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Risk Factors Associated with Perinatal Mortality at Besat Hospital in Sanandaj: A Case-control Study

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ABSTRACT

Background & aim: Perinatal mortality is used in international scales as a reflection of the quality of maternal and newborn care. Therefore, the current study aimed to determine perinatal mortality and its associated factors at Besat Hospital of Sanandaj, Iran.

Methods: This retrospective case-control study was conducted using medical records available at Sanandaj Besat Hospital, Sanandaj, Iran. Sampling was conducted through the census method. Firstly, all cases of perinatal mortalities in the delivery and neonatal wards whose medical files were complete (n=466) were selected as the case group, and a file of live birth for each case was randomly chosen on the same day as the control (n=466). Data analysis was performed by SPSS 21 using the Chi-square, independent samples t-test, and logistic regression.

Results: The rate of perinatal mortality was reported as 38.3 per 1,000 births. Parental consanguinity, parity, number of abortions, birth weight, gestational age, pregnancy and delivery complications as well as congenital abnormalities were significantly different between the two groups (P<0.05). The most important risk factors associated with perinatal mortality were prematurity (OR=15.6; 95% CI: 8.7-29.3; P<0.001), low birth weight (OR=0.6; 95% CI: 0.5-0.7; P<0.001), congenital abnormalities (OR=6; 95% CI: 2.2-16.4; P<0.001), pregnancy complications (OR=2.2; 95% CI: 1.1-4.6; P<0.03), delivery complications (OR=2; 95% CI: 1.5-4.7; P<0.001), and parental consanguinity (OR=21.7; 95% CI: 1.23-2.41; P<0.001).

Conclusion: Parental consanguinity, LBW, preterm birth, hypertension, and premature rupture of membranes were the most important factors increasing the risk of perinatal mortality.

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Introduction

The perinatal period is a short period before and after birth (since the 20th week of pregnancy up to the 4th week after birth) (1). The World Health Organization defines perinatal mortality as deaths occurring at 22 weeks of gestation or more, at birth, and during the first week of life (2). Perinatal mortality is an important indicator reflecting prepregnancy health as well as quality of midwifery, maternal, and child care services (3). It is also used as a health indicator in international comparisons (4).

The global number of neonatal mortalities declined from 5 million in 1990 to 2.4 million in 2019. Newborns face the greatest risk of death in their first 28 days of life, approximately 6,700 neonatal mortalities every day (5); however, the ambitious reductions set forth by the

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Millennium Development Goals have not been achieved (6). Although perinatal mortality is a global problem, the majority of deaths occur in low- and middle-income countries (7). For instance, the rates of perinatal mortality are reported as 10.5 per 1,000 births in the US (8), 2.62 per 1,000 births in the Netherlands (3), 57.7 per 1,000 births in Northern Tanzania (4), 65 per 1,000 births in Pakistan (9), 78 per 1,000 births in Nigeria (10), and 85 per 1,000 births in Ethiopia (11). The rates of prenatal mortality were 27, 49, and 32 per 1,000 live births in Sari, Arak, and Rafsanjan, Iran, respectively (12, 13, 14).

Complications occurring during pregnancy and childbirth are important as they can be used to determine the survival and health of the fetus and neonate (8). Prenatal problems (e.g., hypertension disorders and hemorrhage) (4), diabetes mellitus, labor problems (e.g., the arrest of labor and malpresentation) (4, 9, 15), multiple pregnancy, previous cesarean section, and fetal-neonatal problems (e.g., fetal distress, premature delivery [15], and low birth weight [LBW]) (10) are independent predictors of perinatal mortality.

