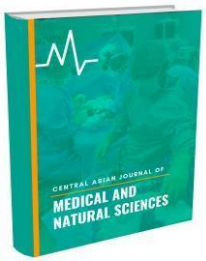

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Article

Characteristics of the Neonatal Period in Children Born Small for Gestational Age (Intrauterine Growth Restriction — IUGR

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Abstract: Intrauterine growth restriction remains one of the most significant problems in modern neonatology because impaired fetal growth is closely associated with increased neonatal morbidity and disturbances of early postnatal adaptation. The present study was devoted to evaluating the characteristics of the neonatal period in children born small for gestational age with signs of intrauterine growth restriction. Clinical analysis included assessment of anthropometric indicators, respiratory adaptation, metabolic stability, neurological condition, and the frequency of intensive care requirements during the early neonatal period. The obtained findings demonstrated that the majority of examined newborns experienced low birth weight, respiratory distress, hypoglycemia, thermoregulation disorders, and feeding difficulties immediately after birth. Premature infants showed the most severe manifestations of maladaptation and more frequently required specialized neonatal support. The results emphasize the important role of chronic placental insufficiency and fetal hypoxia in the development of neonatal complications and highlight the necessity for early diagnosis, careful prenatal monitoring, and multidisciplinary neonatal management.

Keywords: Intrauterine growth restriction, small for gestational age, neonatal adaptation, respiratory distress syndrome, hypoglycemia, placental insufficiency, neonatal intensive care.

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Introduction

Over the last few years, much attention has been paid to the problem of the small-for-gestational-age neonate because, even in developed nations, disturbances in fetal growth continue to be one of the most significant causes of early neonatal morbidity and of long-term sequelae of pregnancy and birth [1].

Some infants have smaller anthropometric parameters by constitutional or genetic factors, and intrauterine growth restriction is a pathological condition in which the fetus fails to attain its biologically determined growth potential and as a consequence, many of these infants will have multiple organ systems simultaneously that are functionally immature and/or metabolically unstable at birth, as well as reduced adaptive reserves. Infants of IUGR are prone to a much more challenging adaptation process, as the chronic hypoxia exposure during fetal development leads to impairment in respiratory control, neurological development, thermoregulation and glucose metabolism, adding to the higher incidence of needing extended neonatal medical monitoring on the day of birth [2].

In clinical practice such children are repeatedly identified as being at increased risk of respiratory distress syndrome, hypoglycemia, hypothermia, feeding intolerance, and infectious complications and in some cases may be at increased risk for hypoxic-ischemic injury to the central nervous system secondary to severe placental insufficiency. Despite the marked improvement in survival rates of newborns with the development of neonatal

intensive care, the risk for later neuropsychological development and metabolic disorders is still clinically relevant.
Concurrently, although significant advances in prenatal diagnostics and obstetric surveillance have been made, the early neonatal characteristics of infants with IUGR remain very variable, reflecting differences in gestational age, degree of placental insufficiency, maternal medical conditions, and the duration of chronic fetal hypoxia and, therefore, remain a very current and topical subject within modern perinatal medicine [3]. Further research into neonatal adaptation in these children could help to identify high risk conditions earlier, optimize intensive care strategies and enhance short and long-term health outcomes.

Materials and methods

The objectives of the present observational clinical study was to assess in a tertiary perinatal care center between 2022 and 2025 the characteristics of the neonatal period in children born small for gestational age with intrauterine growth restriction. Newborns' early adaptation was focus upon, as they may exhibit physiological instability shortly after birth, as a result of chronic placental insufficiency and prolonged intrauterine hypoxia occurring in fetal life [4]. The importance of FGR has greatly risen in recent years as impaired fetal growth is closely linked with neonatal morbidity, delayed neurological maturation and long-term metabolic morbidity [5].
All in all, 100 newborns with small-for-gestational-age (SGA) and intrauterine growth restriction (IUGR) were investigated. Diagnosis was made based on the antenatal ultrasonographic findings, fetal biometric indices, Doppler assessment of placental blood flow, and postnatal anthropometric evaluation done at the time of delivery. One of the major criteria for diagnosis was birth weight below the 10th percentile of birth weight for gestational age, and other clinical indicators of chronic fetal malnutrition were considered when examining the neonates. Both term and preterm infants were included because fetal growth restriction can occur at varying times of gestation depending on the severity of the placental dysfunction and the maternal complications during pregnancy. To simplify the interpretation of neonatal adaptation indicators, the study excluded newborns with congenital malformations, with chromosomal abnormalities, severe intrauterine infections, and newborns with incomplete clinical information. In all cases, maternal medical history was carefully evaluated, including maternal age, obstetric history, anemia, hypertensive disorders, preeclampsia, placental abnormalities, and chronic somatic diseases that might affect fetal growth and intrauterine oxygen supply [6].
All neonates were immediately subjected to a comprehensive clinical examination of their body weight, body length, head circumference, gestational age, Apgar score at first minute, Apgar score at fifth minute, respiratory adaptation, thermoregulation, reflex activity, muscle tone and skin perfusion. A special clinical focus was given to those complications that were frequently encountered in the management of IUGR, such as: Respiratory distress syndrome, hypoglycemia, neurological depression, feeding intolerance, hypothermia, and signs of hypoxic involvement of the CNS [7].

