DOI: 10.17816/KMJ2020-727

Results of the perinatal audit of the Northwestern Federal District

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Abstract

Aim. To assess the results of a perinatal audit of the Northwestern Federal District and to identify opportunities for a decrease in perinatal mortality.

Methods. The audit of perinatal loss was conducted in two stages: (1) remote audit — audit of perinatal mortality indicators; (2) medical history audit — audit of cases of perinatal death of a child based on medical documentation. Held the copy of the data from the 925 medical records for 220 cases of perinatal death. The perinatal audit of the Northwestern Federal District used the Nordic-Baltic perinatal death classification. The following statistical methods were used for statistical data processing: incidence rate of a trait was determined by using frequency tables, the statistical significance of differences was tested by using contingency tables, the Chi-square criterion, along with the Pearson correlation coefficient. The statistical significance of differences in quantitative indicators was assessed by using Student's t-Test. The significance level was set at $p < 0.05$.

Results. It was found that in the Northwestern Federal District pregnancy losses III category of the Nordic-Baltic classification (gestational age newborn, more than 28 weeks, without congenital malformations and intrauterine growth restriction) is 27.5%, intranatal losses VI category of the Nordic-Baltic classification (gestational age newborn, more than 28 weeks, without congenital malformations and intrauterine growth restriction) — 7.4%, the loss of newborns VIII–XI category of the Nordic-Baltic classification (gestational age newborn, more than 28 weeks, without congenital malformations and intrauterine growth restriction) — 16.9%. Among children who died during the perinatal period, children of gestational age over 28 weeks significantly predominate ($p=0.003$). In the nosological structure of stillbirth, most of the diseases are associated with respiratory disorders (85.9%), infectious complications are 14.1%. The main causes of death of newborns in the early neonatal period are respiratory disorders — 40.0% and infectious diseases specific to the perinatal period — 36.0%. The assessment of the sexual prevalence of pregnancy losses did not reveal a statistically significant difference ($p=0.29$). The assessment of the sexual characteristics of intranatal losses showed that boys significantly predominate ($p=0.003$).

Conclusion. The perinatal audit revealed that, in the Northwestern Federal District, the level of the mobile reserve of perinatal losses associated with managed causes is 51.8%.

Keywords: perinatal audit, perinatal mortality, stillbirth rate, early neonatal mortality, The Nordic-Baltic perinatal death classification, mobile reserve of perinatal losses.

For citation: Ivanov D.O., Shevtsova K.G., Moiseeva K.E. , Harbedia Sh.D. Results of the perinatal audit of the Northwestern Federal District. *Kazan Medical Journal.* 2020; 101 (5): 727–733. DOI: 10.17816/KMJ2020-727.

Background. Systematic analysis of perinatal mortality is an integral part of assessing the state of the obstetric and neonatal care systems in various regions of the Russian Federation. This is an integral indicator as it combines ante-, intra-, and postnatal factors leading to lethal outcomes. Since early 1990s, the term "perinatal audit" has been used in perinatology to differentiate the factors for the corresponding periods of perinatal mortality. The audit helps to assess the results of the activities of the maternity and child welfare services that in turn aid in outlining the measures for their further development and improvement, both at the regional and national level [1–3].

Since early 2000s, an upward trend has been observed in the share of perinatal mortality among fetal infantile losses in the Russian Federation [3, 4], indicating an urgent need for a permanent effective perinatal audit that includes different aspects and methodological approaches, depending on the

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regional indicators in comparison with the national and regional data, and accounts for the specific characteristics of each territory during this particular time interval as well [5–8].

The study aimed to assess the results of a perinatal audit conducted using the Scandinavian-Baltic classification of perinatal losses (S-Bc), using the example of the Northwestern Federal District.

Materials and methods. This audit of perinatal losses was conducted in two stages:

– stage 1: remote audit—audit of indicators;

– stage 2: medical history audit—audit of cases of perinatal death of a child based on medical documentation.