Although up to 50% of stillbirth cases occur during the labor in the poor regions of the world, labor intrauterine death accounts for only 15% of all stillbirths in advanced countries (2), indicating that perinatal mortality is preventable in most cases. Therefore, the identification of risk factors can improve perinatal health care policymaking. There is a significant difference in the availability of health facilities and services among the provinces of Iran (16), and according to the literature 63% of the population of Kurdistan province, Iran, are deprived of health services (17). To date, no study has been carried out in Kurdistan province in this regard; therefore, the current study was conducted in Besat Hospital, which is the only mother and child hospital in Sanandaj and referral center of Kurdistan province, to determine perinatal mortality and associated factors in Sanandaj.

Materials and Methods

This retrospective case-control study was performed on all birth records and neonates who were born in Besat Hospital Sanandaj, Iran. The data were collected using available medical records through the census method. To collect the required data, all cases of stillbirths and neonatal mortalities over 22 weeks in the delivery and neonatal wards with complete records were included as the case group. Finally, since 183 files were incomplete, only 466 cases were used for data analysis. Then, for each case, a sample of live birth record file on the same day was randomly selected as the control (n=466). The instrument used to collect the data was a questionnaire, including maternal demographic characteristics (i.e., age, level of education, and place of residence), obstetric factors (i.e., parity, number of abortions, pregnancy complications, birth complications, twin pregnancy, type of delivery, and parental consanguinity), and fetal/neonatal factors (i.e., neonatal weight, gestational age, congenital abnormalities, and gender). After a review of the literature, the causes of perinatal mortality were identified by referring to the references and preparing the initial questionnaire. The questionnaire was checked, revised, and approved by a panel of four experts.

The data were analyzed in SPSS software (version 21) using the Chi-square test, Fisher's exact test, and independent samples t-test. The probability values less than 0.1 were analyzed using the multivariate logistic regression model at the significance level of 0.05 ($P<0.05$) and confidence interval of 95%.

Results

The findings of the present study showed that there were 16,939 births and 649 stillbirths, and neonatal mortalities occurred in the study period. In addition, the rate of perinatal mortality was 38.3 per 1,000 births. A comparison of the demographic characteristics and obstetric factors of the study groups indicated that the two groups demonstrated no significant difference in terms of age, level of education, place of residence, and type of delivery ($P>0.05$). However, there were significant between-group differences in terms of parental consanguinity, parity, number of abortions, twin pregnancy, obstetric factors, pregnancy complications, and childbirth complications (Table 1; $P<0.05$).

Moreover, a comparison of the fetal-neonatal factors between the two groups indicated that there was no significant difference in terms of

fetal gender between the two groups (P>0.05). However, neonatal weight, gestational age, and rate of congenital abnormalities were demonstrated with statistically significant differences between the two groups (Table 2; P<0.05).

Table 1. Comparison of demographic and obstetric characteristics in two groups

Variable / Group		Case (stillbirth and neonatal death) N (%)	Control (live birth) N (%)	P-value
Level of education	Illiterate	41 (8.8)	39 (8.4)	0.1‡
	Primary	117 (25.1)	134 (28.8)	
	Secondary	87 (18.7)	110 (23.6)	
	Tertiary/Diploma	150 (32.2)	131 (28.1)	
	Academic	71 (15.2)	52 (11.1)	
Place of residence	Urban	345 (74)	344 (73.8)	0.97†
	Rural	121 (26)	122 (26.2)	
Parental consanguinity	Yes	90 (19.3)	51 (10.9)	0.001†
	No	376 (80.7)	415 (89.1)	
Pregnancy complications	Yes	171 (36.7)	83 (17.8)	0.001†
	No	295 (63.3)	383 (82.2)	
Twin pregnancy	Yes	87 (18.7)	12 (2.6)	0.001†
	No	379 (81.3)	454 (97.4)	
Delivery complications	Yes	269 (57.7)	37 (7.9)	0.001†
	No	197 (42.3)	429 (92.1)	
Mode of delivery	Vaginal	245 (54.5)	276 (59.2)	0.065‡
	Caesarean	211 (45.3)	185 (39.7)	
	Instrumental	1 (0.2)	5 (1.1)	
		Mean±standard deviation	**Mean±standard deviation**	
Age		30.21±5.54	6.06±29.59	0.1+
Parity		0.93 1.94	1.76 0.89	0.004+
Number of abortions		0.7±0.29	0.49±0.16	0.001+

