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**PROGNOSTIC ROLE OF DOPPLER METRY AND MORPHOLOGICAL PARAMETERS
IN EARLY AND LATE FETOPLACENTAL INSUFFICIENCY**

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Fetoplacental insufficiency is an important cause of fetal growth restriction and adverse perinatal outcomes, particularly when it develops early in pregnancy. A prospective cohort study conducted in 2023–2025 included 205 pregnant women aged 20–40 years: 85 with early-onset fetoplacental insufficiency, 65 with late-onset disease, and 55 controls. Early-onset insufficiency was characterized by higher uterine and umbilical artery pulsatility indices and a lower cerebroplacental ratio than late-onset disease and control pregnancy. Placental weight and chorionic villous area were reduced, whereas dystrophic changes were more frequent. Newborns in the early-onset group had lower birth weight and Apgar scores and showed more pronounced metabolic and coagulation abnormalities. Combined assessment of Doppler indices, placental morphology, and neonatal parameters may improve risk stratification and prediction of adverse perinatal outcomes.

Key words: fetal growth restriction, placental dysfunction, Doppler ultrasound, cerebroplacental ratio, placental morphology, perinatal outcomes.

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**ПРОГНОСТИЧНА РОЛЬ ДОПЛЕРОМЕТРІЇ ТА МОРФОЛОГІЧНИХ ПАРАМЕТРІВ
ПРИ РАННІЙ ТА ПІЗНІЙ ФЕТОПЛАЦЕНТАРНІЙ НЕДОСТАТНОСТІ**

Фетоплацентарна недостатність є важливою причиною затримки росту плода та несприятливих перинатальних наслідків, особливо за раннього розвитку патологічного процесу. У проспективне когортне дослідження 2023–2025 рр. включено 205 вагітних у віці 20–40 років: 85 із ранньою, 65 із пізньою фетоплацентарною недостатністю та 55 жінок контрольної групи. При ранній формі виявлено вищі індекси пульсатії маткових артерій та артерії пуповини й нижче цереброплацентарне співвідношення. Маса плаценти та площа хоріальних ворсинок були знижені, а дистрофічні зміни траплялися частіше. У новонароджених відзначалися менша маса тіла, нижчі показники за шкалою Апгар та більш виражені метаболічні й коагуляційні порушення. Комплексна оцінка доплерометричних, морфологічних та перинатальних показників може підвищити точність стратифікації ризику й прогнозування несприятливих наслідків.

Ключові слова: затримка росту плода, плацентарна дисфункція, доплерографія, цереброплацентарне співвідношення, морфологія плаценти, перинатальні наслідки.

Fetal growth restriction (FGR) remains one of the major challenges in contemporary perinatal medicine and is closely associated with placental dysfunction and an increased risk of adverse maternal and perinatal outcomes. Impaired placental development and uteroplacental perfusion may result in insufficient fetal oxygen and nutrient supply, contributing to abnormal fetal growth and increasing the risk of perinatal morbidity and mortality. Early identification of pregnancies at increased risk is therefore essential for appropriate surveillance and timely obstetric management [9, 14].

FGR represents a heterogeneous condition with considerable differences in its clinical presentation, severity, and prognosis depending on gestational age at onset. Early-onset FGR is generally associated with more pronounced placental dysfunction and may be accompanied by progressive deterioration of fetal hemodynamics, whereas late-onset FGR can be more difficult to recognize using conventional biometric criteria alone. Contemporary approaches therefore emphasize comprehensive assessment rather than reliance on an isolated diagnostic parameter [3, 14].

Doppler ultrasound plays a central role in the evaluation of uteroplacental and fetoplacental circulation. Assessment of the uterine arteries, umbilical artery, and middle cerebral artery, together with calculation of the cerebroplacental ratio (CPR), provides clinically relevant information regarding

placental vascular resistance and fetal circulatory adaptation. Several works demonstrated the potential value of cerebroplacental and umbilicocerebral ratios for predicting perinatal outcomes in pregnancies complicated by FGR, the other researchers reported an association between different Doppler parameters and adverse neonatal outcomes in late-onset FGR [2, 15]. More recent evidence also indicates that specific characteristics of middle cerebral artery Doppler may provide additional information for predicting adverse neonatal outcomes [6].

