Assesment of perinatal mortality in two different periods: results of a single center

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Abstract

Aim: This study aimed to investigate the perinatal mortality rate with 37 864 deliveries which occurred in two different periods in a single center, to compare the components of perinatal mortality and affecting factors with the results of the study related with perinatal mortality which we conducted in 1999 and to emphasize the precautions directed to reduce mortality rates.

Material and Methods: All live births and stillbirths which occurred in Bakırköy Obstetrics and Pediatrics Training and Research Hospital between January 2007 and December 2007 were evaluated. The results were compared with the results of the study conducted in 1999. Newborns with a weight above five hundred grams and a gestational age above 22 weeks were enrolled in the study. The stillbirth rate, early neonatal mortality rate, late neonatal mortality rate, perinatal mortality rate and corrected perinatal mortality rate were calculated. Modified Wigglesworth Classification was used for evaluating the perinatal mortality and the subjects were examined in 7 groups. The characteristics belonging to the years of 2007 and 1999 were examined, the differences were recorded and the results were discussed. When the two periods were compared, it was observed that the perinatal mortality rate increased from 23.5‰ to 26‰.

Result: When the causes were investigated, it was observed that the stillbirth rate was increased in 2007 (84%) and especially congenital anomalies had an important role in this increment. The early neonatal mortality rate declined from 0.8% in 1999 to 0.4% in 2007. It was found that especially the premature mortality rate (Group 3) and the mortality rate related with perinatal asphyxia (Group 4) were significantly decreased.

Conclusion: The decrease in early neonatal mortality rate could be best explained by productive operation of the new neonatal intensive care unit which had been established after 2002. (Turk Pediatri Ars 2016; 51: 128-34)

Keywords: Early neonatal mortality, late neonatal mortality, modified wigglesworth classification, stillbirth, perinatal mortality

Introduction

In developing countries, approximately half of deaths in babies aged below one year occur in the neonatal period (1). Therefore, the perinatal mortality rate is one of the main elements which reflect community health (1).

The perinatal mortality rate is defined as estimation of fetal and early neonatal deaths per 1 000 births (2).

The infant mortality rate is defined as the number of deaths occurring in the first year of life per 1 000 live births. The fetal mortality rate is defined as the number of deaths occurring above the 22nd gestational week per 1000 births and the early neonatal mortality rate is defined as the number of deaths occurring in the first seven days of life per 1000 live births.

The perinatal mortality rate is a significant indicator which measures the efficiency of prenatal care, fetal

care and neonatal care (3). Some difficulties related with definition and method are experienced in determining the perinatal mortality rate. When examining causes of mortality, the ideal classification should be simple and applicable, should clearly demonstrate the causes of mortality and should be directive in the issue of necessary precautions in terms of decreasing perinatal deaths at the end of the study. The Wigglesworth Classification which demonstrates causes of mortality is a method which is used in many centers because of difficulties in making a diagnosis with autopsy (4).

In our country, the first multicenter study related with this issue was conducted in 1999 under the leadership of the Neonatology Association. In this research in which our unit participated with 21 659 births, the perinatal mortality rate in 92 587 births was found to be 34.9% (5).

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Received: 08.10.2015

Accepted: 04.04.2016

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DOI: 10.5152/TurkPediatriArs.2016.3453

In this study, the perinatal mortality rate was examined in 16 216 births with the same method and compared with the results of the year of 1999. the early and late neonatal mortality rates were calculated, the differences between the years of 1999 and 2007 were evaluated and the factors affecting the positive developments were interrogated. It was aimed to emphasize the changes which could be made to decrease the mortality rates in our country by comparing the neonatal mortality rate worldwide and the status in our country.

Material and Methods

In this study, all live births and stillbirths which occurred in Bakırköy Women and Children Education and Research Hospital between January the 1st 2007 and December 31st 2007 were evaluated.