† Fisher's exact test ‡ Chi-square test + Independent samples t-test

Table 2. Comparison of fetal/neonatal characteristics in two groups

Variable / Group		Case (stillbirth and neonatal death) N (%)	Control (live birth) N (%)	P-value
Birth weight (g)	2500<	86 (18.5)	40 (8.6)	0.001†
	2500≥	380 (81.5)	426 (91.4)	
Gestational age (week)	37<	386 (82.8)	39 (8.3)	0.001†
	37≥	80 (17.2)	427 (91.7)	
Congenital abnormalities	Yes	31 (6.7)	457 (98.1)	0.009†
	No	435 (93.3)	9 (1.9)	
Gender of fetus/neonate	Male	250 (53.6)	260 (55.8)	0.146+
	Female	210 (45.1)	205 (44)	
	Ambiguous	6 (1.3)	1 (0.2)	

+ Chi-square test † Fisher's exact test

The results of univariate and multivariate logistic regression showed that perinatal mortality had significant correlations with parental consanguinity (OR=1.7; 95% CI: 1.23-2.41; P<0.001), pregnancy complications (OR=2.2; 95% CI: 1.2-4.6; P<0.001), delivery complications (OR=2.7; 95% CI: 1.5-4.7; P<0.001) (Table 3), birth weight (OR=0.6; 95% CI: 0.5-0.7; P<0.001), prematurity (OR=15.6; 95% CI: 8.7-29.3; P<0.001), and congenital abnormalities (OR=6; 95% CI: 2.2-16.4; P<0.001) (Table 4).

Table 3. Univariate and multivariate logistic regression model of demographic characteristics and obstetric factors associated with perinatal mortality

Variable		Crude	P-value	Pure	P-value
Level of education	Illiterate	1			
	Primary	0.8 (0.5-1.4)	0.4	-	-
	Secondary	0.7 (0.4-1.3)	0.3		
	Tertiary/Diploma	1.1 (0.6-1.7)	0.7		
	Academic	1.3 (0.7-2.2)	0.4		
Place of residence	Urban	1			
	Rural	0.99 (0.74-1.33)	0.9	-	-
Parental consanguinity	No	1		1	
	Yes	1.95 (1.35-2.83)	0.001	1.7 (1.23-2.41)	0.001
Pregnancy complications	Yes	2.7 (2-3.6)	0.001	2.2 (1.2-4.6)	0.03
	No	1		1	
Twin pregnancy	Yes	8.7 (4.7-16.2)	0.001	0.9 (0.4-2.5)	0.9
	No	1		1	
Delivery complications	Yes	15.9 (10.8-23.3)	0.001	2.6 (1.4-4.8)	0.001
	No	1		1	
Mode of delivery	Vaginal	1			
	Caesarean	1.24 (0.7-1.4)	0.09	-	-
	Instrumental	0.2 (0.02-1.9)	0.1		
Age Mean±standard deviation		1 (0.99-1.01)	0.1	-	-
Parity Mean±standard deviation		1.23 (1.06-1.41)	0.004	1.13 (0.8-1.4)	0.4
Number of abortions Mean±standard deviation		1.44 (1.14-1.81)	0.004	1.1 (0.68-1.5)	0.9

The most commonly observed pregnancy complication in this study was hypertension indicating a higher frequency in the case group (18.5% vs. 4.9%), and this difference was statistically significant (P<0.05).

