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Short Communication

Assessing neonatal complications of intrauterine growth restriction; A one-week assessment at the National Institute of Child Health, Karachi.

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Abstract

Background: Intrauterine growth restriction (IUGR) is characterized by fetal growth below the expected rate for a given infant's potential due to genetic or environmental factors. Neonates with IUGR are at risk for various short-term and long-term complications, which can lead to increased mortality and morbidity. Preterm IUGR affects approximately 7% to 9% of newborns, and it is associated with 50% of unexplained stillbirths. This study aimed to determine the frequency of complications associated with IUGR within one week of birth among neonates admitted to the National Institute of Child Health (NICH) neonatal department in Karachi, Pakistan.

Methodology: This study was conducted at NICH Karachi, Pakistan. Neonates diagnosed with IUGR were included after obtaining informed consent. Outcomes, including complications such as hypocalcemia, hypothermia, sepsis, jaundice, persistent pulmonary hypertension, and hypoglycemia, were systematically assessed.

Results: The mean age of neonates was 4.9 ± 1.3 days. Among the 191 neonates studied, 61.3% were male and 38.7% were female. Complications observed included hypocalcemia (8.3%), hypothermia (5.2%), sepsis (15.2%), jaundice (23.6%), hypoglycemia (6.2%), and persistent pulmonary hypertension (10.6%). Notably, 30.9% of the neonates exhibited no complications.

Conclusion: Jaundice was identified as the most common complication of IUGR, followed by sepsis and persistent pulmonary hypertension. These findings underscore the need for further research to explore the risk factors associated with IUGR complications and to develop strategies for early detection and management to improve neonatal outcomes.

Keywords

Complications, Intrauterine Growth Restriction, Birth, Neonates, Neonatal Mortality, Morbidity.

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Introduction

Intrauterine growth restriction (IUGR) is a significant condition associated with increased perinatal morbidity and mortality. IUGR is characterized by a fetus failing to achieve its growth potential, and it is often used interchangeably with the term small for gestational age (SGA), which refers to a fetus with a weight below the 10th percentile for its gestational age. Identifying IUGR is crucial for managing and mitigating potential risks. Diagnosis begins with assessing risk factors and is confirmed through ultrasound biometry when an estimated fetal weight (EFW) falls below the 10th percentile[1].

IUGR, also known as fetal growth restriction, describes a condition in which the fetus is smaller than expected for its gestational age. This can occur whether the fetus is born at term (after 37 weeks) or preterm (before 37 weeks)[2]. This condition is prevalent, affecting up to 7% of pregnancies, and is primarily attributed to placental insufficiency[3]. This insufficiency forces the fetus to adapt its circulation to prioritize oxygen and nutrient delivery to the brain[4-6].

Studies indicate that fetuses with IUGR face a significantly increased risk of perinatal death, with a five- to six-fold higher risk for both preterm and term cases[6]. However, the true incidence of IUGR in Pakistan is not well-documented, largely due to the high prevalence of home births and the lack of standardized newborn weighing practices[7]. This gap in data could potentially obscure the true extent of the problem, with estimates suggesting that up to 91% of children in Pakistan are not weighed at birth[7].

Globally, IUGR incidence is six times higher in developing countries and even higher in lower and middle-income regions. The prevalence varies significantly across countries and regions, with the highest rates observed in South Asian countries such as Bangladesh, India, Pakistan, and Sri Lanka, as well as in parts of Africa and Latin America[8,9]. For instance, in India, the prevalence of low birth weight (LBW) is 26%, with IUGR affecting 54% of newborns10. Complications associated with IUGR include hypocalcemia, hypothermia, sepsis, jaundice, persistent pulmonary hypertension, and hypoglycemia[2,5,7,10,11]. In developing countries, the incidence of IUGR-related complications is notably high, affecting up to 30% of neonates and constituting 50-60% of LBW cases[12].

