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Perinatal deaths in Bursa Province, Turkey: an analysis by applying the International Classification of Diseases-perinatal mortality (ICD-PM) system

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ABSTRACT

Objectives: The International Classification of Diseases for Perinatal Mortality (ICD-PM) system is a globally used classification based on the International Statistical Classification of Diseases and Related Health Problems (ICD-10) codes. Moreover, it focuses on the time of death and maternal conditions. Here, we analyzed perinatal deaths by using the ICD-PM system.

Methods: This is a retrospective study, performed between January 1, 2020, and March 30, 2022, in Bursa. Perinatal characteristics and the causes of perinatal deaths were recorded. The perinatal deaths were classified according to the ICD-PM system and descriptives were given.

Results: The majority of perinatal death cases (119 cases) occurred in the antepartum period. The leading cause of antepartum deaths was unspecified causes (62.2%) followed by fetal growth disorders (9.3%). A total of 63 (53.7%) mothers were healthy (M5) while 27 (22.7%) mothers had medical or surgical conditions (M4). Acute intrapartum events (33.4%) were the commonest cause of intrapartum deaths followed by unspecified causes (26.6%). When neonatal deaths were analyzed, low birth weight/prematurity constitute 59.6% of neonatal deaths. The largest proportion of mothers was healthy in the intrapartum (40%) while maternal complications of pregnancy (M2) was the most commonest classification for neonatal deaths.

Conclusions: ICD-PM is a globally used system for classifying perinatal deaths. The time of perinatal death used in this system provides focus on interventions in perinatal care and it encourages comparison between perinatal care centers. We suggest that we might use resources truly to prevent perinatal deaths in our country by using this system.

Keywords: ICD-10, ICD-PM, perinatal death, perinatal mortality

The perinatal period covers the late pregnancy period after the 24th gestational week, the birth time, and the first week of the postnatal interval. Thus, perinatal mortality is composed of stillbirths, intrapartum and early neonatal mortality. The perinatal mortality rate is known to be one of the indicators of the development of a country. As a consequence of this, the analysis of perinatal deaths have a crucial role for both physicians and governments [1-3]. Defining the reason by autopsy is too important for detecting malpractice, inheritance law, and preventive medicine in perinatal deaths [4, 5]. Nevertheless, perinatal deaths have been inadequately recorded all around the world.

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Classification systems have been tried to be used to clarify the cause of perinatal deaths. Some high-income countries have suggested local classification systems such as the Codac system for the United Kingdom, the Stockholm system for Sweden, and the Tulip system for the Netherlands [6]. In 2016, the World Health Organization offered a globally used classification system named the International Classification of Diseases for Perinatal Mortality (ICD-PM) [7]. This system was based on the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10). Moreover, the cause of death was classified by the time of death such as antepartum, intrapartum, or neonatal period, and maternal conditions such as complications of placenta, cord, and membranes; complications of pregnancy, the other complications of labor and delivery; maternal medical and surgical conditions.

To the best of our knowledge, there is only one study in the literature analyzing the cause of perinatal deaths with the ICD-PM classification system in Turkey. Considering the importance of perinatal deaths, the importance of identifying their causes is extremely important. Here, we presented the perinatal characteristics of perinatal death cases of Bursa and classified these with the universal ICD-PM system.

METHODS

This study was designed as a retrospective study reflecting the data of a city in Turkey. The ICD-PM system was applied to the perinatal deaths between January 1, 2020, and March 30, 2022, in Bursa. The study was approved by the local ethics committee with an approval number of 2019-KAEK-140. Since the patients did not participate actively in the study, verbal or written informed consent was not obtained. Stillbirths, intrapartum deaths, and neonatal deaths were included in the study while pregnancy terminations were not taken into account. Deaths without sufficient clinical data were excluded from the study. Stillbirth was defined as intrauterine deaths that occurred after the 24th gestational week. Intrapartum death was diagnosed when the death takes place during labor or cesarean section while neonatal death was defined the babies born alive and dying within 28 days of life.
The maternal age, any previous medical disease, smoking habit, parity, the time interval between pregnancies, any need for artificial reproductive techniques, education status of mother and father, the number of antenatal visits, the vaccination status, presence of consanguineous marriage, Rh isoimmunization, gestational age at the time of death, delivery mode,gender and birth weight of the baby were recorded from the medical records. Moreover, the presence of congenital anomalies, infection or growth restriction, any birth trauma, and neonatal disorders such as convulsions, and respiratory or cardiovascular conditions were noted.

The deaths were classified according to the ICD-PM system. The system was initially composed of three groups named as A (antepartum), I (intrapartum), and N (neonatal). Then, these groups were subdivided in terms of causes (6 groups for A, seven groups for I and 11 groups for N). All causes were divided according to the maternal conditions (M1 to M5). The number of cases and percentages were written in each section.

Statistical Analysis

Statistical analyses were performed by using SPSS version 25.0. Shapiro Wilk test was used to assess the distribution of variables. Normally distributed, continuous variables were presented with mean ± standard deviation while non-normally distributed ones were shown with median (min-max) values. Categorical variables were expressed as frequency or percentages.