Table 4. Univariate and multivariate logistic regression model of fetal/neonatal factors associated with perinatal mortality

Variable		Crude	P-value	Pure	P-value
Birth weight (g)	2500<	1	0.001	1	0.001
	2500 ≥	0.4 (0.3-0.4)		0.6 (0.5-0.7)	
Gestational age (week)	37 ≥	1	0.001	1	0.001
	37<	73.7 (47.3-114.9)		15.6 (8.7-29.3)	
Congenital abnormalities	No	1	0.001	1	0.001
	Yes	3.6 (1.7-7.7)		6 (2.2-16.4)	

Concerning delivery complications, the results of the current study showed that the majority (92.1%) of the subjects in the control group had no complications; nevertheless, the majority (52.6%) of the subjects in the case group had premature rupture of membranes (PROM), and this difference was statistically significant (Table 5; P<0.05). The most common cause of neonatal mortality was respiratory distress syndrome (RDS; 47.8%), and the cause of mortality in 24.2% of the cases was not diagnosed (Table 6).

Table 5. Frequency of pregnancy and delivery complications in two groups

Pregnancy complications			
Group Variable	**Case (stillbirth and neonatal death) N (%)**	**Control (live birth) N (%)**	**P-value**
Without complication	295 (63.3)	383 (82.2)	0.001
Hypertensive disorders	86 (18.5)	23 (4.9)	
Diabetes mellitus	30 (6.4)	35 (7.5)	
Thyroid disorders	16 (3.4)	20 (4.3)	
Others*	39 (8.4)	5 (1.1)	
Total	466 (100)	466 (100)	
Delivery complications			
Group Variable	**Case (stillbirth and neonatal death)** N (%)	**Control (live birth)** N (%)	**P-value**
Without complication	197 (42.3)	429 (92.1)	0.001
Birth canal injuries	0 (0)	8 (1.7)	
Bleeding	10 (2.1)	0 (0)	
Premature rupture of membranes	245 (52.6)	18 (3.8)	
Others**	14 (3)	11 (2.4)	
Total	466 (100)	466 (100)	

* Anemia, renal disorder, hepatitis, lupus, intrauterine growth restriction, oligohydramnios, and bleeding

** Meconium in amniotic fluid and placental adhesion

Table 6. Frequency of causes of fetal/neonatal mortality

Variable	**N (%)**
Respiratory distress syndrome	223 (47.8)
Pulmonary bleeding	57 (12.2)
Asphyxia	36 (7.7)
Meconium aspiration syndrome	15 (3.4)
Others*	22 (4.7)
Unknown	113 (24.2)
Total	446 (100)

* Sepsis, disseminated intravascular coagulation, severe hyperbilirubinemia, intraventricular hemorrhage, and hydrops

Discussion

The perinatal mortality rate in this study was higher, compared to the rates reported by Evers et al. (2010) in the Netherlands (2.62 per 1,000) (3), Esmailzadeh et al. (2016) in Alborz province, Iran, (11.5 per 1,000) (18), and Qarat et al. (2016) in Sabzevar, Iran, (16.6 per 1,000) (19). However, the current study reported a lower mortality rate in comparison to the rates reported by Khatami Doost et al. (2010) in Arak, Iran, (49 per 1,000) (13), Bayou and Berhan (2012) in Ethiopia (85 per 1,000) (11), Madiha et al. (2014) in Pakistan (65 per 1,000) (9), and Mmbaga et al. (2012) in northern Tanzania (57.7 per 1,000) (4).

The above-mentioned differences could be due to differences in the level of prenatal care offered during labor and delivery and neonatal care facilities in the intensive care units at the studied centers. Sanandaj Besat Hospital is a referral center for all high-risk deliveries in Kurdistan province. This may be one of the reasons for this higher mortality rate in the studied region, compared to those reported for other areas in Iran. However, given the significant differences in the mortality rate in Iran in comparison to the corresponding rates in European countries, it is essential to identify the risk factors associated with perinatal mortality and plan to improve this important health indicator.

According to the results of the present study, parental consanguinity increased the rate of

perinatal mortality. Consanguineous marriage increases genetic and congenital anomalies (20); therefore, it may be a risk factor for perinatal death. Although 37.4% of all marriages were consanguineous in the Iranian population (21), this rate is 47.3% among Kurdish individuals as an ethnic group (22). Considering that the majority of the study population was Kurdish with higher rates of consanguineous marriages, raising public awareness through mass media and prenatal counseling programs can be effective steps toward the reduction of these complications.