Supplemental oxygen and IV fluid use and admission to neonatal intensive care unit (NICU) were also documented. The obtained data were then analyzed statistically by SPSS software. The quantitative variables were summarized as means with standard deviations and qualitative variables were summarized as percentages. Comparative analysis was conducted with student's t test and Chi-square test and it was concluded that the differences were statistically significant at < 0.05.

Results

The analysis of clinical data obtained revealed that a decrease in birth weight and intrauterine growth retardation was associated with significant problems in the early

neonatal adaptation period, the severity of which was affected not only by the duration of fetal chronic hypoxia but also by the duration of fetal chronic hypoxia and the degree of fetal placental insufficiency during fetal development. Most of the infants examined had lower anthropometric measurements, and a few term infants whose body weight was still far below the normal standards of the corresponding gestational age had symptoms of functional immaturity [8].

In most cases these neonates had poor crying, low motor activity, poor thermoregulation and low tolerance for feeding during the first few hours of life. Evaluation by clinical examination revealed that respiratory adaptation disorders was one of the most common complications in intrauterine growth restricted infants. Premature newborns were most commonly affected with respiratory distress syndrome, with minor respiratory instability also recorded amongst term infants who exhibited severe fetal growth impairment. Cyanosis, irregular breathing patterns and oxygen desaturations were seen in several newborns, who needed oxygen supplementation immediately after birth. Concurrently, chronic antenatal hypoxia and poor placental circulation seemed to be closely linked to the pulmonary circulation adaptation process [9]. Neonatal period was also a time of metabolic complications. A significant number of infants were found to have episodes of hypoglycemia, particularly infants with severe body weight deficiency and reduced fatty tissue of the subcutaneous tissue. Hypothermia and feeding intolerance were also common in the first days of life and were also frequently a complication. Limited energy reserves meant these infants were unable to achieve physiologic homeostasis in the extrauterine environment. In a few clinically more severe cases, neurological symptoms such as muscular hypotonia, reduced neonatal reflexes, irritability and transient central nervous system depression were noted [10].

Table 1. The main clinical characteristics of the Neonatal Period in infants with IUGR:

Clinical indications	Frequency (%)
Prematurity	58%
Low birth weight	82%
Respiratory distress syndrome	36%
Hypothermia	27%
Hypoglycemia	31%
Feeding intolerance	34%
Neurological depression	22%
NICU hospitalization	41%
Oxygen therapy requirement	29%

The candidates presented above indicate that the newborns who have IUGR often have multiple disturbances to the neonatal adaptation process involving more than one system (respiratory, metabolic and neurological). The large proportion of being low birth weight, preterm and needing intensive care unit support further illustrates the vulnerability of these infants during the first days in extrauterine life and highlights the need to monitor and provide specialized neonatal care early on.
Nearly half of all the observed newborns were hospitalized in the neonatal intensive care unit, for the most part due to respiratory instability, metabolic disorders, and extended adaptation difficulties. Although he made a significant improvement in the care of the newborn, infants who suffered from FGR continued to require more supportive therapy, and to need closer clinical supervision throughout the early neonatal period [11]. In all, the results obtained have shown that IUGR has a significant impact on neonatal adaptation processes and is one of the most important variables that predict the early neonatal

morbidity.

