J Bionic Mem 2025; 5(2): 32-40 DOI: 10.53545/jbm.2025.47

Journal of Bionic Memory Original article

Maternal near miss: The crown of death in obstetrics

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ABSTRACT

Aim: Maternal near-miss is defined as a woman who survives a life-threatening condition during pregnancy, delivery, or postpartum period. Assessing near-miss cases offers a critical opportunity to apply standardized care before a fatal outcome occurs. However, there is currently no centralized database for near-miss cases in Turkey. The present study aimed to estimate the incidence and causes of near-miss cases at a tertiary hospital setting in Turkey.

Methods: This retrospective observational study was carried out at a university-affiliated research and training hospital between January 2019 and December 2022. A total of 150 maternal near-miss cases and 4 maternal deaths were analyzed. Demographic, obstetrics and laboratory characteristics were presented.

Results: The near miss ratio was 4.25 per 1,000 live births, while the maternal mortality ratio was 11.34 per 100,000 live births. It was found that 38% of patients in the maternal near-miss group had received regular prenatal care and 20% of the near-miss cases were referred to our center after delivering in an external hospital. Hypertensive disorders of pregnancy accounted for 40% of near-miss cases, while hemorrhagic conditions comprised 38%. Placental abruption and obstetric-related disseminated intravascular coagulation made up 12.6% of all cases, and other systemic diseases accounted for 9.3%.

Conclusion: Similar to maternal mortality, hypertensive disorders and hemorrhagic conditions were the leading causes of near-miss events. However, given the higher incidence of near-miss cases compared to maternal deaths, we suggest that identifying near-miss events could play a crucial role in preventing maternal mortality.

Keywords: Maternal morbidity, maternal mortality, near-miss.

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Received: 2025-07-12

Accepted: 2025-08-14 / Published: 2025-08-20

Introduction

Maternal mortality rate is one of the key indicators reflecting the overall developmental status of a country. However, focusing solely on maternal deaths overlooks the fact that many women experience severe health complications without a fatal outcome [1]. Therefore, in 2009, the World Health Organization introduced a standardized definition for near-miss cases to accurately identify such instances and establish a standardized approach. According to this definition, a near-miss case involves a woman who survives life-threatening conditions during pregnancy, childbirth, or within 42 days

postpartum [2]. Assessing near-miss cases is particularly valuable, as they occur more frequently than maternal deaths and, due to their clinical similarity, offer a critical opportunity to apply standardized care before a fatal outcome occurs [3]. Nowadays, the rate of near-miss cases is used as a measure to evaluate the quality of maternal healthcare [4].

The defining criteria include three main approaches for maternal near miss cases: clinical criteria based on specific diseases, intervention-based criteria, and criteria based on organ system dysfunction [2]. The primary pathologies contributing to maternal near-miss cases include hemorrhage, hypertensive disorders of pregnancy, sepsis, abruption placenta, placental invasion anomalies and uterine rupture [5].

It is estimated that each year, approximately 536,000 women die due to pregnancy- or childbirth-related complications, and more than 250,000 of these deaths are considered largely preventable [6,7]. Furthermore, around 99% of these cases are believed to occur in developing countries [6]. According to WHO criteria, the global prevalence of life-threatening maternal conditions in the general population is estimated to exceed 18.67 per 1,000 live births [8]. Prevalence rates vary depending on the criteria used. A systematic review utilizing disease-specific criteria reported that the frequency of maternal near-miss events ranged from 0.80% to 8.23%, whereas studies based on organ-system dysfunction criteria found rates between 0.38% and 1.09% [2]. Similarly, studies using management-based criteria reported prevalence rates ranging from 0.01% to 2.99% [2,9]. Depending on the region and the specific criteria applied, the prevalence of near miss cases has been shown to vary from 0.5% to over 40% of all live birth-related hospital admissions [10]. However, there is currently no centralized database for near miss cases in Turkey.

The present study aimed to estimate the incidence of maternal near-miss cases and identify the main contributing factors within a tertiary hospital setting in Turkey, with the goal of improving the quality of maternal care.