In addition to Doppler assessment, growing attention has been paid to angiogenic biomarkers as potential indicators of placental dysfunction. Alterations in placental growth factor (PlGF), soluble fms-like tyrosine kinase-1 (sFlt-1), and the sFlt-1/PlGF ratio have been investigated in pregnancies complicated by FGR and preeclampsia [1, 9, 11–13]. Palmrich et al. (2024) demonstrated the prognostic relevance of angiogenic markers in pregnancies with FGR [9]. In the other work the authors compared the clinical value of angiogenic factors with fetomaternal Doppler assessment at term [4]. Furthermore, serum PlGF in combination with other prenatal screening markers has shown potential for identifying pregnancies at increased risk of placental dysfunction and impaired fetal growth [5, 12].

The prognostic evaluation of FGR is increasingly moving toward the integration of

multiple clinical, ultrasound, Doppler, biochemical, and placental characteristics. Recent prospective evidence indicates that prediction of adverse outcomes in early-onset FGR may benefit from comprehensive assessment of several prognostic indicators [8]. Similarly, contemporary predictive models seek to combine multiple parameters to improve identification of pregnancies at the highest risk of adverse outcomes [10].

Although fetal surveillance has advanced considerably, substantial variability persists in the diagnostic criteria and clinical management of fetal growth restriction across centers and countries, highlighting the need for integrated and standardized approaches to risk assessment [3]. Investigation of the relationship between fetoplacental hemodynamics, placental morphology, and perinatal outcomes may therefore contribute to a more comprehensive evaluation of disease severity and prognosis.

The purpose of the study was to assess the prognostic significance of Doppler parameters of fetoplacental blood flow in early- and late-onset fetoplacental insufficiency and to determine their relationship with placental morphological characteristics and perinatal outcomes.

Materials and methods. Study design and population. A prospective cohort study was conducted from 2023 to 2025 at the Department of Obstetrics and Gynecology II of Azerbaijan Medical University and the laboratory of the Educational Surgical Clinic of Azerbaijan Medical University. The study included 205 pregnant women aged 20–40 years (mean age 32.0 ± 1.8 years). The main group comprised 150 women with fetoplacental insufficiency and fetal growth restriction and was divided according to onset into an early-onset subgroup ($n=85$) and a late-onset subgroup ($n=65$). The control group included 55 pregnant women of the same age range without fetoplacental insufficiency or fetal growth restriction.

Inclusion criteria. Pregnant women aged 20–40 years with fetoplacental insufficiency and fetal growth restriction who provided voluntary informed consent were included.

Exclusion criteria. Women with malignant neoplasms of the reproductive system or other localizations, chronic kidney disease, grade III arterial hypertension, age younger than 20 or older than 40 years, and refusal to participate were excluded from the study.

Clinical and functional assessment. Clinical and anamnestic data included pregnancy complications and maternal and neonatal condition. Ultrasound examinations were performed at the Educational Surgical Clinic of Azerbaijan Medical University using the USM SHENZHEN MINDRAY DC-8 expert-class ultrasound system. Pulsatility indices of the uterine arteries, umbilical artery, and middle cerebral artery were assessed, and the cerebroplacental ratio was calculated as the middle cerebral artery pulsatility index divided by the umbilical artery pulsatility index. Measurements were obtained in the absence of fetal movements;

three consecutive values were recorded and averaged. According to the ISUOG Guidelines (2023), reference values were 0.8–1.4 for uterine artery pulsatility index, 0.6–0.9 for umbilical artery pulsatility index, and >1.08 for the cerebroplacental ratio.

Laboratory and morphological assessment. Blood biochemistry and lactate were measured on the Cobas 6000 system (Roche, Germany) by an enzymatic method. Malondialdehyde was determined spectrophotometrically using thiobarbituric acid. Protein C and Protein S were assessed by coagulometry on the ACL TOP 500 system (Instrumentation Laboratory, USA). Prothrombin time and fibrinogen were measured using standard methods with quality control in accordance with ISO 15189. Reference ranges were 0.5–2.0 mmol/L for lactate, 3.3–5.5 mmol/L for glucose, <1.2 $\mu\text{mol/L}$ for malondialdehyde, 70–120 % for Protein C and Protein S, 11–15 s for prothrombin time, and 2.5–4.0 g/L for fibrinogen. Placental weight and chorionic villous area were measured after delivery, and dystrophic changes were determined histologically in accordance with the stated placental pathology protocol.