Babies born with a birth weight above 500 g and a gestational age above 22 weeks were included in the study. The fetal mortality rate was defined as the number of stillbirths above 22 weeks and 500 g per 1 000 births.

$$\text{Fetal mortality rate: } \frac{\text{Stillbirths}}{\text{All births (live+stillbirth)}} \times 1\,000$$

$$\text{Early neonatal mortality rate: } \frac{\text{Early neonatal deaths}}{\text{Live births}} \times 1\,000$$

$$\text{Perinatal mortality rate: } \frac{\text{Stillbirths + early neonatal deaths}}{\text{All births (live+stillbirth)}} \times 1\,000$$

$$\text{Late neonatal mortality rate: } \frac{\text{Late neonatal deaths}}{\text{Live births}} \times 1\,000 \text{ (2).}$$

The early neonatal mortality rate was defined as the number of deaths in the first seven days of life per 1 000 live births (4).

The corrected mortality rate was calculated by subtracting the mortality rate related with anomalies from the perinatal mortality rate.

The Modified Wigglesworth Classification was used in classification of perinatal mortality rate.

The Modified Wigglesworth Classification (5):

Group 1: Macerated or nonmacerated stillbirths occurring before the onset of labour.

Group 2: Fatal congenital malformations.

Group 3: Conditions related with premature birth:

- hyaline membrane disease
- intraventricular hemorrhage
- non-specific infections of the preterm
- deaths occurring four hours after premature delivery below and above 1 000 g.

Group 4: All deaths related with asphyxia developing during labour and delivery.

Group 5: Special causes (blood group incompatibilities, hydrops fetalis, congenital metabolic disease, twin-to-twin transfusion, tumor etc.).

Group 6: All infections of term newborns, specific infections of the preterm (GBS, TORCH etc.).

Group 7: Cases with unexplained cause of mortality and other cases.

Chi-square test was used when specifying the early neonatal mortality, late neonatal mortality rate and perinatal mortality rate by years and groups. This study was planned with the local ethics committee approval of Bakırköy Women and Children Training and Research Hospital dated 24/03/2008 with number 139. Consent was not obtained, because the study was conducted retrospectively.

Results

16 216 births and 15 859 live births occurred in our hospital between January the 1st 2007 and 1 December the 31st 2007.

Two hundred thirteen of the subjects who died were male, 205 were female and 11 had gender ambiguity. 74.8% of the births occurred by normal vaginal delivery and 25.25% occurred by cesarean section. The rate of multiple pregnancy was found to be 11.6%.

In our study, 357 (84%) of a total of 429 deaths occurred in the fetal period and 72 (16.7%) occurred in the early neonatal period. The stillbirth rate (SBR) was found to be 22‰, the early neonatal mortality rate (ENMR) was found to be 4.5‰, the perinatal mortality rate (PNMR)

was found to be 26.5‰, the late neonatal mortality rate (LNMR) was found to be 1.9‰ and the corrected perinatal mortality rate (CPMR) was found to be 20.3‰. According to the 1999 data, the ENMR was 8‰, LNMR was 1‰ and PNMR was 23‰.

When the distribution of perinatal deaths by birth weight was examined, it was found that the rate of stillbirth was 46% and the rate of early neonatal mortality was 32% in the group below 1000 g, whereas the rate of early neonatal stillbirth rate was approximately 68% and the early neonatal mortality rate was 46% in the group below 32 weeks. When compared with the 1999 data, the perinatal mortality rate below 1000 g and 28 weeks showed an increase and a significant decrease above 1000 g and 28 weeks in 2007. When the deaths which occurred in the prenatal period were examined in detail, it was found that babies born with a birth weight below 1000 g constituted 22.6% of the mortality and this rate increased to 43.1% in 2007. When examined in terms of gestational week, it was found that the babies born at a gestational age of 20-24 week constituted 6.5% of the perinatal deaths and this rate increased to 25.2% in 2007 (Table 1, 2).

When we examined the early neonatal deaths by groups, we found that preterm deaths in Group 3 ranked first with a rate of 38% (28/72) and this was followed by Group 2 (congenital anomalies) with a rate of 37%. The early neonatal mortality rate was found to be 16.6 % in Group 4 which was constituted by deaths related with asphyxia and three subjects in Group 4 were lost in the first seven days of life because of infection. On the other hand, 73% of the anomalies resulted in intrauterine death (Table 3).