Materials and Methods

This retrospective observational study was carried out at a university-affiliated research and training hospital between January 2019 and December 2022. Ethical approval was obtained from the local ethics committee (Approval No: KAEK-25 2022/12-21).

All pregnant women and those within 42 days postpartum who were admitted to the intensive care unit of our hospital were identified using the hospital's electronic medical records. A total of 150 maternal near-miss cases and 4 maternal deaths were recorded. Near-miss cases were defined based on the organ dysfunction criteria established by the WHO in 2009, incorporating clinical, laboratory, and management-based indicators (Table 1) [2].

Women admitted to the intensive care unit during pregnancy or within 42 days postpartum who did not meet the WHO near-miss criteria were excluded from the study.

Participants were categorized into four groups: Group 1 – Hypertensive disorders; Group 2 – Hemorrhagic conditions; Group 3 – Placental abruption and disseminated intravascular coagulation (DIC); and Group 4 – Other systemic diseases. Group 1 comprised patients with HELLP syndrome (hemolysis, elevated liver enzymes, and low platelets), eclampsia, or severe preeclampsia. Group 2 included cases of postpartum hemorrhage, placental invasion anomalies, and uterine rupture. Group 3 consisted of patients who

Table 1. The WHO maternal near miss criteria.

Clinical Criteria	Laboratory-based Criteria	Management-based Criteria
Shock	pH< 7.1 (severe acidosis)	Cardio-pulmonary resuscitation
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 anesthesia
Oliguria non-responsive to fluids or diuretics	Creatinine ≥300 µmol/L or ≥3.5 mg/dl	Hysterectomy due to infection or hemorrhage
Loss of consciousness lasting ≥12 hours	Bilirubin >100 µmol/L or >6 mg/dl	
Loss of consciousness and absence of heart beta	Acute thrombocytopenia (<$50x10^3$/µL)	
Stroke		
Uncontrollable fit/status epilepticus		
Jaundice in the presence of preeclampsia		

developed placental abruption and obstetric-related DIC. Group 4 encompassed individuals diagnosed with pulmonary edema, sepsis, shock, cardiac arrest, or systemic lupus erythematosus.

Demographic characteristics such as age, parity, gravida, body mass index, gestational week, birth week, delivery mode, chronic illnesses, laboratory results, hospitalization time, the amount of blood and blood product transfusion, surgical interventions were collected from the hospital's electronic medical records.

Statistical analysis

Shapiro Wilk test was used to assess the normality of the distribution of variables. Descriptive statistics were expressed as mean ± standard deviation with minimum and maximum values for continuous variables and frequency (percentage) for categorical variables. The SPSS 22.0 (SPSS Inc; Chicago, IL, USA) software was used for all statistical analyses.

Results

During the study period, a total of 35,246 live births and 473 stillbirths occurred at our hospital. The study included 150 maternal near-miss cases and 4 maternal deaths. The near miss ratio was calculated as 4.25 per 1,000 live births, while the maternal mortality ratio was 11.34 per 100,000 live births. The demographic and peripartum characteristics of near-miss and maternal mortality cases were presented in Table 2.

Table 2. The demographic and peripartum characteristics of near-miss and maternal mortality cases.

Parameters	**Near-miss Cases**		**Maternal Mortality**	
	Min-max	Mean ± SD	Min-max	Mean ± SD
Age (years)	20-44	30.7 ± 5.9	23-38	31.8±6.5
Gravida (n)	1-15	3 ± 1.6	1-4	2±1.4
Parity (n)	0-7	1.6 ± 1.39	0-2	0.8±0.9
BMI (kg/m^2)	25-44	31.6 ± 2.11	30-32	30.8±0.9
Gestational week (week)	13-41	33.8 ± 4.3	25-40	32.3±7.8
Birth weight (gram)	555-4500	2340 ± 915	640-3645	2152±1490
Transfused unit (n) -Erythrocyte transfusion -Fresh frozen plasma -Thrombocyte suspension	 1-14 1-27 1-6	 4.6 ± 2.5 4 ± 3.4 2.4 ± 1.4	 0-13 2-13 0-8	 7 ± 6.6 8.7 ± 5.9 4± 4
Fibrinogen use (gram)	1-8	2.7 ± 1.8	0-8	5.3 ± 4.6
Hospitalization time (day)	2-25	7 ± 3.8	2-8	5.5 ± 3

Table 3. The prepartum and postpartum laboratory characteristics of near-miss and maternal mortality cases.

