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ORİJİNAL ARAŞTIRMA

Neonatal Mortality in a Public Referral Hospital in Konya Over a Three-Year Period

Konya Şehir Hastanesinde Üç Yıllık Dönemde Yenidoğan Mortalite Oranları

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ABSTRACT

Aim: Pregnancy outcomes are important markers of a country's social and economic development, as they indicate the quality of care in the prenatal and neonatal period. The aim of this study was to determine the mortality rate and causes of mortality in the last 3 years in our Neonatal Intensive Care Unit (NICU).

Material and Method: Cases involving patients who died in our hospital between August 2020, and July 2023, were included in the study. Demographic data, length of hospitalization, prenatal risk factors, mode of delivery, causes of mortality, and mortality rate were examined.

Results: The records of a total of 4177 infants admitted between August 2020, and July 2023, were reviewed and a total of 226 patients who died during their hospitalization in the neonatal clinic between these dates were included in the study. Accordingly, the 3-year mortality rate in our NICU was calculated as 5.4%. The most common cause of mortality in infants hospitalized in the NICU was prematurity and its complications (40.7%). Other common causes were respiratory diseases, sepsis, and cardiac diseases.

Conclusion: Effective measures should be taken to reduce perinatal and neonatal mortality, such as adequate and quality antenatal care, improving child health and disease prevention actions, reducing potential complications during pregnancy, childbirth and postpartum, as well as promoting early diagnosis.

Keywords: Neonatal, neonatal mortality, mortality rate

ÖZ

Amaç: Gebeliğin sonuçları, prenatal ve neonatal dönemin kalitesini gösterdiğinden, ülkenin sosyal ve ekonomik gelişmişliğini gösteren önemli belirteçlerindendir. Bu çalışmada, yenidoğan yoğun bakım ünitemizin son üç yıllık mortalite hızının ve mortalite nedenlerinin belirlenmesi amaçlanmıştır.

Gereç ve Yöntem: Hastanemizde Ağustos 2020-Temmuz 2023 tarihleri arasında ölen olgular çalışmaya dâhil edilmiştir. Olguların demografik verileri, yatış süreleri, prenatal risk faktörleri, doğum şekli, mortalite nedenleri ve mortalite oranı belirlenmiştir.

Bulgular: Ağustos 2020- Temmuz 2023 tarihleri arasında yatırılan toplam 4.177 bebeğin kayıtları incelenmiş ve bu tarihler arasında yenidoğan kliniğinde yatışı sırasında vefat eden toplam 226 hasta çalışmaya dâhil edilmiştir. Bu sonuçlar ile yenidoğan yoğun bakım ünitemizde üç yıllık mortalite oranı %5.4 olarak hesaplanmıştır. Yenidoğan yoğun bakım ünitesinde yatan bebeklerin en sık mortalite nedeni prematürite ve komplikasyonları iken (%40,7), diğer sık sebepler respiratuvar hastalıklar, sepsis ve kardiyak hastalıklar olarak belirlendi.

Sonuç: Perinatal ve neonatal mortaliteyi azaltmak için yeterli ve kaliteli doğum öncesi bakım, çocuk sağlığı ve hastalıkları önlemeye yönelik eylemlerin geliştirilmesi, gebelikte, doğumda ve doğum sonrasında olası komplikasyonların azaltılmasına ek olarak erken teşhise yardımcı olmak gibi etkili önlemler alınmalıdır.

Anahtar Kelimeler: Yenidoğan, mortalite hızı, yenidoğan mortalitesi

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INTRODUCTION

Perinatal and neonatal mortality are among the most important public health problems of a country. Pregnancy outcomes are important markers of a country's social and economic development, as they indicate the quality of care in the prenatal and neonatal period. According to the World Health Organization (WHO) statistical reports published in 2019, the number of neonatal deaths decreased to 2.3 million in 2019. According to the same data, approximately 6400 newborn deaths occur every day in the world, accounting for approximately 47% of all child deaths under the age of 5. The neonatal mortality rate of Turkey has been reduced to 0.9%(1). All measures taken to improve preventive, therapeutic, and public health in Turkey have paid off, resulting in a desired reduction in child mortality. According to the 2020 report of the UN Inter-agency Group for Child Mortality Estimation, Turkey is the 3rd fastest country to reduce infant and child mortality in the last 30 years (2,3).