Discussion

The findings from this study indicate that the consequences of the small size at birth and the physiological state of intrauterine growth restriction is a clinically vulnerable newborn population in which the adaptation process after birth occurs with lower level of physiological reserves. Although the survival rate among very growth-restricted newborns has increased greatly over the last decades, disturbances of respiratory, metabolic and neurological systems are still very common in the first few days of life [12].

Chronic placental insufficiency seems to be a key factor in the pathogenesis of these complications, as it slowly reduces fetal oxygen and nutrient supply with time, thus having a detrimental effect on fetal organ maturation and adaptation to post-natal life. The high prevalence of respiratory adaptations disorders, especially in the severe growth restricted preemies, was one of the most significant results from the present study. It may be accounted for by fetal hypoxia, which might be associated with pulmonary immaturity, also contributing to the instability of respiratory function in the immediate post-natal period. This has been related in modern neonatal investigations where growth restricted infants had a higher incidence of respiratory distress syndrome, pulmonary hypertension and extended oxygen requirement in the neonatal period [13].

Chronic intrauterine stress also can affect lung development and the normal shift of fetal to neonatal circulation, even in term infants. Metabolic instability was another major clinical issue for the babies that were studied. The high incidence of hypoglycemia and hypothermia indicates the low levels of glycogen reserves and subcutaneous fat seen in the FGR's. During the first hours after birth metabolic compensation can quickly become inadequate, as these newborns use much of their energy to regulate normal body temperature and respiratory activity. Feeding intolerance and weak sucking reflexes also make nutritional adaptation difficult, and necessitate special neonatal care for longer periods [14].

Neurological symptoms that were found during the study warrant special mention and are of particular interest because they are not in the brain until the baby is born, but they can be affected long before that. The effects of impaired fetal cerebral oxygenation are seen to persist in neurological adaptation after birth, as several infants had reduced muscle tone and weak neonatal reflexes, and transient depression of central nervous system activity. Children born with severe intrauterine growth retardation are increasingly reported to suffer from cognitive, behavioral and neurodevelopmental problems in later childhood, even though they appear to be stable at the time of birth [15].

In general, the results gained highlight the importance of early diagnosis of placental dysfunction, attention to fetal growth patterns and the need for action at the newborn stage right after birth. The importance of multidisciplinary collaboration between obstetricians, neonatologists, neurologists and intensive care physicians in the future cannot be overstated in order to minimize neonatal morbidity and optimize short and long-term results in this high-risk population.

Conclusion

The study conducted in this respect showed that the IUGR small for gestation neonates have a much more complex neonatal adaptation period than those whose prenatal growth has occurred within normal limits of physiology. Chronic placental insufficiency and intrauterine hypoxia has profound effects on functional maturation of important organ systems in utero, leading to a reduced compensatory reserve and susceptibility for early neonatal complications in many of these infants at the time of birth. The results obtained corroborated that respiratory disease, metabolic instability, hypothermia, feeding intolerance and neurological depression are still the most frequent

clinical conditions that are encountered in the first days of life in this patient population. The very close association between diminished fetal growth and the level of early neonatal maladaptation was one of the most important findings of the study. Infants who were extremely low birth weight (ELBW) had the most severe body weight deficiency and needed the most extended intensive medical care after delivery, and were found to have the highest rate of respiratory distress syndrome (RDS). Even term newborns with a severe intrauterine growth restriction often showed evidence of functional immaturity as well, and thus gestational age is not necessarily a reliable indicator of true maturity of the newborn in the face of extraordinary conditions of birth. The chronic fetal hypoxia-induced systemic effect on developing organs and tissues is further highlighted by the fact that metabolic impairment and neurological symptoms also persist in the neonatal period. The results also highlight the importance of early prenatal diagnosis and continuous fetal monitoring during pregnancy. Earlier detection of placental dysfunction, careful monitoring of fetal growth and appropriate obstetric management can help to lead to early intervention and decrease the occurrence of serious neonatal complications. It is also essential to have specialized neonatal observation post-birth, as babies of IGR may be needing respiratory, nutritional and metabolic help even if they are not extreme premature babies. Newborns with intrauterine growth restriction should be viewed as a high risk neonatal group at risk of continuing to have a negative impact on their physical and neurological development well beyond the neonatal period, and warrant multi-disciplinary supervision throughout subsequent childhood development.

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