During the audit stage 1, a demographic zoning of fetal infantile losses (FIL) indicators was performed by federal districts of the Russian Federation. Thereafter, from the general structure of fetal infantile losses in each district, the proportion of perinatal mortality rate was determined with the identification of the proportion of stillbirth [9].

The decision on the stage 2 (medical history audit) was made based on the data obtained, as the highest share of perinatal mortality among fetal infantile losses in Russia (72.4%) and stillbirths among perinatal mortality (55.7%) was recorded in Northwestern Federal District that necessitated a perinatal audit there. S-Bc was used to assess perinatal losses.

The general population was defined as the number of all cases of perinatal deaths in the territory of seven regions of the Northwestern Federal District in 2018; including 503 stillborn and newborns who died within the first 7 days of life. The monitoring unit was a case of perinatal death of a child. The sample representativeness was ensured with a sample size of at least 218 cases of perinatal deaths. The monitoring objects and documents for the audit were selected by the Ministries of Health of the respective regions of the Northwestern Federal District.

925 medical documents for 220 cases of perinatal deaths were received and analyzed; namely, the medical card of a pregnant patient (f. 111/u), prenatal record (f. 113/u-07), labor and delivery record (f. 096/u), hospital neonatal record (f. 097/u), autopsy report of a fetus, stillborn, or newborn (f. 013-1/u). The sample representativeness was tested by the method of Professor A.M. Merkov, and the error in the study did not exceed 3.4%, which was quite acceptable.

Data analysis was performed using the statistical software package PASW STATISTICS. The relative values of the frequency and distribution of qualitative indicators and the arithmetic mean values of quantitative indicators and their standard errors were calculated. The significance of the differences between qualitative characteristics (categorized data) was tested using contingency tables using the χ^2 test along with the Pearson correlation coefficient. The significance of differences in quantitative indicators was assessed using Student's *t*-test. The level of significance was set at $p < 0.05$.

Results and discussion. The Northwestern Federal District recorded the highest indices for both perinatal mortality among fetal infantile losses (72.4%) and stillbirths among perinatal mortality (55.7%; Table 1) in Russia.

In the vast majority of cases, losses of S-Bc category I children were unavoidable. Children with congenital developmental anomalies were assigned to category I. The perinatal losses in the Northwestern Federal District amounted to 10.58%, including dead newborns accounting for 68.4% and stillborn accounting for 31.6% of the losses. The body weight of children in this category was 1921.80 ± 290 g with a gestational age of 33.2±1.17 weeks. Concurrently, 19%, 21%, 25%, and 35% of the children in this category had extremely low body weight (up to 999 g), relatively low body weight (1000–1499 g), low body weight (1500–2499 g), and body weight over 2500 g, respectively.

Analysis of body weight and gestational age in the groups of deceased newborns and stillborn children with congenital malformations revealed no statistically significant differences in these groups ($p > 0.05$). The average body weight and gestational age of the deceased newborns were 1963.7 ± 0.404 g (minimum, 0.860 g; maximum, 3680 g) and 32.1 ± 5.5 weeks, respectively. The average body weight and gestational age of the stillborn children were 1858.9 ± 0.431 g (minimum, 0.900 g; maximum, 3860 g) and 33.9 ± 4.96 weeks, respectively.

Antenatal losses, including those with intrauterine growth retardation, can be conditionally prevented [10]. They reflect the efficiency of the outpatient medical care for women during pregnancy at the level of the maternity welfare center; since, it is the careful monitoring of the women's health, timely identification of adverse factors that may negatively impact the child's development, and the appropriate control of the gestational course that help prevent fetal deaths.