Parameters	**Near-miss Cases**		**Maternal Mortality**	
	Min-max	Mean ± SD	Min-max	Mean ± SD
Prepartum hemoglobin (g/dl)	4-14	9.8 ± 2.4	11-14	12.3±1.3
Postpartum hemoglobin (g/dl)	4-13	7.8 ± 1.61	4-8	6±2
Prepartum hematocrit (%)	12-43	29.7 ± 7.1	32-43	36.5±4.6
Postpartum hematocrit (%)	14-40	24.2 ± 4.59	16-25	19.7±4.7
Prepartum platelet (x10^3/µL)	14-510	181.1 ± 91.6	32-191	121±77.7
Postpartum platelet (x10^3/µL)	21-380	134 ± 75.3	14-146	73.3±67
Prepartum AST (IU/L)	8-940	69.5 ± 148.9	18-357	116.3±162
Postpartum AST (IU/L)	8-1785	90.4 ± 228.1	122-6592	2841.3±3356
Prepartum ALT (IU/L)	2-597	44 ± 93.9	8-305	86.8±145.6
Postpartum ALT (IU/L)	5-990	50 ± 113.8	36-1876	1252±1053
Prepartum creatinine (mg/dl)	0.1-4	0.61 ± 0.36	0.5-1.1	0.7±0.3
Postpartum creatinine (mg/dl)	0.1-4	0.63 ± 0.4	0.1-3	1.9±0.9
Prepartum INR	0.7-8	0.97 ± 0.59	0.8-1.6	1.1±0.3
Postpartum INR	0.7-1.9	0.9 ± 0.14	0.9-3	1.96±1
Prepartum aPTT (sec)	2-90	26.9 ± 10.9	20-65	36±19.9
Postpartum aPTT (sec.)	15-75	26.7 ± 8.1	26-56	44.7±16.3
Prepartum protrombin time (second)	9-22	11,9 ± 2,19	10-19	13±4.1
Postpartum protrombin time (sec)	9-20	12.1 ± 1.9	10-43	25.7±16.6
Prepartum fibrinogen (mg/dl)	30-790	378.3 ± 165.1	96-640	447±250.8
Postpartum fibrinogen (mg/dl)	80-890	322.9 ± 149.5	41-410	175±204

Table 4. The distribution of near-miss and maternal mortality cases by diagnostic group.

Parameters		**Near-miss (n)**	**%**	**Maternal mortality (n)**	**%**
Hypertensive Disorders (Group 1)	Severe preeclampsia	27	45	0	0
	Eclampsia	6	10	1	50
	HELLP	27	45	1	50
	Total	60	100	2	100
Hemorrhagic Conditions (Group 2)	Placenta acreata spectrum	27	47.4	0	0
	Postpartum haemorrhage	26	45.6	1	25
	Uterine rupture	4	7	0	0
	Total	57	100	1	100
Abruptio placenta and DIC (Group 3)	Abruptio placenta	16	84.2	0	0
	DIC	3	15.8	1	100
	Total	19	100	1	100
Other systemic conditions (Group 4)	Pulmonary edema	3	21.4	0	0
	Sepsis	2	14.3	0	0
	Shock	7	50	0	0
	Cardiac	1	7.1	0	0
	COVID-19	1	7.1	0	0
	Total	14	100	0	0
Total		150	100	4	100

It was found that 38% of patients in the maternal near-miss group and 50% in the maternal mortality group had received regular prenatal care. Additionally, 20% of the near-miss cases and 25% of the maternal deaths were referred to our center after delivering in an external hospital. Blood transfusion was required in 77.2% of the near-miss group and 75% of the maternal mortality group. Fibrinogen was administered to 35.3% of patients in the near-miss group and to 50% of those in the maternal mortality group.