Perinatal outcomes and data collection. Birth weight, head and abdominal circumference, Apgar scores at 1 and 5 minutes, neonatal biochemical markers, mode of delivery, and need for resuscitation were recorded. Data were collected prospectively in standardized forms, checked for completeness, and processed anonymously. The primary outcomes were the severity of fetal growth restriction and fetal/neonatal condition; secondary outcomes included pregnancy complications, Doppler indices, placental morphometry, neonatal biochemical parameters, and delivery and early neonatal characteristics.

Ethics and standards. The study was conducted in accordance with the Declaration of Helsinki (2013). All participants provided written informed consent.

Statistical analysis. Data were processed using SPSS version 25.0. Quantitative variables are presented as mean $\pm$ standard deviation ($M \pm SD$), and qualitative variables as absolute numbers and percentages. Group comparisons were performed using Student's *t*-test, the Mann–Whitney *U* test, analysis of variance, and the χ^2 test or Fisher's exact test, as appropriate. Correlations were assessed using Pearson's or Spearman's correlation coefficients. Differences were considered statistically significant at $p < 0.05$.

Results of the study. The mean age of women in the main group was 32.0 ± 1.8 years. Women aged 26–35 years predominated in all study groups. In the early-onset subgroup, 12 (14.1 %) women were aged 20–25 years, 18 (21.2 %) were 26–30 years, 38 (44.7 %) were 31–35 years, and 17 (20.0 %) were 36–40 years. The corresponding values in the late-onset subgroup were 8 (12.3 %), 20 (30.8 %), 25 (38.5 %), and 12 (18.5 %), and in controls 7 (12.7 %), 15 (27.3 %), 20 (36.4 %), and 13 (23.6 %), respectively.

Clinical pregnancy complications were more frequent in women with early-onset fetoplacental insufficiency. Abnormal labor patterns occurred in 64 (75.3 %) women with early-onset disease, 30 (46.2 %) with late-onset disease, and 2 (3.6 %) controls. First-trimester toxicosis was recorded in 54 (63.5 %), 28 (43.1 %), and 5 (9.1 %), respectively; anemia in 46 (54.1 %), 30 (46.2 %), and 4 (7.3 %);

threatened miscarriage in 32 (37.6 %), 15 (23.1 %), and 0; and preeclampsia in 18 (21.2 %), 5 (7.7 %), and 0. Compared with late-onset disease, abnormal labor patterns and first-trimester toxicosis were significantly more frequent in the early-onset subgroup ($p=0.001$ and $p=0.02$, respectively), as was preeclampsia ($p=0.04$). Most comparisons with the control group were significant at $p<0.001$ (Table 1).

Table 1

Doppler and placental morphometric parameters across study groups

Parameter	Early-onset FPI (n=85)	Late-onset FPI (n=65)	Control (n=55)
Uterine artery PI	1.98±0.20	1.63±0.18	1.18±0.12
Umbilical artery PI	0.94±0.12	0.85±0.10	0.72±0.08
Cerebroplacental ratio	1.25±0.15	1.42±0.18	1.70±0.20
Placental weight, g	360±25	400±30	480±30
Chorionic villi area, cm ²	220±15	250±20	300±25
Dystrophic changes, %	48.2	32.3	5.5

Doppler examination demonstrated the greatest impairment in the early-onset subgroup. Uterine artery pulsatility index was 1.98±0.20 versus 1.63±0.18 in late-onset disease ($p<0.001$) and 1.18±0.12 in controls ($p<0.001$). Umbilical artery pulsatility index was 0.94±0.12 versus 0.85±0.10 ($p=0.002$) and 0.72±0.08 ($p<0.001$), respectively. The cerebroplacental ratio was lower in early-onset disease (1.25±0.15) than in late-onset disease (1.42±0.18, $p=0.01$) and controls (1.70±0.20, $p<0.001$).