The LBW was identified in the current study as another predictor of perinatal mortality, as evidenced in other studies (23-25). A study carried out by Hu et al. (26) showed that 76.4% of dead neonates had an LBW. The LBW is one of the three leading causes of neonatal mortality (8). In addition, one of the important causes of LBW is premature delivery which is associated with the increased risk of hypothermia, hypoglycemia, RDS, apnea, jaundice, and nutritional problems (27). These results underline the need for the improvement of prevention and care programs, especially in hospitals dealing with high-risk pregnancy and delivery.

The results of the current study indicated that preterm birth is the most important predictor of perinatal mortality. This finding is also highlighted in studies conducted by Moura et al. (2012) (28) and Bayou and Behran (2012) (11). In a study carried out by Iyoke et al. (2014), 46.1% of preterm births were associated with perinatal mortality (29). Preterm birth is one of the main causes of neonatal morbidity and mortality. Complications, such as RDS, hyaline membrane disease, pneumothorax, necrotizing enterocolitis, and congenital malformations, increase the mortality of premature newborns (8).

According to the results of the present study, pregnancy complications can increase the rate of perinatal mortality. Furthermore, hypertension was identified as the most common complication associated with perinatal mortality. Similarly, studies carried out by Bayou and Behran (2012) (11), Qerat et al. (2016) (19), and Van Esch et al. (2017) (30) showed that there is an increase in prenatal mortality in complicated pregnancies, which is associated with hypertension. The decreased placental blood flow reduces oxygen levels, and the placenta may suffer from ischemia and chorionic capillary thrombosis, ultimately leading to reduced placental function with serious effects on fetal survival (31). The aforementioned results indicate the importance of giving more attention to prenatal and postnatal screening and care.

In the present study, delivery complications were associated with increased perinatal mortality. The most common delivery complication affecting perinatal mortality was the PROM. Similarly, studies conducted by Geelhoed et al. (2015) (32) and Cupen et al. (2017) (33) demonstrated that delivery complications, especially PROM, are associated with an increase in the rate of perinatal mortality.

The findings of the present study also demonstrated that congenital malformations were regarded as other factors affecting perinatal mortality. Garcia et al. (2019) also observed that newborns with congenital malformations are exposed to 6-fold risk of mortality (34). Furthermore, Daemi et al. (2019) and Getiye and Fantahun (2017) concluded that congenital malformations were among the important factors affecting perinatal mortality (35, 36). Raising the public awareness of consanguineous marriage problems, increasing access to genetic counseling services, and enhancing insurance coverage for premarital genetic testing and prenatal screening can reduce perinatal mortality and improve health indicators.

The results of the present study indicated that the most commonly diagnosed cause of neonatal mortality was RDS, leading to a 15.5-fold increase in preterm neonatal mortality. This finding has been also highlighted in other studies as a cause of perinatal mortality (4, 9, 33, 34, 37). In one-fourth of the cases of neonatal/fetal mortalities, the causes of death were unclear, which is similar to the findings of a study performed in Alborz (15). It seems that some measures are required to improve the diagnosis and registration of the causes of intrauterine and neonatal mortalities in the national health system, and the resulting figures

can be used for prevention and treatment planning purposes.

Conclusion

The rate of perinatal mortality in the present study was higher than the rates reported for other parts of Iran. Parental consanguinity, hypertension, PROM, preterm birth, and LBW were the most important factors increasing the risk of perinatal mortality. Revision problems related to pregnancy, childbirth, and neonatal intensive care units, and complete record of birth information, increasing public awareness of the complications of consanguineous marriages through social media, and developing genetic counseling centers in the province reduce perinatal mortality.

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Conflicts of interest

Authors declared no conflicts of interest.

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