The death of a child during the antenatal period, including in multifetal pregnancy, with the identification of the proportion of children with intrauterine growth retardation, are considered for S-Bc categories II–V. These categories include 39.7% of all cases of perinatal mortality, including the following:

– category II: death of a child during the antenatal period with intrauterine growth retarda-

Table 1. Assessment of the structure of fetal infantile losses (FIL) with respect to the demographic zoning by federal districts of the Russian Federation

Territorial-federal district of Russia	FIL of the perinatal period, ‰	Share of perinatal mortality in the FIL structure, %	Stillbirth	
			‰	Share of perinatal mortality, %
Russia	7.50	66.90	5.60	49.80
Central Federal District	6.60	64.80	5.00	49.30
Northwestern Federal District	7.60	72.40	5.90	55.70
Southern Federal District	7.80	68.40	6.20	54.60
North Caucasian Federal District	7.30	59.60	4.20	34.60
Volga Federal District	8.50	72.00	6.40	54.20
Ural Federal District	6.60	64.40	5.10	49.30
Siberian Federal District	7.70	64.60	5.50	46.20
Far Eastern Federal District	8.50	68.10	6.60	52.90

tion without congenital defects after the term of 28 weeks of gestation (4.23%);

– category III: death of a child during the antenatal period without intrauterine growth retardation and without congenital defects after the term of 28 weeks of gestation (27.51%);

– category IV: death of a child during the antenatal period before the term of 28 weeks of gestation without intrauterine growth retardation (7.94%);

– category V: death of a child during the antenatal period without congenital malformations in multifetal pregnancy (1.6%).

The body weight of children in categories II–V was 1872.7 ± 129 g and their gestational age was 32.2 ± 0.57 weeks. Moreover, in most cases (31%), the body weight of children exceeded 2500 g ($M \pm m$ = 3284.7 ± 123.2 g). Relatively low ($M \pm \pm m$ = 1170.5 ± 34.4 g) and low ($M \pm m$ = 1998.4 ± 64.9 g) body weights were recorded in 22.7% of children, and extremely low body weight was recorded 24% of children ($M \pm m$ = 613.1 ± 29.7 g).

Assessment of sex characteristics of antenatal losses did not reveal a statistically significant difference. Boys and girls who died antenatally accounted for 50.7% and 49.3% (p = 0.29) of all losses in category II–V, respectively. Analysis of the body weight and gestational age of children in categories II–III showed the presence of statistically significant differences compared to those in category IV of antenatal losses (p = 0.000).

The average gestational age of children born before the term of 28 weeks of pregnancy was 25.06 ± 0.39 weeks with an average body weight of 747.8±92 g (minimum, 295 g; maximum, 1820 g). Extremely low body weight, relatively low body weight, and low body weight was recorded in 80.0%, 13.3%, and 6.7% of the children, respectively. The average gestational age of children over 28 weeks of pregnancy was 34±0.49 weeks with an average body weight of 2153.0±137 g (minimum, 509 g; maximum, 4300 g). In most cases (38.3%), the body weight of children exceeded 2500 g. Extremely low body weight, relatively low body weight, and low body weight was noted in 10.0%, 25.0%, and 26.7% of the children, respectively.

Analysis of diseases and pathological conditions of stillborn showed that in 89.3% of the children, the most common causes of stillbirths were diseases associated with the respiratory and cardiovascular systems, characteristic of the perinatal period [code according to the International Classification of Diseases (ICD) P20–P29]; including intrauterine hypoxia first noted before the onset of labor (96.6% of cases). In 10.7% of the children, infectious diseases specific to the perinatal period (ICD code R35–R39) caused stillbirth; including intra-amniotic infection of the fetus (ICD code P39.2) and congenital viral infections (ICD code P35) in 71.4% and 28.6% of the children, respectively.

Analysis of the mother's conditions and the complications of her pregnancy and childbirth that had an impact on the stillborn showed that fetal lesions were caused by unspecified morphological and functional abnormalities of the placenta (ICD code P02.2), chorioamnionitis (ICD code P02.7), funicular compression (ICD code P02.5), and complications associated with placental separation and hemorrhage (ICD code P02.1) in 56.7%, 20.0%, 13.3%, and 10% of the children, respectively.

