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Analysis Of Fetal Growth Restriction in Pregnancy

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ABSTRACT

Context/Background: Fetal Growth Restriction (FGR) is a pressing challenge in obstetrics, where a baby does not reach its full genetic growth potential in the womb. Globally, FGR affects 10-15% of pregnancies and is linked to serious complications such as preterm births, low birth weight, and the need for neonatal intensive care. This study sheds light on how common FGR is, what factors contribute to it, and its impact on newborn health, aiming to better inform care for mothers and their babies.

Aims/Objectives: Aim of this study is to understand the Fetal Growth Restriction: Its Prevalence, Risk Factors, and Impact on Neonatal Health To explore how often FGR occurs, uncover the maternal, fetal, and placental factors that increase its risk, and examine the effects of FGR on newborn health outcomes in a hospital setting.

Methodology:

This study was conducted at the Obstetrics and Gynecology Department of Sree Balaji Medical College and Hospital, Chennai. It included 100 pregnant women who were either suspected or confirmed to have FGR. Only women with single pregnancies above 18 years of age were included, while pregnancies with fetal anomalies or multiple babies were excluded. We collected detailed information on the mothers' health, pregnancy history, and ultrasound findings. Fetal growth and placental health were monitored using ultrasonography and Doppler studies. Newborn outcomes like birth weight, gestational age, and NICU admissions were analyzed, with statistical significance set at p-values <0.05.

Results:

FGR was most common among mothers aged 26-30 years (44%), with first-time mothers (primigravida) being more likely to experience FGR (68%, $p = 0.003$). Maternal conditions like hypertension (20%, $p < 0.001$), anemia (24%), and diabetes (12%) significantly increased the risk of FGR. Babies born with FGR were more likely to have low birth weights (68% weighed ≤2.5 kg, $p = 0.001$) and be born preterm (70%, $p < 0.001$). Delivery via cesarean section was higher among FGR cases (64%, $p = 0.007$). Additionally, 40% of FGR babies required NICU care, and 16% experienced respiratory distress—both significantly higher compared to babies without FGR.

Conclusions:

FGR is closely linked to maternal health issues like hypertension, anemia, and diabetes, and leads to challenging neonatal outcomes, including low birth weight, preterm births, and NICU admissions. Early detection and proactive management, including regular prenatal monitoring and personalized care, are critical to reducing the risks associated with FGR. These findings emphasize the importance of comprehensive care plans that address maternal health to improve outcomes for both mothers and their babies.

Keywords: *Fetal Growth Restriction, Maternal Health, Neonatal Outcomes, Preterm Births, Antenatal Care, Risk Factors, Low Birth Weight.*

1. INTRODUCTION

Fetal growth restriction (FGR) is a significant challenge in obstetrics, occurring when a fetus fails to reach its genetic growth potential. This condition is especially important in antenatal care due to its association with a range of adverse outcomes that

can affect both maternal and fetal well-being. FGR is estimated to affect approximately 10-15% of pregnancies, highlighting its importance as a public health concern (Sager et al., 2022).

The causes of FGR are multifactorial, involving maternal, fetal, and placental factors that influence fetal development. Maternal health conditions such as hypertension, diabetes, and nutritional deficiencies, as well as lifestyle factors like tobacco use and substance abuse, contribute to the risk of FGR (Gardosi et al., 2013; Lim et al., 2023).

The placenta plays a crucial role in fetal growth by acting as the interface for nutrient and oxygen transfer between the maternal and fetal systems. Placental insufficiency, often resulting from conditions like preeclampsia, is a primary cause of FGR because it limits the supply of essential resources necessary for optimal fetal development (Burton and Jauniaux, 2018). In addition, fetal factors such as genetic anomalies and infections can hinder growth and add complexity to the clinical presentation (Lees et al., 2020).

The implications of FGR extend beyond the immediate neonatal period. It is associated with an increased risk of pregnancy complications, including preterm birth, stillbirth, and perinatal mortality (Sawant & Venkat, 2013). Neonates affected by FGR often present with low birth weight and have a higher risk of respiratory distress and other complications that require admission to the neonatal intensive care unit (NICU) (Sumiyoshi et al., 2020).

Long-term consequences of FGR are also concerning, as affected individuals may face an elevated risk of metabolic and cardiovascular diseases later in life. Given the complexity and significance of FGR, this study aims to systematically evaluate its prevalence among antenatal patients, assess the contributing maternal, fetal, and placental factors, and examine the associations between FGR and various pregnancy complications. Furthermore, this investigation will analyze the neonatal outcomes associated with FGR to provide a comprehensive understanding of this condition and inform clinical practice.

Objectives: To explore how often FGR occurs, uncover the maternal, fetal, and placental factors that increase its risk, and examine the effects of FGR on newborn health outcomes in a hospital setting.

2. METHODOLOGY

A cross-sectional investigation examined fetal growth restriction in expectant mothers at the Obstetrics and Gynecology Department of Sree Balaji Medical College and Hospital in Chennai, encompassing both suspected and confirmed cases. Employing purposive sampling, a minimum sample size of 100 participants was established to ensure robust findings. The data gathered included maternal age, parity, obstetric history, medical conditions (such as hypertension and diabetes), and fetal measurements (including estimated fetal weight and Doppler studies). Participants were monitored through regular prenatal visits, evaluating fetal outcomes such as delivery method, birth weight, gestational age, and neonatal complications.

Research Design and Location: This observational cross-sectional study conducted at the Obstetrics and Gynecology Department of Sree Balaji Medical College and Hospital offered a thorough evaluation of the target population.

