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Premature mortality rates and affecting risk factors: A three-year experience

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Abstract

Aim: Preterm infants are immature and have a high risk for mortality. This study aims to draw attention to the high mortality rate and the problems of premature newborns affecting the mortality rate.

Material and Methods: In this retrospective study, preterm newborns hospitalized in a tertiary hospital for three years having the study admission criteria, were enrolled.

Results: 870 preterm infants (48.4% were girls) were included in the three-year study period. In the three years, 28.7% of the cases resulted in death, and a significant decrease was observed in premature baby mortality rates over the years ($p<0.001$). The most common causes of death were found to be respiratory distress syndrome, sepsis, and pneumothorax. As the gestational age and birth weight decreased, mortality was found to be significantly higher ($p<0.001$ and $p<0.001$). A significantly higher mortality rate was found in those born via normal vaginal delivery than in those born via cesarean section ($p=0.010$). Mortality was also higher in babies requiring oxygen immediately after birth ($p<0.001$).

Discussion: As a result, the decrease in mortality rates in our center from 45.7% to 26.9% and then to 16.7% over the years is encouraging, but it is much higher than the data of developed countries. The role of these data is to determine the main problems and to create solutions for preventing premature mortality.

Keywords

Mortality, Prematurity, Risk Factors

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Introduction

According to the World Health Organization (WHO) reports, there are 4 million newborn deaths annually. The mortality rate of under-five children in a country is considered the most important indicator in assessing the health situation. It is known that the infant mortality rate is a good indicator of the level of socioeconomic development in a country. Although neonatal mortality is decreasing all over the world due to developing technology, newly developed drugs and increasing knowledge, it still maintains its importance [1]. Although newborn infant mortality rates are not known due to insufficient records in our country, according to WHO data, it has been determined that the rate is mostly related to infections at 32% and problems related to prematurity at 24% [2].

To prevent perinatal and neonatal mortality, it is becoming increasingly important to know the causes and to determine strategies to prevent infant deaths.

Material and Methods

Mortality rates, causes of mortality, and antenatal, natal and postnatal factors affecting the risk of mortality of a total of 870 preterm babies who were monitored as inpatients in the Premature Intensive Care Unit of a tertiary care children's hospital between 2005 and 2007 were examined in our study. Since some patients were diagnosed with more than one disease, the single most important cause of death was determined. The babies born before the 38th week of gestation, whose gestational age was calculated in the first 24 hours according to the new Ballard method, were included in the study. Data were collected retrospectively by reviewing patient files.

Statistical analysis of the data was performed with SPSS 11.0 Microsoft for Windows program. In determining the factors that increase the mortality risk, one-way analysis was used; the difference in numerical variables between the groups was investigated by the student-t test and ANOVA analysis. The relationship of the groups with other groups was investigated by chi-square and Fisher's exact test when possible.

Ethical Approval

This study was approved by the Ethics Committee of Dr Behçet Uz Children's Hospital (Date: 2008-09-10, No: 25).

Results

Descriptive data

48.4% of the 870 cases included in the study were female. The rate of those born through spontaneous pregnancy was 93.4%, and assisted reproductive techniques were used in 6.6%. While 2.3% of babies were born at home, 51.4% were transported from an external center under appropriate conditions.

80.8% of the cases were found to be appropriate for gestational age (AGA), 16.9% were small for gestational age (SGA), and 2.3% were large for gestational age (LGA). While prenatal risk factors (infection, medication, smoking, trauma, hypertension and diabetes) were present in 37.6% of pregnancy follow-ups, a significant decrease in prenatal risk factors was detected over the years ($p = 0.011$). There were natal risk factors (need for resuscitation at birth, premature rupture of membranes, placenta anomaly) in 20.9% of pregnancies, and the presence of these factors decreased significantly over the years ($p<0.001$). Antenatal steroids were applied in only 2.5% of the cases, and a significant increase in the application was observed over the years ($p<0.05$).

42.3% of the patients had a normal vaginal delivery, and no significant increase in cesarean deliveries was detected over the years ($p>0.05$). Surfactant therapy was applied in 18.0% of the cases, and an increase in this application was observed over the years ($p<0.05$). 66.2% of the patients received oxygen support and respiratory support, and 41.0% of the patients received mechanical ventilator support for a period.

