Maternal Near Miss Morbidity and Maternal Mortality in a Tertiary Referral Center in Turkey

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ABSTRACT

OBJECTIVE: The objective of the study is to present the maternal near miss and maternal mortality cases from a tertiary hospital and to evaluate the factors associated with the presence of maternal near miss.

STUDY DESIGN: We performed a retrospective study, including all women who fulfilled the WHO criteria for maternal near miss or death between June 2009 and June 2014 at a tertiary referral education hospital. This study was conducted to evaluate the risk factors' influence on near miss, multivariate logistic regression was used. Before setting logistic regression, univariate analyses were used to select candidate variables.

RESULTS: During the 5-year study, there were 82924 deliveries and 81673 live births. We identified 202 maternal near miss events and 11 maternal deaths. The maternal near miss ratio was 2.47 per 1.000 live births and the maternal mortality ratio was 13.46 per 100.000 live births. There were 213 women with a severe maternal outcome ratio (near miss + maternal death), with a ratio of 2.6 cases/1.000 live birth. Near miss events were associated with length of hospital stay (p<0.001), hemoglobin level (p=0.003).

CONCLUSION: By the help of the WHO near miss approach, we identified that near miss events were associated with length of hospital stay, hemoglobin level, cesarean section deliveries and parity.

Keywords: Near miss, Potentially life threatening, Maternal mortality, Maternal morbidity

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Introduction

Maternal mortality continues to be one of the most serious and intractable health problems. The deaths of more than 250.000 women during pregnancy and childbirth each year are largely preventable (1).

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Maternal near miss defined as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy" is receiving more attention and becoming an important indicator of the quality of obstetric care (2). The WHO technical working group recommends the maternal near-miss approach be considered in national plans for improving maternal health. Applying this approach should help to identify the health system shortfalls that countries need to address in order to reduce complications and fatal outcomes of pregnancy and childbirth (2).

The objective of this study was mainly to present the maternal near miss and maternal mortality cases from a tertiary referral education hospital. This is the first study from Turkey analyzing severe maternal morbidity using WHO near-miss criteria.

Material and Method

We performed a retrospective study, including all women who fulfilled the WHO criteria for maternal near miss or death between June 2009 and June 2014 at a tertiary referral education hospital. Our hospital is a tertiary health center and one of the largest public hospital in Turkey. The hospital handles about 17.000 deliveries annually, which include 5000 high

risk pregnancies. Due to our hospital's feature of being a reference hospital, high risk pregnancies are frequent. The local ethics institutional board approved the study.

Maternal death was described as death during pregnancy or within 42 days' post-partum, regardless from the length or site of pregnancy, from any cause related to or aggravated by the pregnancy or its management, yet not from accidental or incidental causes (3). For identifying near-miss cases WHO criteria were used (Table 1) (4). Women with potentially life-threatening conditions were identified according to criteria reported by WHO (Table 2) (4).

Two trained data collectors (KE, OK) assessed the medical records from patients' files. In order to identify women who had experienced a maternal near miss event or death; we assessed the files of all women who had had potentially life threatening conditions. Information on the demographic and health characteristics, pregnancy, delivery, and maternal and perinatal outcomes of individual women were recorded. We also included 2 patients with potentially life threating conditions after each maternal near miss case. Variables used for the definition of maternal near miss according to WHO criteria were retrospectively evaluated.

We calculated the maternal near miss ratio, defined as the number of maternal near miss events per 1,000 live births, and the maternal mortality ratio, defined as the number of maternal deaths per 100,000 live births. We also examined the association between maternal near miss and characteristics, namely, age, body mass index, time to start hysterectomy, length of hospital stay, hemoglobin level.

Table 1: The World healt organization maternal near miss criteria

Clinical criteria	**Laboratory-based criteria**	**Management-based criteria**
Shock	Severe hypoperfusion (lactate >5 mmol/L or >45 mg/dL),	Use of continuous vasoactive drugs
Cardiovascular arrest	Severe acidosis (pH <7.1)	Cardio-pulmonary resuscitation
Acute cyanosis	Severe hypoxemia (O_2 saturation <90% for ≥60 minutes or PAO_2/FiO_2<200	Intubation and ventilation not related to anesthesia
Gasping	Severe acute azotemia (creatinine ≥300 µmol/mL or ≥3.5 mg/dL)	Dialysis for acute renal failure
Severe tachypnea (respiratory rate >40 breaths per minute) or severe bradypnea (respiratory rate <6 breaths per minute)	Severe acute thrombocytopenia <50 000 platelets/mL)	Massive transfusion of blood or red cells (≥5 units)
Oliguria non responsive to fluids or diuretics	Severe acute hyperbilirubinemia (bilirubin >100 µmol/l or >6.0 mg/dL)	Uterine hemorrhage or infection leading to hysterectomy
Failure to form clots		
Jaundice in the presence of preeclampsia		
Any loss of consciousness not medically induced, lasting >12 hours		
Stroke		
Uncontrollable fit/status epilepticus		
Total paralysis		