When the late neonatal deaths were examined, it was found that 31 subjects were lost between 8 and 28 days. Among the causes of mortality, prematurity and sepsis, necrotizing enterocolitis, bronchopulmonary dysplasia and asphyxia ranked first.

When the maternal risk factors in perinatal mortality were examined, it was found that the most common morbidities included abruptio placenta, preeclampsia, hypertension, hemorrhage, diabetes mellitus and prolapsus of the umbilical cord and the results were compared with the 1999 data. The rate of abruptio placenta decreased from 41.1% in 1999 to 30% in 2007. The rate of umbilical cord entanglement decreased from 12.9% to 1.6%. On the other hand, the rates of preeclampsia, hypertension and gestational diabetes among maternal morbidities increased markedly in 2007.

Table 1. Distribution of the perinatal mortality by years and birth weight

Birth weight	Perinatal mortality			
	1999		2007	
	n	(%)	n	(%)
<1 000 grams	115	22.6	185	43.1
1 001-1 500 grams	125	24.6	78	18.2
1 501-2 500 grams	126	24.8	89	20.7
>2 500 grams	143	28.1	77	17.9

Table 2. Distribution of the perinatal mortality by years and gestational week

Gestational week	Perinatal mortality			
	1999		2007	
	n	(%)	n	(%)
20-24	33	6.5	108	25.2
25-28	78	15.3	99	23.1
29-32	136	26.7	72	16.8
33-36	126	24.8	80	18.6
>37	136	26.7	70	16.3

Table 3. Distribution of the perinatal mortality and its components by modified Wigglesworth classification

	Fetal mortality (n)	Early neonatal mortality (n)	Perinatal mortality (n)	Perinatal mortality (%)
Group 1	259	-	259	60
Group 2	72	27	99	23
Group 3	6	28	34	7.9
Group 4	4	12	16	3.7
Group 5	14	2	16	3.7
Group 6	1	3	4	0.9
Group 7	1	0	1	0.2
	357	72	429	100

When these data obtained in 2007 in our study were compared with the 1999 data, no significant change was found in perinatal mortality rate, but a significant reduction was found especially in preterm deaths (Group 3) and asphyxia (Group 4). On the other hand, the rates of stillbirth (Group 1) and congenital anomaly (Group 2) were found to be high (Table 4, 5).

Table 4. Evaluation of early neonatal mortality, late neonatal mortality and perinatal mortality by years

		1999		2007		p
		n	(%)	n	(%)	
Birth	Live birth	21 324	98.5	15 859	97.8	<0.001*
	Stillbirth	335	1.5	357	2.2	
Early neonatal mortality		174	0.8	72	0.4	<0.001*
Late neonatal mortality		18	0.1	31	0.2	0.004*
Total neonatal mortality		192	0.9	103	0.9	0.007*
Perinatal mortality		509	2,3	429	2,6	0.067*

*Chi-square test was used (p<0.01).

Table 5. Evaluation of perinatal mortality rates by years with modified Wigglesworth classification

	1999		2007		p
	n	(%)	n	(%)	
Group 1	243	47.7	259	60.4	<0.001
Group 2	54	10.6	99	23.1	<0.001
Group 3	101	19.8	34	7.9	<0.001
Group 4	80	15.7	16	3.7	<0.001
Group 5	15	2.9	16	3.7	0.504
Group 6	5	1	4	0.9	0.938
Group 7	11	2.2	1	0.2	0.009

**Chi-square test was used. (p<0.01)

Discussion

The perinatal mortality rate which is affected by various biological, environmental, social and demographic properties is one of the important parameters which shows the quality of health care services in communities. One of the main objectives in the area of neonatology and obstetrics is to reduce the perinatal mortality rate to the lowest possible level. The aim is to define the causes of mortality, demonstrate preventive precautions and present a qualified health care service.

When the annual perinatal mortality rates in the world were examined, it was observed that 98% occurred in developing and underdeveloped countries. According to the reports of the World Health Organization (WHO), the PNMR is 62‰ in Africa and below 10‰ in Asia (3). The PNMR has been reported to be 5‰ in developed countries including Japan, Germany, Finland, Sweden (6).