The preoperative and postoperative laboratory characteristics of near-miss maternal mortality cases were presented in Table 3.

The distribution of near-miss and maternal mortality cases by diagnostic group was presented in Table 4.

Hypertensive disorders of pregnancy accounted for 40% of near-miss cases, while hemorrhagic conditions comprised 38%. Placental abruption and obstetric-related DIC made up 12.6% of all cases, and other systemic diseases accounted for 9.3%. Among hypertensive disorders, severe preeclampsia and HELLP syndrome were the most common causes of maternal near-miss. In the hemorrhagic group, placenta accreta spectrum was the leading cause, followed by postpartum hemorrhage. In the maternal mortality group,

two cases were classified under hypertensive disorders. Of the remaining two maternal deaths, one was due to postpartum hemorrhage in the hemorrhagic group, and the other was attributed to DIC in the placental abruption and DIC group.

When surgical interventions in the near-miss and maternal mortality groups were analyzed, the cesarean section rate was found to be 86.7% (n=130) in the near-miss group and 75% (n=3) in the maternal mortality group. Postpartum hysterectomy was performed in 32.7% (n=49) of near-miss cases and in 50% (n=2) of maternal deaths. Major artery ligation was carried out in 18.7% (n=28) of the near-miss group and 50% (n=2) of the maternal mortality group. Balloon tamponade was applied in 19.3% (n=29) of near-miss cases, and compression sutures were used in 12.8% (n=19); in the maternal mortality group, these procedures were performed in 25% and 50% of cases, respectively. Segmental resection was conducted only in the near-miss group, in 5.3% (n=8) of patients.

Discussion

The primary findings of this study revealed a maternal near-miss ratio of 4.25 per 1,000 live births and a maternal mortality ratio of 11.34 per 100,000 live births. Moreover, hypertensive disorders and hemorrhagic conditions emerged as the most common underlying causes of both near-miss events and maternal deaths.

The prevalence of maternal near-miss varies significantly based on the specific criteria applied and the region studied, with notably higher rates observed in low-income countries. A recent study from India reported a near-miss ratio of 2.95 per 1,000 births, while another Indian study found a near-miss rate of 22.7 per 1,000 births alongside a maternal mortality ratio of 899 per 100,000 live births [11, 12]. Reports from other low-income countries using the WHO near-miss criteria revealed near-miss ratios of 19.8% in Nigeria, 1.21% in Egypt, and 3.49% in Peru [13]. Furthermore, a systematic review indicated that the median maternal near-miss ratio in low- to middle-income countries was 15.9 per 1,000 live births, with an interquartile range of 8.9 to 34.7 [14].

The maternal near-miss and mortality rates observed in Turkey are generally consistent with findings from international studies. Uygur et al. reported an overall maternal near-miss ratio of 2.47 per 1,000 live births and a maternal mortality ratio of 13.46 per 100,000 live births [15].Similarly, Oğlak et al. found the near-miss incidence to be 5.03 per 1,000 live births, a figure comparable to those reported in Australia (7.0/1,000) and the Netherlands (7.1/1,000) [1,16,17].In the same study, the maternal mortality ratio was 8.1 per 100,000 live births [1].Tonyalı et al. reported a near-miss ratio of 2.04 per 1,000 live births, while another recent study documented a rate of 2.31 per 100 births [4,18]. In 2025, Erdem et al. reported a maternal near-miss prevalence of 218 per 100,000 live births [19]. A study by Akın Evsen revealed a near-miss incidence of 2.31 per 100 live births and a maternal mortality incidence of 202.4 per 100,000 births [18].Considering these ratios, these findings demonstrate that the maternal near-miss and mortality ratios in the current study are consistent with national data.