In a total three-year period, 28.7% of the cases resulted in death, and a significant decrease was observed in premature infant mortality rates over the years respectively 45.7%, 26.9%, and 16.9% ($p<0.001$).

The detailed distribution of the causes of mortality by years is given in Table 1.

Mortality relationship with antenatal and perinatal factors

It was determined that maternal age, number of pregnancies, parental consanguinity, and use of assisted reproductive techniques did not affect mortality ($p>0.05$). There was no difference in the mortality rates in preterm with maternal risk factors (infection, drug or cigarette use, history of trauma, hypertension, diabetes history) and antenatal steroid administration ($p>0.05$).

A significantly higher mortality rate was found in those born via normal vaginal delivery (than in those born via cesarean section 33.4% versus 25.3% ($p=0.010$). Mortality was also higher in babies who needed oxygen immediately after birth with 41.3% versus 4.1% ($p<0.001$).

Relationship between fetal factors and mortality

A mortality rate of 25.4% in girls was significantly higher than

Table 1. Mortality rates in preterm patients according to diagnoses

Diagnosis	2005 n (%)	2006 n (%)	2007 n (%)	Total number of dead preterms according to diagnosis (%)
Respiratory distress syndrome	72(62.1)	41(73.1)	27(50.0)	140(48.2)
Sepsis	19(16.4)	22(27.5)	16(29.6)	57(53.3)
Pneumothorax	11(9.5)	4(5.0)	2(3.7)	17(48.6)
Congenital anomalies	7(6.0)	6(7.5)	4(7.4)	17(73.9)
Disseminated intravascular coagulation	2(1.7)	3(3.8)	1(1.9)	6(40.0)
Hypoxic ischemic encephalopathy	2(1.7)	0	0	2(8.0)
Metabolic disease	2(1.7)	0	0	2(25.0)
Intraventricular hemorrhage	1(0.9)	3(3.8)	1(1.9)	5(45.4)
Pulmonary hypertension	0	1(1.3)	3(5.6)	4(30.8)

Table 2. Association between gestational age and mortality

Gestational age (weeks)	Total number of patients (%)	Number of patients who died (%)	p value
<24	11(1.3)	9(81.8)	<0.001
25-26	40(4.6)	33(82.5)	
27-28	114(13.1)	54(47.4)	
29-30	142(16.3)	58(40.8)	
31-32	236(27.1)	48(20.3)	
33-34	189(21.7)	17(9.0)	
35-36	124(14.3)	28(22.6)	
37	14(1.6)	3(21.4)	

Table 3. Association between birth weight and mortality

Birth weight (g)	Total number of patients (%)	Number of patients who died (%)	p value
<500	4(0.5)	4(100.0)	<0.001
500-749	30(3.4)	27(90.0)	
750-999	82(9.4)	53(64.6)	
1000-1249	152(17.5)	48(31.6)	
1250-1500	186(21.4)	42(22.6)	
1500-1999	267(30.7)	41(15.4)	
2000-2499	110(12.6)	23(20.3)	
2500-3999	39(4.5)	12(30.8)	

the rate of 31.8% in boys (p = 0.043). In our data, the average birth weight of the deceased cases was 1306 g, while the living ones were 1595 g (p<0.001). While the mean gestational age was 29.8 weeks in the deceased cases, it was 32.1 weeks in the surviving cases (p<0.001). As the week of gestation and birth weight decreased, mortality was found to be significantly higher (p<0.001 and p<0.001) (Tables 2 and 3).

Mortality rates were similar in SGA, LGA and AGA (p=0.495).

There was a mortality rate of 48.2% in babies diagnosed with respiratory distress syndrome (RDS), and RDS was observed at a rate of 33.3% in all babies. Cardiopulmonary resuscitation, premature rupture of membranes, presence of placental anomalies and surfactant administration were found to increase mortality (p<0.001). It was also shown that the diagnoses of Patent Ductus Arteriosus and sepsis increased mortality (p=0.043, p=0.001). Pneumothorax was detected in 4% of the cases and 48.6% of these resulted in death.