Placental morphology showed a similar gradient of severity. Placental weight was 360±25 g in early-onset fetoplacental insufficiency compared with 400±30 g in late-onset disease and 480±30 g in controls ($p<0.001$ for the reported comparisons). Chorionic villous area was 220±15 cm², 250±20 cm²,

and 300±25 cm², respectively; the early-onset subgroup differed from late-onset disease at $p=0.002$ and from controls at $p<0.001$. Dystrophic changes were observed in 48.2 %, 32.3 %, and 5.5 % of cases, respectively (Fig.1).

Perinatal outcomes were less favorable in the early-onset subgroup. Mean birth weight was 2800±320 g compared with 3100±300 g in late-onset disease ($p<0.01$) and 3500±280 g in controls ($p<0.001$). Head circumference was 32.5±1.2 cm, 33.0±1.1 cm ($p=0.03$), and 34.0±1.0 cm ($p<0.001$), respectively. Apgar scores at 1 minute were 6.8±0.5, 7.3±0.4, and 8.5±0.3, and at 5 minutes 7.9±0.4, 8.2±0.3, and 9.0±0.2, respectively (Fig.2). Resuscitation measures were required more frequently in the early-onset subgroup (Table 2).

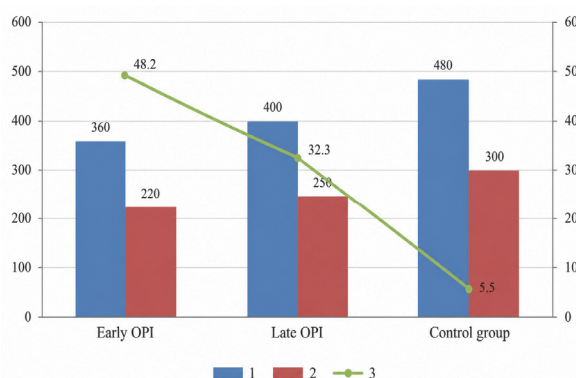


Fig. 1. Placental Morphometry. 1 – Placental weight (g); 2 – Chorionic villi area (cm²); 3 – Dystrophic changes (%).

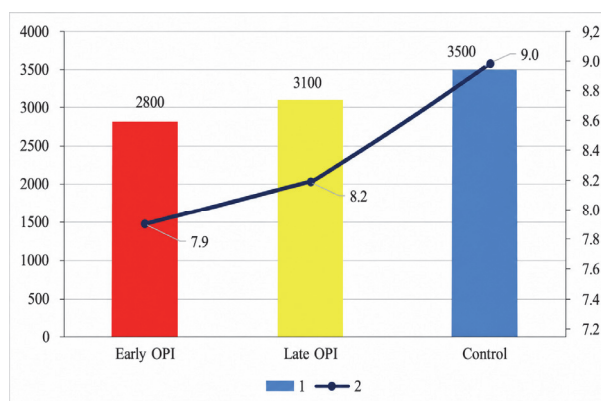


Fig. 2. Perinatal Indicators. 1 – Birth weight; 2 – Apgar score at 5 min.

Table 2

Laboratory indicators of newborns of mothers with fetoplacental insufficiency and fetal growth restriction

Parameter	Early-onset FPI (n=85)	Late-onset FPI (n=65)	Control (n=55)
Lactate, mmol/L	4.2±0.6	3.5±0.5	2.1±0.4
Glucose, mmol/L	2.8±0.4	3.2±0.3	3.8±0.3
Malondialdehyde, μmol/L	1.9±0.3	1.5±0.2	0.9±0.2
Protein C, %	65.2±7.4	70.5±6.2	82.1±5.5
Protein S, %	62.3±6.8	68.0±5.7	80.5±5.0
Prothrombin time, s	16.8±1.2	15.5±1.1	13.8±1.0
Fibrinogen, g/L	3.1±0.4	3.3±0.3	3.8±0.3
Abnormal thrombophilia panel, %	28.2	15.3	2.0

Laboratory findings likewise indicated more pronounced metabolic and coagulation abnormalities in newborns from the early-onset subgroup. Lactate and malondialdehyde were higher, glucose and anticoagulant proteins C and S were lower, and prothrombin time was prolonged. Abnormal thrombophilia markers were detected in 28.2 % of the early-onset group, 15.3 % of the late-onset group, and 2.0 % of controls.