RESULTS

A total of 233 perinatal death cases were analyzed in the present study. The mean maternal age was 33.8 ± 6.1 years. The median gravida was 2 (1-7), and the median number of antenatal visits was 6 (0-12). Smokers were 26 women which constitute 11.2% of the patients. A total of 23 (9.9%) of mothers underwent artificial reproductive techniques. For multiparous pregnant women, the time interval between pregnancies was lower than 1 year in 3 (4.3%) of patients, 1-2 years in 7 (10%) of patients, and more than 2 years in 60 (85.7%) patients. Consanguineous marriage was present in 38 (16.3%) couples. The median gestational week was 31 (24-41) and the median birth weight was 1427.5 (500-3995) grams. According to the education

status; 3% of mothers were illiterate, %30.9 were from primary school, 23.2% from secondary school, 23.6% from high school, and 19.3% from university while 9% were illiterate, %28.8 were from primary school, 21.5% from secondary school, 25.8% from high school, and 23.2% from university. Rh isoimmunization was detected in 25 (10.7%) cases and tetanus toxoid was fully administered in 170 (73%) cases. The delivery mode was composed of 96 (41.2%) vaginal delivery and 137 (58.8%) cesarean sections. A total of 42.9% of the babies were female while the remaining is male.

Table 1. The classification of perinatal deaths according to the ICD-PM system

Cause of perinatal death	Maternal conditions					
	M1	M2	M3	M4	M5	Total n (%)
Antenatal death (A)						
A1: congenital malformations, deformations, chromosomal abnormalities	0	0	0	0	8	8 (6.7)
A2: infectio	1	0	0	00		1 (0.8)
A3: antepartum hypoxia	0	0	0	0	0	0 (0)
A4: other specified antepartum disorder	9	1	0	4	11	25 (21)
A5: disorders related to fetal growth	0	0	0	10	1	11 (9.3)
A6: fetal death of unspecified cause	9	8	0	13	44	74 (62.2)
Total, n (%)	19 (16)	9 (7.6)	0 (0)	27(22.7)	64(53.7)	119 (100)
Intrapartum death (I)						
I1: congenital malformations, deformations, chromosomal abnormalities	0	0	0	1	1	2 (13.3)
I2: birth trauma	0	0	0	0	0	0 (0)
I3: acute intrapartum event	3	0	2	0	0	5 (33.4)
I4: infection	1	0	0	0	0	1 (6.7)
I5: other specified intrapartum disorder	1	0	0	1	1	3 (20)
I6: disorders related to fetal growth	0	0	0	0	0	0 (0)
I7: intrapartum death of unspecified cause	0	0	0	0	4	4 (26.6)
Total, n (%)	5 (33.4)	0 (0)	2 (13.3)	2 (13.3)	6 (40)	15 (100)
Neonatal death (N)						
N1: congenital malformations, deformations, chromosomal abnormalities	0	2	0	0	11	13(13.1)
N2: disorders related to fetal growth	0	0	1	0	0	1 (1)
N3: birth trauma	0	0	0	0	0	0 (0)
N4: complications of intrapartum events	0	0	0	0	0	0 (0)
N5: convulsions and disorders of cerebral status	0	0	0	0	0	1 (1)
N6: infection	3	0	0	0	2	5 (5.1)
N7: respiratory and cardiovascular disorders	2	2	0	4	7	15 (15.2)
N8: other neonatal conditions	0	0	0	0	2	2 (2)
N9: low birth weight and prematurity	10	23	20	0	3	59 (59.6)
N10: miscellaneous	1	0	0	0	2	3 (3)
N11: neonatal death of unspecified cause	0	0	0	0	0	0 (0)
Total, n (%)	16 (16.1)	30 (30.3)	21 (21.2)	5 (5.1)	27 (27.3)	99 (100)

M1 = complications of placenta, cord, and membrane, M2 = maternal complications of pregnancy, M3 = other complications of labor and delivery, M4 = maternal medical and surgical conditions, M5 = no maternal conditions

The classification of perinatal deaths according to the ICD-PM system was demonstrated in Table 1. According to this table, the majority of perinatal death cases (119 cases) occurred in the antepartum period. The leading cause of antepartum deaths was unspecified causes (62.2%) followed by fetal growth disorders (9.3%). A total of 63 (53.7%) mothers were healthy (M5) while 27 (22.7%) mothers had medical or surgical conditions. Acute intrapartum events were the commonest cause of intrapartum deaths with an incidence of 33.4% followed byunspecified causes (26.6%). When neonatal deaths were analyzed, low birth weight/prematurity constitute 59.6% of neonatal deaths. Similar to antepartum deaths, the largest proportion of mothers was healthy in the intrapartum (40%) while maternal complications of pregnancy (M2) was the most commonest classification for neonatal deaths.