Given the high incidence and the severe outcomes associated with IUGR, preventing and managing these complications is a critical public health priority, especially in countries like Pakistan. Despite the wealth of international research, local studies on IUGR-related complications are scarce. This lack of localized data limits the applicability of international findings to the Pakistani population due to differences in prevalence and lifestyle factors. Therefore, this study aims to determine the frequency of complications associated with IUGR within the first week of life among neonates admitted to the neonatal department of NICH.

Methodology

Study Design

This study employed a descriptive cross-sectional design to examine gender and age-related complications in infants with IUGR.

Setting

The study was conducted at the Neonatal Department of the National Institute of Child Health (NICH) in Karachi, Sindh, Pakistan, from September 4, 2020, to March 3, 2021.

Participants

The study focused on infants from birth to 7 days old diagnosed with IUGR and admitted to the NICU at the NICH. While those with incomplete Doppler envelopes, congenital heart disease, congenital diaphragmatic hernia, or Down's syndrome were excluded.

Variables

The variables of interest were the complications associated with IUGR, including Hypocalcemia, Hypothermia, Sepsis, Jaundice, Persistent pulmonary hypertension, and Hypoglycemia.

Data Sources/Measurement

Data collection involved obtaining detailed medical histories, performing routine physical examinations, and conducting baseline investigations under the supervision of consultants. Each infant's clinical data were meticulously recorded to ensure accuracy and completeness.

Bias

Efforts were made to minimize bias by ensuring that all data collection procedures were standardized and conducted by trained personnel. To further reduce bias, consultants supervised data collection to verify the accuracy and reliability of the collected information.

Study Size

The World Health Organization (WHO) sample size calculator was used to calculate the sample size. The calculation was based on the estimated percentage of hypocalcemia (6.5%) among IUGR infants[2].

Statistical Methods

Data were entered and analyzed using SPSS version 21. Descriptive statistics were used to summarize the data. The mean ± SD was calculated for the infants' age. Frequencies and percentages were computed for complications and demographic variables. To assess the impact of age and gender on complications, stratified analyses were performed, with age and gender serving as effect modifiers or confounders. Chi-square tests or Fisher's Exact tests were used as appropriate to determine the association between these variables and the complications. A two-sided p-value of ≤ 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the institutional review board. Informed consent was secured from the parents or guardians of all participating infants. Data confidentiality and security were maintained throughout the study.

Results

This study included 191 neonates to assess the complications associated with IUGR within one week of birth at the neonatal department of NICH. The mean age of the neonates was 4.9 ± 1.3 days, with a 95% CI of 4.71 to 5.08 days. Among the 191 patients, 117 (61.3%) were male, and 74 (38.7%) were female. The prevalence of IUGR-related complications was as follows: hypocalcemia was observed in 16 (8.3%) patients, hypothermia in 10 (5.2%), sepsis in 29 (15.2%), jaundice in 45 (23.6%), hypoglycemia in 12 (6.2%), and persistent pulmonary hypertension in 20 (10.6%). Notably, 59 (30.9%) of the patients exhibited no complications. Stratification of the data by age group and gender revealed no significant associations with the occurrence of complications. The detailed stratification results are presented in Table 1.

Table 1: Demographic details of the participants.

Complications	Total (n=191)	Age			Gender		
		0-5 days	> 5 days	p-value	Male	Female	p-value
Hypocalcemia	16(8.3)	7(3.7)	9(4.7)	0.063	11(5.8)	5(2.6)	0.926
Hypothermia	10(5.2)	6(3.1)	4(2.1)		6(3.1)	4(2.1)	
Sepsis	29(15.2)	12(6.3)	17(8.9)		18(9.4)	11(5.8)	
Jaundice	45(23.6)	27(14.1)	18(9.4)		30(15.7)	15 (7.9)	
Hypoglycemia	12(6.2)	9(4.7)	3(1.6)		6(3.1)	6(3.1)	
Persistent Pulmonary Hypertension	20(10.6)	12(6.3)	8(4.2)		12(6.3)	8(4.2)	
No Complications	59(30.9)	21(11.0)	38(19.9)		34(17.8)	25(13.1)	

*p<0.05 is considered statistically significant.