In our hospital, the first PNMR study was conducted in 1991 and the PNMR was found to be 23.5‰ in this study which was performed retrospectively (7).

In a multi-center perinatal mortality rate study conducted in our country in 1999, the data of 29 university and research hospitals were evaluated and the PNMR was reported to be 10.8‰-11.9‰ (mean: 34.9‰) (5). Our hospital participated in this study with 21 659 births and the PNMR was found to be 23.5‰.

When the results of our study were compared with the 1999 data, it was observed that the PBMR increased from 23.5‰ to 26.5‰, the ENMR decreased from 8.1‰ to 4.5‰, the SBR increased from 15.4‰ to 22‰ and the corrected PNMR calculated by excluding congenital anomalies decreased from 21‰ to 20.3‰. The increase in the perinatal mortality rate was found to be significant (Table 4).

In the assessment performed with the modified Wigglesworth classification as in the other study, it was observed that intrauterine deaths constituted 60.9% of 429 deaths (Group 1) and this was followed by congenital anomalies with a rate of 23.3% (Group 2), preterm deaths with a rate of 7.9% (Group 3) and perinatal asphyxia with a rate of 3.9% (Group 4). The increases in the mortality rates in Group 1 and 2 and the reduction in the mortality rates in Group 3 were found to be statistically significant (Table 5).

According to the reports of the World Health Organization, the annual number of deaths was reported to be reduced from 20 million in 1960 to 6.9 million in 2011 in children aged below 5 years. Seventy percent (70%) of the deaths below five years of age are infant deaths and 40% of these occur in the neonatal period. Seventy five percent (75%) of the neonatal deaths occur in the first week of life. Prematurity, low birth weight, infections, asphyxia and birth trauma constitute eighty percent (80%) of the causes of mortality in the neonatal period. Unfortunately, two thirds of the neonatal deaths occur as a result of preventable causes (8).

When the causes of mortality in our study were examined, it was observed that the stillbirth rate was 22% and stillbirth constituted 60% of the perinatal deaths. In the study conducted in 1999, stillbirth constituted 47.7% of all perinatal deaths. The main etiological factors included inadequate antenatal care, low education and economical level and severe obstetric problems (abruptio placenta, preeclampsia, hemorrhage, gestational diabetes mellitus) among antenatal factors. Despite improvement in the area of healthcare, the rate of antenatal care visits which is recommended by the WHO as a minimum of four visits was reported to be 3.9% in 1993, 53.9% in 2003, 70.2% in 2007 and 73.7% in 2008 in our country (8). Although we could not give this rate numerically in our study, the fact that our patient group has a low socioeconomic and cultural level supported inadequate antenatal care.

In a study conducted in England, the PNMR was found to be 11.4‰ and the SBR was found to be 6.6‰ in the subjects who had low economical levels, whereas the same rates were found to be 7.2‰ and 3.7‰, respectively, in the subjects who had a higher economical level (3). In another study conducted in Bulgaria, it was shown that the PNMR increased from 10.8‰ to 12.9‰ as a result of deterioration in the economical status of the country (9).

In a study conducted by the World Health Organization in 2006 related with the East Asia countries, the SBR was found to be 54‰ in Afghanistan, 17 ‰ in China and 33‰ in Bangladesh (5). According to the 2012 data of the WHO; the SBR was reported to be 103‰ in the low income group, 77‰ in the moderate-low income group, 39‰ in the moderate income group and 10‰ in the high income group (10). In the remaining parts of the world, the SBR has been reported to be 104‰ in Africa, 34‰ in America, 78‰ in Eastern Mediterranean, 27‰ in Europe, 74‰ in Southeast Asia and, 37‰ in the Western Pacific (10). The SBR in our study was found to be lower compared to the other countries and Turkey data excluding China and similar to the European data reported by the WHO in 2012.