DISCUSSION

Perinatal death is an indicator of the quality of maternal and fetal well-being. Proper detection and classification of perinatal deaths have become a priority for public health. Although most perinatal deaths occur in low and middle-income countries, nearly 5 million deaths persist worldwide each year [8, 9]. Unfortunately, the number of deaths could be much more than expected due to the poor recording system.

Perinatal deaths can arise from maternal, fetal, or placental reasons. The underlying reason is generally complex and multifactorial. Many classification systems have been introduced for the classification of perinatal deaths. In 2016, World Health Organization suggested a new, global classification system which was named ICD-PM. This system had many advantages as compared to others. The perinatal deaths were classified in terms of the time of death, this system took maternal conditions into account, allowed postmortem and histological investigations, and provided international comparisons for perinatal deaths [10].

In 2016, a pilot database study using ICD-PM system was performed for perinatal deaths in South Africa and the United Kingdom. Both in South Africa and the United Kingdom, most of the deaths occurred in the antepartum period. The most common causes of death in the antepartum period were unspecified causes and chromosomal abnormalities. In the intrapartum period, the leading cause of death was acute intrapartum events. In the same study, the most common reason for neonatal death was low birthweight/prematurity followed by chromosomal abnormalities. Commonly, there was no maternal condition for antepartum, intrapartum, and neonatal deaths. Maternal medical conditions and complications of the placenta, cord, and membranes were common accompanying conditions [11].

A study from South Africa reported similar results to these studies. According to this study, antepartum deaths with unspecified causes and M5 maternal condition were the most common form of antepartum perinatal death. In this study, acute intrapartum events was the leading reason for intrapartum deaths while it was low birth weight or prematurity for neonatal deaths [12].

Luk *et al*. [13] performed a validation study and showed that the proportion of unknown causes of perinatal deaths decreased by nearly 3 folds with ICD-PM system as compared to local systems. Likewise the previous study, the majority of perinatal deaths were found to occur in the antepartum period with an unspecified causes in this study. Moreover, they reported that the most common cause of neonatal death was low birth weight/prematurity while it was congenital malformations in the intrapartum period. According to the maternal conditions, M1 was commonest in the antepartum and neonatal period and M3 in the intrapartum period [13].

Contrary to these studies, Aminu *et al* demonstrated that most of the cases were intrapartum deaths. Infection was the most common reason while M1 was the most common maternal condition for antepartum stillbirths. Acute intrapartum events compose the largest proportion for intrapartum deaths and M3 was the most common maternal condition [14]. Different from this study, the study evaluating the classification of stillbirths in Northeast Nigeria retrospectively found that M4 was the commonest reason for antepartum stillbirths while M3 was the most common cause of intrapartum stillbirths. Both antepartum and intrapartum deaths occurred owing to disorders of fetal growth [15].

In the study of Priyani *et al*. [16], antepartum hypoxia was found to be the commonest cause of stillbirths. Fetal death of unspecified cause was the third

common cause of stillbirths. Congenital malformations followed by prematurity were the common reasons for neonatal deaths, while congenital malformation was the most common reason for intrapartum deaths [16].

A study from developing countries demonstrated that preterm birth (60.5%), birth asphyxia (22.5%) and congenital malformations (12.7%) were the leading causes of death in newborns [17]. There is only one study in the literature applying ICD-PM system in Turkey. This study reported that most perinatal deaths were in the antepartum period and the most common cause was fetal development disorders. Intrapartum deaths were shown to occur owing to extremely low birth weight [18].

In our study, we found that the majority of perinatal death cases occurred in the antepartum period. The leading cause of antepartum deaths was unspecified causes followed by fetal growth disorders.

Commonly, there was no maternal condition for antepartum and intrapartum deaths. Acute intrapartum events were the commonest cause of intrapartum deaths followed by unspecified causes. When neonatal deaths were analyzed, low birth weight/prematurity constitute 59.6% of neonatal deaths. Maternal complications of pregnancy (M2) was the most commonest classification for neonatal deaths.

Comparison of the results in various studies is difficult. The study populations were not the same and the management of pregnancy or labor is different among countries. However, prematurity, asphyxia, infections, birth trauma, and congenital anomalies were reported to be common causes of perinatal death in many studies.

Limitations

The present study has some limitations. First of all, it has a retrospective design. Second, it consists of a limited number of cases. Last, it reflects the data of only one region of Turkey.

CONCLUSION

ICD-PM is a globally used, comparative system for classifying perinatal deaths. The time of perinatal death used in this system provides to focus on interventions in perinatal care. Although it is not a perfect classification system, it encourages comparison between perinatal care centers. Thus, we suggest that we might use resources truly and drive interventions timely to prevent perinatal deaths in our country by using this system.

Authors' Contribution

Study Conception: SM; Study Design: SM; Supervision: SM; Funding: SM; Materials: SM; Data Collection and/or Processing: SM; Statistical Analysis and/or Data Interpretation: SM; Literature Review: SM; Manuscript Preparation: SM and Critical Review: SM.

Conflict of interest

The author disclosed no conflict of interest during the preparation or publication of this manuscript.

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