Discussion. The present study demonstrated substantial differences in fetoplacental hemodynamics, placental morphology, and perinatal outcomes between early- and late-onset fetoplacental insufficiency. The abnormalities were most pronounced in women with early-onset FPI, who demonstrated increased uterine and umbilical artery pulsatility indices, a reduced cerebroplacental ratio, lower placental weight and chorionic villous area, a higher frequency of dystrophic placental changes, and less favorable neonatal outcomes. Taken together, these findings indicate that early-onset placental dysfunction is associated with more severe impairment of the maternal-placental-fetal circulation and more pronounced structural and functional alterations of the placenta.

Doppler abnormalities were among the most prominent findings of the present study. Women with early-onset FPI had a significantly higher uterine artery pulsatility index than those with late-onset FPI and controls. Umbilical artery resistance was also increased, whereas CPR was reduced. These findings reflect increased resistance within the uteroplacental and fetoplacental vascular beds and compensatory redistribution of fetal circulation. The observed pattern is consistent with the established role of Doppler ultrasound in the assessment of pregnancies complicated by FGR and placental dysfunction. Coenen et al. (2022) demonstrated that cerebroplacental and umbilicocerebral ratios may contribute to the prediction of perinatal outcomes in FGR pregnancies [2]. Similarly, Yılmaz et al. (2023) showed that Doppler parameters are associated with adverse neonatal outcomes in fetuses with late-onset FGR [15].

The prognostic importance of cerebral Doppler assessment is further supported by more recent evidence. Karabay et al. (2025) investigated the relationship between fetal middle cerebral artery Doppler characteristics and adverse neonatal outcomes in late FGR [6]. Although the populations and Doppler parameters evaluated in that study differ from those of the present investigation, both sets of findings support the concept that assessment of fetal circulatory adaptation may provide clinically relevant information beyond fetal biometry alone. In our study, the lower CPR observed particularly in early-onset FPI may therefore be interpreted as an indicator of more pronounced hemodynamic compromise.

These findings should also be considered in the context of the increasing interest in angiogenic markers of placental dysfunction. Palmrich et al. (2024) reported the prognostic value of angiogenic markers in pregnancies complicated by FGR [9].

Garcia-Manau et al. (2025), in a randomized controlled trial, compared angiogenic factors with fetomaternal Doppler assessment in FGR at term [4]. Furthermore, Birdir et al. (2018) evaluated sFlt-1, PlGF, the sFlt-1/PlGF ratio, and PAPP-A as predictors of late-onset preeclampsia and intrauterine growth restriction [1]. Collectively, these studies indicate that placental dysfunction is a complex process in which vascular resistance, angiogenic imbalance, and fetal adaptive responses represent interconnected components.

The potential clinical relevance of angiogenic imbalance appears particularly important in early-onset disease. Shinohara et al. (2026) demonstrated that the sFlt-1/PlGF ratio may predict serious outcomes in early-onset FGR [11]. Villalaín et al. (2025) also highlighted the potential clinical application of angiogenesis biomarkers in FGR [13]. In addition, Huang and Wang (2025) evaluated serum PlGF combined with PAPP-A for prediction of FGR in early pregnancy [5], while Shu and Wang (2025) examined prenatal screening markers combined with PlGF for early prediction of preeclampsia [12]. Although angiogenic biomarkers were not the principal focus of the present analysis, these data provide an important biological context for the Doppler abnormalities observed in our patients and support the multifactorial nature of placental dysfunction.

Placental morphometry provided additional evidence of greater disease severity in the early-onset group. Placental weight was reduced to 360 ± 25 g in women with early-onset FPI compared with 400 ± 30 g in late-onset FPI and 480 ± 30 g in controls. Similarly, chorionic villous area was reduced, while dystrophic changes were substantially more frequent in early-onset disease. These structural findings complement the Doppler results and suggest that increased vascular resistance and impaired fetoplacental circulation occur in parallel with morphological evidence of placental damage. The combination of functional and structural abnormalities may therefore provide a more complete representation of placental dysfunction than either component considered independently.