The aim of this study was to investigate the 3-year neonatal mortality rate and the factors affecting this rate in our Neonatal Intensive Care Unit (NICU), which has the highest patient count in Konya Province.

MATERIAL AND METHOD

The study was carried out with the permission of Necmettin Erbakan University Non-drug and Medical Device Researches Ethics Committee (Date: 2023, Decision No: 2023/4543).

This retrospective study examined the records of 4177 infants admitted to our hospital, between August 2020, and July 2023. A total of 226 patients who died during their stay in the NICU were included in the study. Intrauterine deaths and stillbirths were excluded from the study. Demographic data (gestation week, birth weight, mode of delivery, gender), and data regarding the length of hospitalization, maternal age, comorbidities of the mother, and causes of mortality were obtained from the files of the patients. The neonatal mortality rate and the total mortality rate of the NICU were calculated. Statistical analyses were performed using IBM Statistical Package for the Social Sciences statistics software, version 22.0 (SPSS, IBM Corp, Armonk, NY, USA). The conformity of numerical variables with normal distribution was checked. Non-normally distributed were presented as the median (min-max). Descriptive statistics were expressed as numbers and percentages.

RESULTS

A total of 24,228 live births occurred in our hospital between August 2020, and July 2023. And of these, 4177 infants were hospitalized in the NICU and 226 infants died in NICU care. The characteristics of the deceased patients are summarized in **Table 1**. The mean birth weight of the infants was 1465

g (370–4000) and their mean gestational age was 30 (23–42) weeks. Of these patients, 70.5% were born by cesarean section and 26.5% were resuscitated in the delivery room. In terms of pregnancy-related risk factors, 8 mothers had preterm premature rupture of membranes (PPROM), 13 had preeclampsia, 8 had maternal diabetes, and 7 had COVID-19 infection. Of the pregnant women, 12.8% did not attend routine pregnancy follow-ups (**Table 1**).

Table 1. Demographic and Clinical Characteristics	
	n: 226
Gestational age* (weeks)	30 (23–42)
Birth weight* (g)	1465 (370–4000)
Gender (n/%)	
Female	103 (45.5%)
Male	123 (54.4%)
Delivery type (n/%)	
VD	66 (29.1%)
C/S	160 (70.5%)
Resuscitation (n/%)	
No	166 (73.5%)
Yes	60 (26.5%)
Maternal Age (years)	26 (15–46)
Maternal disease (n/%)	
No	156 (69%)
PPROM	8 (3.5%)
Preeclampsia	8 (5.7%)
Gestational diabetes	8 (3.5%)
COVID-19	7 (3.1%)
Unknown	29 (12.8%)
Others	5 (2.2%)
Length of hospitalization* (days)	5 (1–221)

VD: Vaginal delivery; C/S: Caesarean section; PPROM: Preterm premature rupture of membranes; Others: abruption of placenta, hypothyroidism, cancer, and traffic accident. *Median (min-max)

The most common cause of mortality in the infants hospitalized in the NICU was prematurity and its complications (40.7%). Other common causes were respiratory diseases (17.2%), sepsis (13.7%), and cardiac diseases (10.2%). The mortality rate related to asphyxia was 4.9% (**Table 2**).

Table 2. Causes of death in infants hospitalized in the NICU (n/%)	
Diseases	**n (%)**
Prematurity	92 (40.7)
Respiratory Diseases	39 (17.2%)
Sepsis	31 (13.7%)
Congenital Heart Diseases	23 (10.2%)
Surgical Diseases	13 (5.8%)
Asphyxia	11 (4.9%)
Congenital Anomalies and Syndromes	9 (4%)
Inherited Metabolic Diseases	8 (3.5%)

It was determined that the most common reason for death was due to sepsis, respiratory diseases and CHD in term and near-term patients (**Table 3**). Patients with a gestational age of 23–25 weeks were most commonly lost. The riskiest group in terms of birth weight were infants with a birth weight of ≤1000 g (**Table 4**).