Discussion

Prematurity remains one of the most important causes of mortality in the perinatal, neonatal and post-neonatal periods. While the mortality rate of premature babies in neonatal intensive care units has decreased over time, the frequency of complications accompanying this condition has increased.

If we look at our country's data, according to the study conducted at Hacettepe University, the mortality rate was found to be 57% in those born younger than the 31st week [3]. In another study conducted at Dr. Sami Ulus Children's Hospital, the preterm mortality rate was found to be 20% [4]. When the data abroad are evaluated, the mortality rates are 12.1, and 23.2% in very low-weight babies in Japan and Portugal, respectively, and 8.4% in France for patients born before 32 weeks, which is much lower than our data with 28.7% [5-7]. However, although it is encouraging that the mortality rates in our center have decreased over the years from 45.7% to 26.9% and then to 16.7%, it is still much higher than the data of developed countries. It was thought that these high rates may be caused by the lack of delivery room and obstetrics department within our hospital, delays due to transportation difficulties, errors in the transportation system and the low socioeconomic conditions of the patients admitted to the hospital.

In studies, neonatal mortality rates are 8-10 times higher in adolescent and advanced maternal-age pregnancies, and in our study, the effect of maternal age on mortality was not found to be significant [8]. Mortality rates in multiple pregnancies were found to be significantly higher, consistent with the literature [9]. Other significant risk factors that supported the literature data were cardiopulmonary resuscitation, premature rupture of membranes, and placenta anomaly [8].

The lack of a decrease in the mortality rate with steroid application did not coincide with the data in the literature, but it was thought that the factor in this may be the use of steroids in a small number of patients [10]. WHO recommends that the cesarean birth rate be kept under 12%, but in our study, this rate was 57.7% and the mortality rates were found to be significantly lower in those born this way. This data supports studies showing that mortality is reduced by cesarean section in very low-weight babies [11]. Some studies have determined that vaginal birth has a positive effect on survival. In our study, the mortality rate of male preterm babies was found to be higher, which supports the literature [12].

It has been shown that the most important factors determining the chances of survival of preterms are birth weight and gestational age [13]. In the study conducted by the Turkish Neonatology Association in 2007, in which 31 centers participated, the mortality rates were 92% in babies with birth weights under 500 g, 67% in those with birth weights of 500-749 g, 40% in -999 g, 18% in 1000-1249 g, and 14% in1250-1499 g, 12% in 1500-1999 g, 6% in 1500-1999 g, and 4% in 2000-2499 g.

The mean gestational age was smaller in the deceased cases, which was consistent with the literature [13]. Although gestational age and birth weight are the most important determinants of mortality and morbidity, gestational age may not reflect reality if good prenatal follow-up and necessary ultrasound are not performed [14]. For this reason, it is thought to be more practical to use since birth weight can be determined more easily and is objective [15].

In the literature, in a multi-center study conducted in our country in 2007, the mortality data in preterms diagnosed with RDS was 21.9% with lower rate to our data, and these rates vary between 0-54.5% in other countries [16].

The second most common cause of death is sepsis, which occurs in 34.2% of our cases, and the mortality rate in these patients is 36.2%, which is similar to the 15-50% data in the literature [17]. Our third most common diagnosis of death is pneumothorax, which is detected in 4% of cases, and is similar to the rates of 3.2-9.2% in literature data [18].

The fact that our study is retrospective and includes only three years can be considered among its limitations, but it is thought to contribute to Turkey's data.

Conclusion

As a result, the decrease in mortality rates in our center over the

years, from 45.7% to 26.9% and then to 16.7%, is encouraging, but it is much higher than the data of developed countries. The most important reasons for the improvement in mortality rates in our country and in our center over the years were associated with improvements in technical equipment, more effective use of mechanical ventilation, regular training of service staff, and the introduction of surfactant and other supportive treatments in premature babies. Factors that determine the baby's chance of survival start before the baby's birth. The most important element is to provide antenatal care that will eliminate preventable causes of premature birth. A good pregnancy follow-up and delivery under appropriate conditions with a sufficiently equipped team will significantly affect mortality.

Scientific Responsibility Statement
The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement
All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest
The authors declare that there is no conflict of interest.

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