The greater severity of placental and hemodynamic abnormalities in early-onset FPI was also reflected in neonatal outcomes. Newborns in this group had lower birth weight and head circumference and lower Apgar scores compared with the late-onset FPI and control groups. Biochemical findings further indicated greater metabolic and oxidative stress. These results support the clinical relevance of identifying severe placental dysfunction before delivery because deterioration of fetoplacental circulation appears to be associated with measurable consequences for neonatal condition.

The findings are particularly relevant when considered alongside recent studies focusing specifically on prediction of adverse outcomes in early-onset FGR. Li et al. (2026), in a prospective study, investigated prediction of adverse outcomes in early-

onset FGR [8]. Their work reinforces the importance of risk stratification in this particularly vulnerable group and supports the use of multiple prognostic indicators rather than reliance on a single measurement. The pronounced combination of Doppler, morphological, and neonatal abnormalities observed in our early-onset group is consistent with the rationale underlying such comprehensive prognostic assessment.

Another important consideration is the heterogeneity of contemporary approaches to FGR. Fantasia et al. (2022), in an international survey, demonstrated variability in the diagnosis and management of fetal growth restriction [3]. Villalaín et al. (2025) further reviewed contemporary approaches to FGR screening and diagnosis [14]. This variability is clinically relevant because differences in diagnostic thresholds, Doppler surveillance strategies, and timing of intervention may influence both classification and outcomes. The present findings support the value of an integrated diagnostic strategy incorporating fetal Doppler assessment with other indicators of placental function and fetal condition.

The potential advantages of such an integrated strategy are also supported by emerging evidence on multivariable prediction. Peng et al. (2026), in a systematic review and meta-analysis of predictive models for adverse pregnancy outcomes in FGR, evaluated contemporary approaches to risk prediction [10]. This direction is particularly relevant because no single marker can fully characterize the complex pathophysiology and clinical course of FGR. Combining Doppler parameters

with clinical characteristics, placental findings, and potentially angiogenic biomarkers may improve identification of patients at greatest risk and facilitate individualized surveillance.

From a regional perspective, optimization of perinatal care also remains relevant to contemporary maternal and child health. Khalafli et al. (2025) described regional features of birth-rate dynamics in Azerbaijan [7]. Although that study did not specifically investigate FGR or placental insufficiency, regional demographic and perinatal characteristics should be considered when developing locally applicable strategies for maternal and neonatal care. Therefore, studies conducted in local populations may complement international evidence and contribute to adaptation of risk-assessment approaches to specific healthcare settings.

Thus, our results support the concept that early-onset FPI represents a more severe phenotype of placental dysfunction than late-onset disease, characterized by simultaneous deterioration of Doppler parameters, structural placental abnormalities, and unfavorable perinatal indicators. The findings are consistent with contemporary evidence emphasizing the prognostic relevance of Doppler assessment [2, 6, 15], angiogenic markers [1, 4, 5, 9, 11–13], and integrated predictive approaches [8, 10, 14]. A combined assessment of these domains may therefore improve risk stratification and contribute to more individualized surveillance of pregnancies complicated by placental dysfunction and fetal growth restriction.

Conclusion

The results of the present study indicate that early-onset fetoplacental insufficiency is associated with more pronounced impairments in uteroplacental and fetoplacental blood flow, morphological placental alterations, and adverse perinatal outcomes compared with late-onset FPI. A comprehensive assessment of Doppler parameters, placental morphometric characteristics, and neonatal perinatal indicators enables a more accurate evaluation of the severity of placental dysfunction and may improve prediction of pregnancy outcomes. The findings highlight the importance of early diagnosis and dynamic monitoring of pregnant women at risk of FPI, facilitating timely clinical decision-making and improving perinatal outcomes.

Further multicenter prospective studies with larger cohorts and long-term follow-up are needed to validate integrated Doppler, placental morphological, and neonatal markers for individualized prediction of adverse perinatal outcomes.

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Conflict of interest. The authors have no conflicts of interest to declare.