Table 2: Potentially life-threatening conditions

Women with severe complications	**Women undergoing critical interventions**
Severe postpartum haemorrhage Severe pre-eclampsia Eclampsia Sepsis or severe systemic infection Ruptured uterus Other complications associated with severe maternal outcome	Use of blood products Interventional radiology Laparotomy Admission to intensive care unit

Statistics

To evaluate the risk factors', influence on near miss, multivariate logistic regression was used. Before setting logistic regression, univariate analyses were used to select candidate variables. Variables that have p values lower than 0.25 were taken as candidate variables for logistic regression. Poliserial correlation coefficient was used to define the correlation between near miss criteria and continuous variables. Type-I error rate was taken as α=0.05 for statistically significance. SPSS 22.0 and R software was used for statistical analyses.

Results

In the 5-year study period, there were 82.924 deliveries and 81.673 live births. We identified 404 women with potentially life-threatening conditions, 202 maternal near miss events and 11 maternal deaths. The maternal near miss ratio was 2.47 per 1,000 live births (95% CI) and the maternal mortality ratio was 13.46 per 100.000 live births (95% CI). There were 213 women with a severe maternal outcome ratio (near miss + maternal death), with a ratio of 2.6 cases/1.000 live birth.

For the near miss events, the main criteria were: 114 management-based criteria, 46 clinical criteria and 107 laboratory-based criteria. The combination of these criteria (laboratory and management) was able to identify 17 cases of maternal near miss.

Table 3 summarizes the background characteristics of the study population. The mean age of the patients with maternal near miss events was 30.16±6.40 compared to 32.79±5.62 years for maternal mortality patients. Gestational age at delivery reached a median of 32.5±8.5 weeks for the near miss events. The analyses revealed that the most frequent cause of maternal death was hypertensive disorders of pregnancy, followed by sepsis. For the cases of near miss, the most frequent cause was obstetric hemorrhage (n=111, 54.9%) followed by hypertensive disorders of pregnancy (n=86, 42.6%).

Near miss events were associated with length of hospital stay (p<0.001), hemoglobin level (p=0.003) (Table 4). Women who had undergone 3 or more cesarean sections were at increased risk of maternal near miss (OR=15.1, p=0.001, %95 CI, 3.277-70.114). Also women with a parity of 1-3 compared with 0 had a higher risk of being a near miss (OR=1.526, p=0.046, %95 CI, 1.008-2.310). Women with HELLP syndrome had an OR of 3.497 for occurrence of near miss compared with cases with placenta previa (p<0.001, %95 CI: 2.131-5.741) (Table 5, 6).

Table 3: Underlying causes of potentially life-threatening conditions and life threatening conditions

	Women with potentially life-threatening conditions (n=404)	Maternal near-miss cases (n=202)	Maternal deaths (n=11)*	*p*
Maternal age (y)	29.35 ± 4.77	30.16 ± 6.40	32.79 ± 5.62	0.079
Body mass index (kg/m^2)	29.04 ± 3.86	29.31 ± 4.59	Data unavailable	0.586
Parity	1.2 ±1.14	1.34 ± 1.27	1.00 ± 0.96	0.178
Gestational age (wk)	32.43 ± 2.95	32.5 ± 8.5	28.93 ± 6.86	0.882
Obstetric hemorrhage, n (%)	270 (66.8)	111 (54.9)	0	
Hypertensive disorders, n (%)	134 (33.1)	86 (42.6)	7 (64%)	
Pregnancy-related infection, n (%)	0 (0)	5 (2.5)	2 (18%)	
Clinical criteria	-	46		
Laboratory-based criteria	-	107		
Management-based criteria	-	114		