The second most common cause of perinatal mortality was congenital anomalies in our study. The rate of these deaths which are included in Group 2 in the modified Wigglesworth classification constituted 23.1% of all perinatal deaths. In our study which was conducted in 1999, Group 2 constituted 10.6% of all perinatal deaths (7). Congenital anomalies are affected by many factors including maternal age, genetics and fetal development (11, 12). Prenatal diagnosis is very important in congenital anomalies, but the diagnosis can not be made in all

centers and termination of pregnancy in cases of severe anomalies diagnosed prenatally can not be realized because parents do not give consent. Therefore, the fetus with anomaly is lost in the intrauterine or early neonatal period and leads to an increase in the perinatal mortality rate (12). The number of births which resulted in fetal mortality or mortality related with congenital anomaly which constituted Group 1 and Group 2 in 2007 showed a 20% increase compared to 1999. The reason of this increase especially in the mortality Group 1 and Group 2 in our study was thought to be related with the fact that pregnancies without antenatal diagnosis progressed to delivery with a higher rate compared to 1999.

In the study of Göynümer et al. (13), the rate of congenital anomalies independent of system was reported to be 31.9% and it was emphasized that the most common anomalies involved the central nervous system. In our study, the rate of congenital anomalies among perinatal deaths was found to be 23% and the most common congenital anomaly was central nervous system anomalies (32.3%). This was followed by multiple anomalies with a rate of 25.2% and cardio-urinary system anomalies with a rate of 11%.

Bresner et al. (14) from Australia reported that the mortality related with congenital anomalies could be reduced by 30% by detecting and termination of congenital anomalies diagnosed prenatally before the 20th gestational week. In conclusion, the most important point in reducing the number of deaths caused by congenital anomalies is prenatal diagnosis and termination of pregnancy when necessary.

When the deaths in Group 3 were examined, it was found that 38.8% of 34 preterms (7.9%) were lost in the early neonatal period and 24 of the 34 preterms were below 1000 g. The most important causes of mortality included respiratory distress syndrome, asphyxia, immaturity and congenital anomalies. When infants deaths between 2007 and 2011 in Turkey were investigated, it was reported that the first five causes included prematurity (27.7%), congenital anomalies (14.3%), sepsis (10.2%), congenital cardiac diseases (7.8%) and asphyxia (4.8%). According to the data of the Ministry of Health, 76.1% of the preterms who died in the first week had a gestational age of 28 weeks, 61.3% had a gestational age of 28-32 weeks and 52.9% had a gestational week of 32-26 weeks (8). Twenty four (70.6%) of the 34 subjects who were lost in our study were below 28 weeks or 1000 g and our results were similar to the data of the Ministry of Health. When compared with the study conducted in 1999, a significant reduction was observed in the mortality in Group 3 ($p<0.01$).

Tablo 6. Results of the studies related with mortality rates conducted in our country (18-21)

	Year	Stillbirth rate	Early neonatal mortality rate	Perinatal mortality rate
Selçuk University	2000	31.5	21.1	52.7
Dicle University	2001	44.9	78.9	123.5
Ondokuz Mayıs University	2003	49.7	39.9	87.8
Hacettepe University	2003	18.3	6.4	24.5
Bakırköy Maternity and Children Education and Research Hospital	1999	15.4	8.1	23.5
Bakırköy Maternity and Children Education and Research Hospital	2007	22	4.5	26.5

In our country, significant advances have been experienced in care of preterm babies especially with the increase in the number and quality of neonatal intensive care units in the last 10 years. Baby-friendly hospital programs and increases in the numbers of devices, beds, physicians and nurses in intensive care units provided important developments in care of preterm babies (6).

The rate of the deaths related with perinatal asphyxia which constituted Group 4 was 3.7% and 12 of the subjects were lost in the early neonatal period. This rate was 15.2% in 1999 and the difference between the two periods was found to be very significant ($p<0.001$). The fact that perinatal factors including placental abruption, cord entanglement or prolapses decreased significantly in 2007 affected this outcome.

On the other hand, maximum support given to the baby in postnatal care due to the third level neonatal intensive care unit which opened in 2002, presence of experienced physicians and nurses with neonatal resuscitation certificate and developed technical equipment played a significant role in reduction of mortality related with asphyxia. In our unit, the number of deaths related with asphyxia reduced significantly with extension of the neonatal resuscitation program and a significant increase in the number of the personnel who participated in this neonatal resuscitation program.