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Article received: 5.08.2025

DOI 10.26724/2079-8334-2026-3-97-151-155

UDC 616.831+616.12-036.88 6

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VARIABILITY OF MORTALITY RISK DUE TO CEREBROVASCULAR DISEASES BY DAYS OF THE WEEK AND SEASONS IN AZERBAIJAN

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Information has been retrospectively collected on all medical death certificates in Azerbaijan for 2022, where the initial cause was indicated as cerebrovascular diseases (7052), which were distributed according to the days of death. All the characteristics of descriptive statistics were determined (average daily number of deaths, average error, mode, median, variance, standard deviation, kurtosis, asymmetry, minimum and maximum number of daily deaths, etc.). Attention is drawn to the complete coincidence of the mode and median (19), as well as their similarity to the average (19.4). At the same time, the interval between the maximum (48) and minimum (7) number of deaths was wide (41). The average daily number of deaths by day of the week ranged from 19.8 ± 0.88 (Wednesday) to 21.1 ± 0.88 (Monday). The difference between these values was statistically significant ($P=0.05$). In Azerbaijan, the average daily number of deaths directly from cerebrovascular diseases is 19.4 ± 0.34 , and it varies by day of the week, month, and season. The ranges of fluctuations in daily deaths (7–48), average daily deaths by week ($13.0 \pm 1.52 - 39.7 \pm 2.83$) and by month ($16.1 \pm 0.89 - 32.0 \pm 1.46$) are relatively wide, and by days of the week ($18.8 \pm 0.88 - 21.1 \pm 0.88$) and seasons ($17.4 \pm 0.42 - 24.8 \pm 0.91$) are relatively narrow.

Key words: mortality risk, season, week, variability, cerebrovascular disease.

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ВАРІАБІЛЬНІСТЬ РИЗИКУ СМЕРТНОСТІ ВІД ЦЕРЕБРОВАСКУЛЯРНИХ ЗАХВОРЮВАНЬ ЗАЛЕЖНО ВІД ДНЯ ТИЖНЯ ТА ПОРИ РОКУ В АЗЕРБАЙДЖАНІ

Ретроспективно зібрано інформацію про всі медичні свідоцтва про смерть в Азербайджані за 2022 рік, у яких як первинну причину вказано цереброваскулярні захворювання (7052), і розподілено її за днями констатації летального результату. Було визначено всі характеристики описової статистики (середньодобова кількість випадків смерті, середня похибка, мода, медіана, дисперсія, стандартне відхилення, ексцес, асиметрія, мінімальна та максимальна кількість добових випадків смерті тощо). Привертає увагу повний збіг моди та медіани (19), а також їхня схожість із середнім показником (19,4). При цьому інтервал між максимальною (48) та мінімальною (7) кількістю випадків смерті був широким (41). Середньодобова кількість смертей за днями тижня коливалася в діапазоні $19,8 \pm 0,88$ (середа) – $21,1 \pm 0,88$ (понеділок). Різниця між цими значеннями була статистично значущою ($P=0,05$). В Азербайджані середньодобова кількість смертей безпосередньо від цереброваскулярних захворювань становить $19,4 \pm 0,34$; вона змінюється залежно від дня тижня, місяця та пори року. Межі коливань щоденних випадків смерті (7–48), середньодобових випадків смерті за тижнями ($13,0 \pm 1,52 - 39,7 \pm 2,83$) та за місяцями ($16,1 \pm 0,89 - 32,0 \pm 1,46$) порівняно широкі, а за днями тижня ($18,8 \pm 0,88 - 21,1 \pm 0,88$) та сезонами року ($17,4 \pm 0,42 - 24,8 \pm 0,91$) порівняно вузькі.

Ключові слова: ризик смертності, сезон, тиждень, варіабельність, цереброваскулярні захворювання.

Seasonal variability in morbidity and mortality associated with cardiovascular diseases has long been observed, but in recent years it has attracted attention in many countries worldwide [7, 8]. Analyzing the main patterns of seasonal cardiovascular mortality, the authors emphasize its geographic and socio-

economic characteristics [11, 12, 15]. Cardiovascular diseases (CVDs) were the leading cause of disability-adjusted life years (DALYs) and deaths estimated in the GBD. As of 2023, there were 437 million (95 % UI: 401 to 465 million) CVD DALYs globally, a 1.4-fold increase from the number in 1990 of 320 million