**The two remaining maternal deaths (18%) occurred out of the hospital and the reasons were not clearly defined.*

Table 4: Correlations between near miss criteria and continuous variables

	Poliserial correlation coefficient	*p*
Age	-0.014	0.871
Body mass index	-0.134	0.264
Time to start hysterectomy	0.424	<0.001
Length of hospital stay	0.300	<0.001
Hemoglobin level	-0.240	0.003
Platelet level	0.218	0.005
Number of units of blood products transfused	0.528	<0.001

Table 5: Univariate analysis of demographic and obstetric related variables of maternal near-miss and potentially life-threatening conditions

	Maternal near-miss cases (n=202)	Women with potentially life-threatening conditions (n=404)	*p*
Maternal age			
≤ 18 y	19	22	0.030
19-35 y	127	294	
> 35 y	56	88	
Parity			
0	68	179	0.028
1-3	121	209	
>3	13	16	
Gestational week			
≥34 w	109	241	0.254
<34 w	90	163	
History of cesarean			
0	146	309	0.001
1-2	45	92	
>2	11	3	
Mode of delivery			
Vaginal delivery	36	94	0.124
Cesarean	166	310	

Table 6: Logistic regression model for obstetric related variables of maternal near-miss and potentially life-threatening conditions

	B	s.h.	Wald	s.d.	*p*	OR	OR 95% CI Lower Limit	OR 95% CI Upper Limit
1CS	.101	.236	.182	1	.670	1.106	.696	1.756
2 CS	2.719	.781	12.102	1	.001	15.158	3.277	70.114
preeclampsia	-1.595	.537	8.844	1	.003	.203	.071	.580
previa	.323	.243	1.762	1	.184	1.381	.857	2.226
HELLP	1.252	.253	24.516	1	.000	3.497	2.131	5.741
atony	.575	.411	1.960	1	.162	1.778	.794	3.978
parity(1)	.422	.212	3.983	1	.046	1.526	1.008	2.310
parity(2)	.393	.472	.696	1	.404	1.482	.588	3.735
Constant	-1.410	.240	34.590	1	.000	.244		

**The table consists of multivariate logistic regression test results and the variables are elaborated simultaneously*

B s.h. Wald s.d. p OR OR CS

Discussion

Because maternal deaths are infrequent, more frequent severe maternal morbidity becomes valuable sources of information to understand the set of preventable conditions that contributes to maternal death (5).

During the study period, 202 admissions of maternal near miss occurred at the unit, with 11 maternal deaths. Our study revealed that overall maternal near miss ratio was 2.47 per 1,000 live births and the maternal mortality ratio was 13.46 per 100,000 live births which was below the ratio of Turkey in 2007-2009 periods (19.7 per 100.000 live births) (6). As one of the largest public hospital in the country, the hospital handles about 17.000 deliveries annually. A recent systematic literature review on the prevalence of maternal near miss revealed a prevalence that ranged from 0.04% to 15% depending on the criteria used to define it (7). The management based criteria identified 114 of the 202 cases.

In the present study, the analyses revealed that the most frequent cause of maternal death was hypertensive disorders of pregnancy, followed by sepsis. For the cases of near miss, the most frequent cause was obstetric hemorrhage followed by hypertensive disorders of pregnancy. Also women who had a long hospital stay and low hemoglobin level were found to be associated with the occurrence of a near miss. The results of the multivariate analysis indicated that a high cesarean section rate and parity were associated with the occurrence of maternal near miss. Litorp et al (8) also emphasized that the factors that remained significantly associated with an increased risk of severe maternal morbidity and near miss were a cesarean section in the current pregnancy.

In the study of Jabir et al (9), the maternal near-miss rate was 5.06 per 1,000 live births, while the overall maternal near miss: mortality ratio was 9:1. They found anemia (55%) and previous cesarean section (45%) to be the most common associated conditions with severe maternal morbidity. In a cross-sectional study with a nested case–control component, Galvão et al (10) found the maternal near miss ratio to be 5.8 cases/1,000 live births. In the multivariate analysis, patient's status, previous caesarian, abortion and level of consciousness were reported as significant (10).

As a doctor, obstetrician and a perinatologist, our one of the most important goal is to decrease the maternal mortality and morbidity. In this context, worldwide organizations, regional and local societies have an important role for organization of the strategies and promoting the healthcare providers (11). The maternal near-miss approach is accepted as a new strategy for improving maternal health.

The fact that this is a retrospective study in which the data were collected from patient records constitute a limitation. But the findings from this study are important because the interventions associated with an improvement in one outcome may be associated with an improvement in the other.

Ensuring that more professionals are aware of and utilize the maternal near miss events, will result in more effective medical management of these cases.

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