According to the 2009 data of the Ministry of Health, the early neonatal mortality rate related with perinatal asphyxia was reported to be 6.1‰ and the late neonatal mortality rate was reported to be 3.8‰ (8) and the results were found to be higher compared to the 2007 results (3.7%).

Group 5 was constituted of special causes and the most important cause of mortality in this group was found to be immune hydrops fetalis with a rate of 3.7%.

In Group 6, 4 subjects were defined as infections of term newborn. In Group 7 one subject was lost. When

we evaluated all subjects, we found that preterm deaths (38%) in Group 3 ranked first among 75 subjects who were lost in the early period; congenital anomalies (37%) ranked number two and perinatal asphyxia (16.6%) ranked number three.

In the reports of the World Health Organization, it was stated that 40-60% of infant mortality in developing countries occurred because of preventable causes and prematurity and congenital anomalies ranked first. When the morbidities were examined by the order of frequency, it was found that infections were reported with a rate of 32%, congenital anomalies were reported with a rate of 10%, asphyxia was reported with a rate of 29% and prematurity was reported with a rate of 24% (8).

In studies conducted locally in university hospitals in our country after the year of 2000, the PNMR was found to be 123.5‰-87.7‰-52.7‰-24.5, respectively. The results of Hacettepe university (24.5‰) were found to be similar to the results of our study. The ENMRs of the centers were found to be in the range of 21.1‰-78.9‰ which were higher compared to the results of our unit. The SBR was found to be in the range of 31.5‰-44.9‰ which was similar to the Hacettepe data and lower compared to the other centers (15-18) (Table 6).

In our study, we found that the ENMR decreased in years and the LNMR increased. It was observed that the most important causes of mortality included prematurity problems with a rate of 51.4% (sepsis, necrotizing enterocolitis, bronchopulmonary dysplasia, intracranial hemorrhage). Congenital anomalies ranked first with a rate of 18%.

According to the 2009 data of the Ministry of Health, 36% of the late neonatal deaths occurred because of prematurity problems, 13.1% occurred because of extracardiac problems and 7.7% occurred because of congenital heart anomalies (6). The results of our study were found to be similar to the data of the Ministry of Health.

In conclusion, the PNMR, SBR, LNMR increased in 2007 compared to the 1999 data, whereas the ENMR and total NMR decreased significantly. It was thought that these results might be related with the fact that pregnancies carrying a risk and cases with fetal anomaly were found with a higher rate in our center, because our center was a third level perinatal center.

The most important cause in the increase in the stillbirth rate was considered to be low socioeconomical and cultural level and inadequate antenatal care. The significant improvement in Group 3 and Group 4 was related with qualified care given by our intensive care unit beginning from 2002.

In the area of neonatal health, premature babies constitute the group which is harmed with the highest rate. Both healthcare workers and politicians should show a maximum effort to cope with the difficulties encountered in this area and a more holistic approach is required (19).

Conclusion

Application of general health training, training of pregnant women, antenatal follow-up at a standard level and enabling prenatal diagnostic opportunities are essential in order to reduce the perinatal mortality rate to the rates of developed centers. In addition, prevention of premature deliveries, decision of termination in cases of anomalies which are incompatible with life and persuasion of families in this issue will positively affect the rates of stillbirth and early neonatal mortality as our study shows. It has been predicted that increasing the number of effectively-operating third step intensive care units will decrease especially the early neonatal mortality rates.

Ethics Committee Approval: Ethics committee approval was received for this study from Bakırköy Obstetrics and Pediatrics Training and Research Hospital's local ethics committee at 24/03/2008 with the record number of 139.

Informed Consent: Written informed consent was not received due to the retrospective nature of this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - S.K.; Design - F.S.; Supervision - S.K.; Funding - S.S.D.; Materials - S.S.D.; Data Collection and/or Processing - S.S.D., E.Y.A.; Analysis and/or Interpretation - F.S., E.Y.A., F.D.; Literature Review - S.S.D., S.K., N.K.; Writing - F.S., S.K.; Critical Review - S.K.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

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