Death of a child without congenital malformations during childbirth is preventable in most

cases [6]. The frequency of deaths of children in the intrapartum period can be reduced by optimizing obstetric care during childbirth. This entails an immediate response to emergency obstetric situations and a timely decision on the management of childbirth, in some cases, due to the timely determination of the need to take a woman to a perinatal center or call a body of specialists.

S-Bc categories VI and VII enable the assessment of the level of losses of viable children in the intrapartum period by considering their gestational age. Their share in perinatal mortality was 13.76%, including the death of a child without congenital malformations over 28 weeks of gestation in 7.93% of cases (category VI) and under 28 weeks in 5.82% of cases (category VII).

The body weight of children in the categories VI–VII was 1854 ± 248 g and their average gestational age was 30.5 ± 1.4 weeks. Body weight exceeding 2500 g ($M \pm m = 3350 \pm 128.3$ g), relatively low body weight ($M \pm m = 1220 \pm 130$ g), low body weight ($M \pm m = 2220 \pm 177.6$ g), and extremely low body weight ($M \pm m = 613.4 \pm 37.1$ g) was recorded in 34.6%, 7.7%, 15.5%, and 42.3% of the children, respectively.

An assessment of the sex characteristics of intranatal losses showed that in categories VI–VII, boys significantly predominated. The proportion of boys was 81.8% in category VI and 80.0% in category VII ($\chi^2 = 26.8$, $p = 0.003$).

Analysis of the body weight and gestational age of children in categories VI–VII revealed the presence of significant differences ($p = 0.000$).

The average gestational age of children born before the term of 28 weeks of gestation was 23.5 ± ± 0.3 weeks, with an average body weight of 613.3 ± 37.1 g (minimum, 468 g; maximum, 820 g). Extremely low weight was noted in 100% of the children. The average gestational age of children over 28 weeks of pregnancy was 36.2 ± 1.2 weeks (minimum, 28 weeks; maximum, 41 weeks), with an average body weight of 2764.8 ± 225.1 g (minimum, 1090 g; maximum, 3840 g). In most cases (60.0%), the body weight of children exceeded 2500 g. There were no children with extremely low body weight in category VII. Relatively low body weight and low body weight were noted in 13.3% and 26.7% of the children, respectively..

Analysis of the diseases and pathological conditions of the children who died in the intrapartum period revealed that in 82.6% of the children, the most common causes of stillbirth were diseases associated with the respiratory and cardiovascular systems characteristic of the perinatal period (ICD code R20–R29); including intrauterine hypoxia first noted during labor and delivery (ICD code R20.1) and unspecified congenital pneumonia (ICD code P23.9) in 78.2% and 21.1% of the children, respectively. In 17.4% of the children, death in the intrapartum period was caused by infectious diseases specific to the perinatal period (ICD code R35–R39).

S-Bc categories VIII–XII enable the analysis of the death of newborns in the first 7 days of life by considering their gestational age and the condition of the child at birth. The share of perinatal losses in categories VIII–XI of the classification was 23.3% of children. Among them, 13.2% were newborns with an Apgar score of more than 6 points; while, 10.1% had an Apgar score of less than 7 points; including those with an Apgar score of 4–6 points (3.7%) and those with intrauterine growth retardation (2.1%). Those without congenital malformations with an Apgar score of less than 7 points and a gestational age of 34 weeks and older accounted for 6.9% (S-Bc category XI) and those of 28–33 weeks of gestational age were 3.2% of the children (S-Bc category IX). S-Bc category VIII estimates the proportion of children born at 28–33 weeks of pregnancy with an Apgar score of more than 6 points (2.7%). S-Bc category X considers the proportion of children born more viable, without congenital malformations, at the gestational age of 34 weeks and older, with an Apgar score of more than 6 points. The proportion of this category was 10.5% that was a significant reserve for reducing perinatal losses. S-Bc category XII assesses newborns with a gestational age of less than 28 weeks, and this category amounted for 9.0% of the perinatal losses.