Table 3. Distribution of the Exitus patients by gestational age and birth weight.

Gestational age*, weeks	n: 226
23-25	61(27%)
26-28	38(16.8%)
29-32	29(12.8%)
33-34	17(7.5%)
35-37	35(15.5%)
38-40	46(20.4%)
Birth weight*, (gram)	**n: 226**
≤ 1000	90(39.8%)
1001-1500	25(11.1%)
1501-2000	29(12.8%)
2001-3000	53(23.5%)
3001-4000	28(12.4%)

*Median (min-max)

Table 4: Causes of death by gestational age

Diseases*	23-33 (n:145) (n/%)	34-36 (n: 35) (n/%)	≥ 37 (n:46) (n/%)
Prematurity	92 (63.4%)	-	-
Respiratory Diseases	11 (7.6%)	9 (25.7%)	11(23.9%)
Sepsis	21 (14.5%)	9 (25.7%)	9 (19.6%)
Congenital Heart Diseases	10 (6.9%)	5 (14.3%)	8 (17.4%)
Surgical Diseases	5 (3.4%)	4 (11.4%)	4 (8.7%)
Asfixia	-	4 (11.4%)	6 (13%)
Congenital Anomalies and Syndromes	1 (0.7%)	3(8.6%)	1 (2.2%)
Inherited Metabolic Diseases	2 (1.4%)	-	6 (13.8%)

*Median (min-max)

DISCUSSION

Despite all of the developments and improvements in NICUs in recent years, neonatal mortality is still an important problem in developing countries. Globally, approximately 1/3 of newborns die on the day of birth and 3/4 of them die in their first week of life (4).

Our hospital is one of the largest centers serving in its region in terms of bed capacity. This clinic accepts a large number of referrals since it has a perinatology center that performs intensive cardiac surgery, pediatric surgery, and many other surgical operations. A total of 24,228 live births occurred in our hospital between August 2020, and July 2023. The 3-year mortality rate of our clinic was determined as 5.4%. According to Turkish Neonatology Society (TNS) data of NICUs, the mean annual hospitalization-based mortality rate of Turkish centers is 4.3%–5.1%, while centers reporting a mortality rate of up to 11% also exist (5). Despite the high number of annual hospitalizations and the high-risk patient profile, our mortality rate was found to be consistent with Turkey's overall mortality rate.

The neonatal period starts from birth and ends on day 28 of life. Neonatal mortality rates are influenced by a variety of factors, such as economic and cultural factors. Neonatal mortality does not have one specific cause. It less frequently occurs due to environmental factors such as infectious diseases. Mortality during this period is mostly due to endogenous causes such as complications at birth, genetic factors, and the negative effects of maternal malnutrition on the mother and the newborn during pregnancy. Perinatal mortality rates (rate of infant deaths in the first 7 days of life and stillbirths) are an indicator of maternal health, antenatal care adequacy, and delivery quality (6,7). Although the COVID-19 pandemic was occurring during the study period, it was shown that most of the patients attended regular pregnancy follow-ups. A maternal age of <18 and >35 years is known to be a risk factor for infant mortality. Although maternal age alone does not predict a risk, it increases the risk of death when combined with other risk factors (2). Unlike the literature, maternal age was not found to be significant in our study.