Discussion

Intrauterine growth restriction (IUGR) is characterized by deviation from expected fetal growth due to either reduced intrinsic growth potential or adverse external factors[13]. Typically, a healthy neonate should have a birth weight within the 10th to 90th percentile without evidence of malnutrition or growth retardation. In developing countries, high rates of IUGR are often linked to socio-economic factors, including gender discrimination[13]. This discrimination can result in inadequate nutrition for female fetuses compared to males, and this disparity persists despite interventions targeting pregnant women alone. Key determinants of fetal growth in low- and middle-income countries include adolescent and pre-pregnancy nutrition, pre-pregnancy weight, poverty, and the interval between pregnancies.

Targeted interventions are crucial to effectively address the socio-economic factors contributing to IUGR. These include improving female nutrition, delaying the age of first pregnancy, preventing gender-based violence, and managing chronic diseases and pregnancy-related disorders. Evidence-based interventions that have demonstrated effectiveness include balanced energy-protein supplementation, intermittent preventive treatment for malaria during pregnancy, multiple micronutrient supplementation, insecticide-treated nets, anti-platelet therapy for preeclampsia, and smoking cessation.

We observed that the mean age of neonates with intrauterine growth restriction (IUGR) was 4.9 ± 1.3 days. This indicates that most neonates were relatively young within the first week of life, which aligns with the study's focus on complications occurring within this early period. The gender distribution in our study revealed that 61.3% of the neonates were male, while 38.7% were female. This distribution shows a higher proportion of male neonates with IUGR than females. This contrasts with findings from Hasmasanu et al.[14], who reported that females constituted 62.5% of their study population, while males made up 37.5%. The observed discrepancy in gender proportions raises important questions about potential gender-based differences in the incidence of IUGR. It could reflect underlying socio-economic or cultural factors that impact the nutritional and health status of neonates differently based on gender. For instance, in some societies, female infants may face additional nutritional and healthcare challenges compared to male infants, potentially influencing IUGR rates.

Among the complications associated with IUGR, jaundice emerged as the most prevalent complication, affecting 23.6% of neonates, followed by sepsis at 15.2%. Hypocalcemia, hypoglycemia, and persistent pulmonary hypertension were less common but still significant, affecting 8.3%, 6.2%, and 10.6% of neonates, respectively. Hypothermia, while a critical issue, was observed in a smaller proportion of 5.2% of the cases. When comparing our results to those reported in the literature, there are notable differences. Ortigosa Rocha et al. observed sepsis in 4% of their study population and hypoglycemia in 24%[15]. This suggests a lower incidence of sepsis but a higher incidence of hypoglycemia in their cohort compared to ours. Velipaşaoğlu et al. reported a significantly higher incidence of sepsis at 34.4%, which contrasts sharply with our finding of 15.2%[16].

These differences in reported incidences could be attributed to several factors, including variations in the study populations, geographical and environmental differences, differences in healthcare practices, and variations in diagnostic criteria or definitions.

Overall, IUGR continues to be a significant issue in developing countries, particularly in Asia, contributing to a substantial global burden. Addressing IUGR effectively requires a comprehensive approach that combines medical and socio-economic interventions to improve outcomes for affected neonates.

Limitations

Several limitations must be considered when interpreting the results of this study. Firstly, the sample size was relatively small, which may affect

the generalizability of the findings. A larger sample would provide more robust data and enhance the reliability of the conclusions. Secondly, time constraints limited the study's scope, affecting the ability to enroll a greater number of participants. Additionally, the study was restricted to neonates from the National Institute of Child Health (NICH) Karachi, which may not be representative of the broader population. This geographical limitation could impact the generalizability of the results to other regions or populations within Pakistan.

Conclusion

Our study identified jaundice as the most common complication associated with intrauterine growth restriction (IUGR), followed by sepsis and persistent pulmonary hypertension. These findings underscore the need for targeted research to explore factors that may increase the risk of these complications. To validate and extend our findings, future research should involve larger sample sizes and consider multiple parameters across various study centers in Pakistan. Such studies will provide a more comprehensive understanding of IUGR complications and help develop more effective interventions for affected neonates.

Conflicts of Interest

None.

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