Analysis of the causes of deaths of newborns in the early neonatal period revealed that respiratory disorders in newborns that occurred in the perinatal period (ICD code R20–R29), infectious diseases specific for the perinatal period (ICD code R35–R39), intraventricular hemorrhage (ICD code R52), hemorrhagic disease of the fetus and newborn (ICD code R53), hemolytic disease of the fetus and newborn (ICD code R55), and other disorders of cerebral status in a newborn (ICD code P91) caused death in 40.0% (including distress in 41.2% and congenital pneumonia in 17.6% of the children), 36.0% (including bacterial sepsis in 22.2%), 12.0%, 2.0%, 2.0%, and 8% of the children, respectively.

The study revealed that in the group of stillbirths and children who died within the first 7 days of life, children of gestational age over 28 weeks prevailed statistically (75.47% ± 4.87% and 78.02% ± 4.95%, respectively, $p = 0.003$).

The data obtained enabled to establish that the required measures for reducing perinatal losses could be addressing the abnormalities in the state of the health of the mother and the child, timely diagnosis at the maternity welfare center, optimi-

zation of obstetric care during childbirth; including an adequate assessment of the obstetric risk for a woman in labor, and the timely choice of rational management of childbirth.

CONCLUSIONS

1. Perinatal audit using the Scandinavian-Baltic classification of perinatal losses showed that in the Northwestern Federal District, among the perinatal losses, the prevalence of perinatal mortality associated with manageable causes was 51.8%. This included antenatal losses (category III of the Scandinavian-Baltic classification, children of gestational age over 28 weeks without congenital defects and intrauterine growth retardation), intranatal losses (category VI of the Scandinavian-Baltic classification, children of gestational age over 28 weeks without congenital defects and intrauterine growth retardation), and loss of newborns (categories VIII–XI of the Scandinavian-Baltic classification, children of gestational age over 28 weeks without congenital defects and intrauterine growth retardation) in 27.5%, 7.4%, and 16.9% of cases, respectively. Among children who died in the perinatal period, children of gestational age over 28 weeks predominated statistically ($p = 0.003$).

2. In the nosological structure of stillbirth, diseases associated with respiratory disorders and infectious diseases accounted for 85.9% and 14.1% of the cases, respectively. Analysis of the mother's conditions, complications of her pregnancy and childbirth that had an impact on the stillborn showed that the fetal lesions were caused by unspecified morphological and functional abnormalities of the placenta, chorioamnionitis, and funicular compression in 56.7%, 20.0%, and 13.3% of the cases, respectively.

3. The main causes of death of newborns in the early neonatal period were respiratory disorders in newborns (40.0%), infectious diseases specific to the perinatal period (36.0%), and intraventricular hemorrhage (12.0%).

4. Assessment of sex characteristics of antenatal losses did not reveal a statistically significant difference. Boys and girls who died antenatally made up 50.7% and 49.3% ($p = 0.29$) of all losses of categories II–V of the Scandinavian-Baltic classification, respectively. Evaluation of sex characteristics of intranatal losses showed that in categories VI–VII, boys predominated significantly. The proportion of boys was 81.8% and 80.0% in category VI and VII, respectively ($\chi^2 = 26.8$; $p = 0.003$).

Author contributions. D.O.I. was the head of the scientific research; K.G.Sh. conducted the study, analyzed the results obtained, and created their literary presentation; K.E.M performed the analysis and interpretation of the results obtained, and created their literary presentation; Sh.D.H. took part in the study and performed the mathematical data processing.

Funding. The study had no external funding.

Conflict of interest. The authors declare no conflict of interest.

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