our hospital indicates the quality of maternal care and a functional health system. The WHO reported that obstetric hemorrhage was the leading cause, with postpartum hemorrhage (PPH) accounting for 2/3 of all maternal deaths. Severe PPH may cause to multiorgan dysfunction and requires multidisciplinary strategies in well-resourced units. The availability of uterotonics, blood and blood products, and interventions to end hemorrhage are crucial to improving standards of maternal health care [22]. Tahaoğlu et al. reported that the incidence of emergency peripartum hysterectomy was 0.77 per l000 live births in the same population in 2013 [23]. In this study, the incidence was 3.2% in MNM patients. Also, previous researches have reported a higher case mortality rate of hypertensive disorders, and was stated to be due to insufficient management of these cases [8]. In our clinical protocol, all MNM patients with hypertensive disorders received Magnesium sulphate treatment in ICU. The ICU follow-up rate among MNM patients is low, and most deaths occurred without being accepted into ICU [8]. Otherwise, in this study, there were no patients with puerperal sepsis, which has been responsible as many as 30% of maternal deaths in low and middle-income countries [20].

The hemodynamic changes of gestation may mask the impending hypovolemic shock, causes conventional vital signs to be less helpful, and signs taken in isolation may neglect impending deterioration [14]. Lee et al. [24] reported that a shock index higher than 0.9 had high sensitivity and specificity for prediction of massive transfusion and invasive procedures. El Ayadi et al. [14] recommended a shock index threshold of ≥ 1.4 indicating an urgent need for intervention, and ≥ 1.7 indicating a high risk of adverse outcome. In this study, the SI of MNM patients with obstetric hemorrhage was 1.36 ± 0.43, and the SI of the patient who died due to PPH was 1.74.

There are some limitations to this study. This study has been designed retrospectively and has the potential to contain limitations of such studies. Because of the dependence on information reported in the patient record, we could not identify risk factors for all MNM patients. The study was conducted for a one-year duration, so the number of patients were not adequate to conclude the less frequent causes of MNM. Our hospital is a tertiary referral center, and the hospital-based data might have cause to overestimating MNM and MM ratios due to the concentration of referral MNM events. Nevertheless, we can say that this bias may affect the MI to a lesser extent considering that most women with MNM are treated in hospitals.

CONCLUSION

The MNM rates and MM rates in our hospital were higher than high-income countries but were lower than in low- and middle-income countries. Hypertensive disorders and obstetric hemorrhage were the leading conditions related to MNM and MM. However, the MIs for these causes were low, reflecting the good quality of maternal care and well-resourced units. Adopting the MNM concept into the health system and use as an indicator for evaluating maternal health facilities is crucial to prevent MM.

Conflict of interest

The authors declared no conflict of interest.

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