Most mothers included in the present study had no prenatal risk factors. But prenatal risk factors such as preeclampsia/eclampsia, maternal diabetes, PPROM and infection increase maternal and neonatal mortality (2). It has been stated that the risk of neonatal death caused by these risk factors can be reduced with appropriate medical and obstetric care. We think that prenatal risk factors were found to be low in the mothers of the babies in our study due to the close follow-up of high-risk pregnancy

In countries with the highest infant mortality rates, half of neonatal deaths are caused by infections, while in countries with lower rates, prematurity and congenital malformations are the main causes of death (9,10). The most common cause of neonatal death was prematurity and its complications, followed by respiratory diseases, sepsis, and congenital heart diseases, respectively. It is thought that the high preterm birth rate and mortality rate of our center are due to our high annual birth rate and the fact that our center serves perinatal patients.

Congenital malformations, deformities, and chromosomal anomalies are the foremost secondary causes of neonatal mortality in developed countries. The number of deaths due to congenital anomalies/syndromes were very low in the present study. Most malformations and chromosomal abnormalities have unknown causes and are therefore not considered as preventable deaths. It is thought that mortality rates may decrease as early diagnosis of these diseases becomes possible in parallel with developments in genetic science (12).

Neonatal Resuscitation Program (NRP) trainings becoming more widespread over the years has led to a decrease in deaths due to asphyxia, which is a preventable cause of death. While the overall mortality rate due to asphyxia is 8% in Turkey, the fact that this rate was lower in our center may be due to the suitability of resuscitation conditions in the units where deliveries were performed and the high number of NRP-certified personel.

CONCLUSION

Effective measures should be taken to reduce perinatal and neonatal mortality, such as adequate and quality antenatal care, improving child health and disease prevention actions, reducing potential complications during pregnancy, childbirth and postpartum, as well as promoting early diagnosis. Besides following technological improvements to improve perinatal-antenatal care and the conditions of neonatal units, the number of trained personnel should also be increased. In addition, the number of infants requiring major surgery is increasing. Thus, it is thought that neonatal mortality rates could be further reduced with health policies and regulations such as increasing the number of surgical centers as required by regional population densities or detaching surgical centers from general purpose centers.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Necmettin Erbakan University Non-drug and Medical Device Researches Ethics Committee (Date: 2023, Decision No: 2023/4543).

Referee Evaluation Process: Externally peer-reviewed.

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REFERENCES

1. World Health Organization. Neonatal and Perinatal Mortality: Country, Regional and Global Estimates, 2019.
2. T.C Sağlık Bakanlığı Halk Sağlığı Müdürlüğü,Türkiyede bebek ölümleri durum raporu 2021, syf 14-54.
3. United Nations, Department of Economic and Social Affairs, Sustainable Development <sustainabledevelopment.un.org>
4. World Health Organization. International Statistical Classification of Diseases and Related Health Problems, 12th Revision. Geneva: World Health Organization; 2019.
5. Türk Neonatoloji Derneği Dernek Bültenleri. http://www.neonatology.org.tr/hakkimizda/dernek-bulteni/. Sayı 27-31.
6. Demirel G, Tezel B, Özbaş S, et al. Rapid decrease of neonatal mortality in Turkey. Matern Child Health J 2013;17(7):1215-21.
7. Lawn JE, Cousens S, Zupan J, Lancet Neonatal Survival Steering Team. 4 million neonatal deaths: When? Where? Why? Lancet 2005; 365: 891-900.
8. Budhathoki SS, Sunny AK, Paudel PG, et al. Epidemiology of neonatal infections in hospitals of Nepal: evidence from a large-scale study. Arch Public Health 2020; 78:39.
9. Liu L, Oza S, Hogan D, et al. Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: an updated systematic analysis. Lancet 2015; 385(9966):430-40.
10. Koshida S, Yanagi T, Ono T,et al. Possible Prevention of Neonatal Death: A Regional Population-Based Study in Japan. Yonsei Med J 2016; 57(2):426-9.
11. Callaghan WM, MacDorman MF, Rasmussen SA, et al. The contribution of preterm birth to infant mortality rates in the United States. Pediatrics. 2006;118:1566–73.
12. Bernardino FBS, Gonçalves TM, Pereira TID, et al. Trends in neonatal mortality in Brazil from 2007 to 2017. Cien Saude Colet. 2022 Feb;27(2):567-78.