Hemorrhagic and hypertensive disorders are considered the primary causes of maternal near-miss, largely due to delays in diagnosis, timely management of complications, and referral to appropriate healthcare facilities. Several studies conducted in different regions of India have identified preeclampsia and hemorrhage as the leading etiological factors for maternal near-miss cases, which aligns with the findings of the present study [20-22].Similarly, Nakimuli et al. reported that the most common cause of

maternal near-miss was preeclampsia (7%), followed by postpartum hemorrhage (6.7%) in Uganda [23].In the study by Verma et al., published in 2023, the majority of maternal near-miss cases (38.46%) were attributed to hypertensive disorders [24]. A review of studies published from Turkey also suggests that the causes of maternal near-miss are similar to those reported globally. In the study of Akın Evsen, the most common etiologic factors of maternal near miss were haemorrhagic diseases (52.1%) followed by hypertensive diseases (33.2%) [18]. Likewise, Cengiz et al revealed that the most frequently observed diagnosis was preeclampsia (41.5%), followed by obstetric hemorrhage (29.2%) [6].In the study by Uygur et al., the analysis showed that the leading cause of maternal death was hypertensive disorders of pregnancy, followed by sepsis. In contrast, obstetric hemorrhage was identified as the most common cause of maternal near-miss, followed by hypertensive disorders [15].

One of the most important goals for healthcare professionals is to reduce maternal mortality and morbidity. In this circumstance, international organizations and local societies play a crucial role in developing strategies. We suggest that definition of maternal near-miss criteria is one of this strategies that could improve perinatal outcomes. Awareness of these cases is essential for ensuring timely and effective intervention.

The present study has several limitations. First, its retrospective design makes it susceptible to recognition bias. Second, the data were derived from a single-center, which may limit external validity. Third, the relatively small sample size restricts the generalizability of the findings. Lastly, as a tertiary care hospital, our facility may receive more severe cases, potentially leading to an overestimation of maternal near-miss and mortality ratios.

Conclusion

In conclusion, maternal near-miss events are critical markers for assessing the effectiveness and safety of maternity services in healthcare settings. Considering that hypertensive disorders and hemorrhagic conditions are the leading causes of maternal near-miss, the role of preventive strategies, early diagnosis, and effective management in reducing both near-miss events and maternal mortality should be recognized. However, given the higher incidence of near-miss cases compared to maternal deaths, we suggest that identifying near-miss events could play a crucial role in preventing maternal mortality.

Funding: *The author(s) received no financial support for the research, authorship, and/or publication of this article.*

Conflict of Interest: *The authors declare that they have no conflict of interest.*

Ethical statement: *Ethical approval was obtained from the local ethics committee (Approval No: KAEK-25 2022/12-21).*

References

[1]Oğlak SC, Tunç Ş, Obut M, et al. Maternal near-miss patients and maternal mortality

cases in a Turkish tertiary referral hospital. Ginekol Pol. 2021;92(4):300-305.

[2] Say L, Souza JP, Pattinson RC; WHO working group on Maternal Mortality and Morbidity classifications. Maternal near miss--towards a standard tool for monitoring quality of maternal health care. Best Pract Res Clin Obstet Gynaecol. 2009;23(3):287-96.

[3] IF Jorge, CDNM Rodrigues, LAF Aboim, et al. Obstetric Near-Miss Cases – Data from The First Nine Years of a New Portuguese Hospital. J Gynecol Reprod Health. 2024;2(3):1-6.

[4] Tonyali NV, Aktemur G, Karabay G, et al. Maternal near miss: A comprehensive analysis of severe maternal morbidity and mortality at a tertiary referral center. Ann Med Res. 2024;31(11):935-40.

[5] Teka H, Yemane A, Berhe Zelelow Y, et al. Maternal near-miss and mortality in a teaching hospital in Tigray region, Northern Ethiopia. Womens Health (Lond). 2022;18:17455057221078739.

[6] Cengiz H, Kaya C, Ateş R, et al. ‘‘Near Miss’’Obstetric Cases: 4 Years’ Experience of a Tertiary Center. Gynecol Obstet Reprod Med. 2013; 19(1):19-22.

[7] Bustreo F, Say L, Koblinsky M, et al. Ending preventable maternal deaths: the time is now. Lancet Glob Health. 2013;1(4):e176-7.

[8] Abdollahpour S, Heidarian Miri H, Khadivzadeh T. The global prevalence of maternal near miss: a systematic review and meta-analysis. Health Promot Perspect. 2019;9(4):255-262.

[9] Jjuuko M, Lugobe HM, Migisha R, et al. Maternal near miss as a predictor of adverse perinatal outcomes: findings from a prospective cohort study in southwestern Uganda. BMC Pregnancy Childbirth. 2024;24(1):42.

[10] Kuklina EV, Goodman DA. Severe Maternal or Near Miss Morbidity: Implications for Public Health Surveillance and Clinical Audit. Clin Obstet Gynecol. 2018;61(2):307-318.

[11] Ravula PC, Gala Shah A, Devi Kallur S, et al. Maternal Near Miss Morbidity and Mortality: An Audit Analysis of 10 Years From a Private Tertiary Care Obstetric Center. Cureus. 2025;17(4):e82031.

[12] Acharya S, Rath D. Maternal near miss indicators at a tertiary care hospital and its implications. Int. J. Sci. Res. Arch. 2025;14(2), 925-933.

[13] Neal S, Mahendra S, Bose K, et al. The causes of maternal mortality in adolescents in low and middle income countries: a systematic review of the literature. BMC Pregnancy Childbirth. 2016;16(1):352.

[14] Kulkarni R, Kshirsagar H, Begum S, et al. Maternal near miss events in India. Indian J Med Res. 2021;154(4):573-582.

[15] Uygur D. Engin Üstün Y. Kara Ö, et al. Maternal Near Miss Morbidity and Maternal Mortality in a Tertiary Referral Center in Turkey. Gynecol Obstet Reprod Med 2017;23(2):60-4.

[16] Jayaratnam S, Kua S, deCosta C, et al. Maternal 'near miss' collection at an Australian tertiary maternity hospital. BMC Pregnancy Childbirth. 2018;18(1):221.

[17] Zwart JJ, Richters JM, Ory F, de Vries JI, et al. Severe maternal morbidity during pregnancy, delivery and puerperium in the Netherlands: a nationwide population-based study of 371,000 pregnancies. BJOG. 2008;115(7):842-50.

[18] Akın Evsen, G, Evsen MS, Gündüz R, et al. An Evaluation of Maternal Near-Miss Patient Profiles, the Prevalence, Treatment Approach, Outcomes, and Prognostic

Factors: A Retrospective Study. J Clin Obstet Gynecol. 2024;34 (2): 47-54.

[19] Erdem Ö, Oğlak SC, Toktaş İ, et al. Retrospective evaluation of patients admitted to the intensive care unit due to obstetric reasons in terms of maternal near-miss, a five-year case-control study. BMC Pregnancy Childbirth. 2025;25(1):73.

[20] Mansuri F, Mall A. Analysis of Maternal Near Miss at Tertiary Level Hospitals, Ahmedabad: A Valuable Indicator for Maternal Health Care. Indian J Community Med. 2019;44(3):217-221

[21] Jain U. A study on maternal near miss cases in Government Medical College Shivpuri, India. Int J Reprod Contracept Obstet Gynecol. 2019;8:3047-3056.

[22] Kumari S, Kapoor G, Sharma M, et al. Study of maternal near miss and maternal mortality in a tertiary care hospital. J Clin Diagn Res. 2020;14:01-06.

[23] Nakimuli A, Nakubulwa S, Kakaire O, et al. Maternal near misses from two referral hospitals in Uganda: a prospective cohort study on incidence, determinants and prognostic factors. BMC Pregnancy Childbirth. 2016;16:24.

[24] Verma A, Choudhary R, Chaudhary R, et al. Maternal Near-Miss and Maternal Mortality in a Tertiary Care Center of Western Uttar Pradesh: A Retrospective Study. Cureus. 2023;15(7):e42697.