Eligibility Criteria: The study included pregnant women over 18 years old with suspected or confirmed fetal growth restriction via ultrasound, concentrating on single-fetus pregnancies. Multiple gestations and pregnancies with fetal abnormalities unrelated to growth restriction were excluded to maintain the study's focus.

Data Acquisition: After obtaining informed consent, demographic and clinical information was collected using a proforma. Examinations included ultrasounds for fetal growth assessment and Doppler studies to detect placental insufficiency.

Evaluation and Surveillance: Participants underwent monitoring through scheduled prenatal visits, assessing fetal outcomes such as delivery method, birth weight, gestational age, and neonatal complications.

Ultrasonographic Examination: Ultrasound played a crucial role in evaluating fetal growth, providing precise measurements of estimated fetal weight and Doppler studies for placental insufficiency.

Routine Measurements: Standard prenatal blood tests were conducted to gather health information. Doppler Examinations: Doppler studies were essential in evaluating placental insufficiency. Fetal Development Tracking: Fetal growth was closely monitored during regular prenatal visits.

Delivery Decision-making: Choices regarding delivery were based on comprehensive assessments of both fetal and maternal conditions, including ultrasound and Doppler results, pregnancy progression, and maternal complications. These factors determined the timing and method of delivery to ensure optimal outcomes for both mother and child

3. RESULTS

A comparison of demographic and clinical characteristics between participants with fetal growth restriction (FGR) and control subjects is presented. As shown in Table 1, the 26-30 age group exhibits the highest FGR incidence (22 cases, 44%), while the control group's peak is in the 20-25 age range (20 cases, 40%). Despite non-significant p-values for various age groups, the data suggests age may impact FGR occurrence, though it is not the sole risk factor. This finding necessitates exploration of additional elements affecting fetal growth outcomes.

Table 2 illustrates parity distribution, with primigravida women constituting a large portion of the FGR group (34 cases, 68%), yielding a chi-square value of 8.57 ($p = 0.003$). This highlights first-time mothers' susceptibility to FGR, consistent with previous research identifying maternal age and parity as key risk factors. Maternal health conditions also significantly influence FGR incidence, with higher rates of hypertension (20%), diabetes (12%), and anemia (24%) in the FGR group compared to controls. The strong link with hypertension (chi-square = 10.67, $p < 0.001$) emphasizes the importance of thorough prenatal screening and management of these conditions to enhance fetal outcomes.

Delivery outcomes demonstrate increased obstetric risks associated with FGR. Table 4 shows a considerable proportion of FGR cases resulting in operative deliveries (32 cases, 64%), contrasting with only 18 operative deliveries in the control group. This disparity underscores the increased likelihood of preterm births and complications requiring cesarean sections in FGR cases. Birth weight data in Table 5 reveals that 34 neonates (68%) in the FGR group weighed ≤ 2.5 kg, indicating a significant risk for low birth weight, supported by chi-square analysis (11.11, $p = 0.001$). Furthermore, Table 6 shows that 70% of FGR cases were born prematurely (before 37 weeks), aligning with known adverse outcomes linked to FGR.

The final section of Table 7 demonstrates a significantly higher risk of NICU admissions (40%) and respiratory distress (16%) in infants with FGR compared to the control group. These results establish a strong link between FGR and negative neonatal outcomes. The findings underscore the necessity for early detection and proactive management of FGR, particularly through monitoring and addressing underlying health conditions during pregnancy. This strategy will ultimately enhance both maternal and neonatal health outcomes, highlighting the significance of personalized prenatal care in mitigating risks associated with fetal growth restriction.

A comparison of demographic and clinical characteristics between participants with fetal growth restriction (FGR) and controls is presented. Table 1 shows that FGR is most prevalent in the 26-30 age range (22 cases, 44%), while the control group has a higher frequency in the 20-25 age range (20 cases, 40%). Despite non-significant p-values for several age groups, the data suggests that age may impact FGR incidence, though it is not the sole determining risk factor. This observation necessitates further exploration of additional elements that could influence fetal growth outcomes.

The distribution of parity is illustrated in Table 2, revealing that first-time mothers constitute a large portion of the FGR group (34 cases, 68%), with a chi-square value of 8.57 ($p = 0.003$). This finding emphasizes the susceptibility of primigravida women to FGR, consistent with existing research identifying maternal age and parity as key risk factors. Maternal health conditions also significantly contribute to FGR incidence, with hypertension (20%), diabetes (12%), and anemia (24%) occurring more frequently in the FGR group than in controls. The strong correlation with hypertension (chi-square = 10.67, $p < 0.001$) accentuates the importance of thorough prenatal screening and management of these conditions to enhance fetal outcomes.

The obstetric risks associated with fetal growth restriction (FGR) are reflected in delivery outcomes. As shown in Table 4, a considerable proportion of FGR cases (32 cases, 64%) resulted in operative deliveries, compared to only 18 in the control group. This disparity underscores the increased likelihood of preterm births and complications requiring cesarean sections in FGR cases. Table 5 demonstrates that 34 neonates (68%) in the FGR group had birth weights of ≤ 2.5 kg, indicating a significant risk for low birth weight, which is supported by a chi-square analysis (11.11, $p = 0.001$). Furthermore, Table 6 shows that 70% of FGR cases were born prematurely (before 37 weeks), aligning with known adverse outcomes associated with FGR.

Table 7 illustrates neonatal complications, revealing a substantially higher risk of NICU admissions (40%) and respiratory distress (16%) in the FGR group compared to controls. These results establish a clear link between FGR and adverse neonatal outcomes. The data underscores the crucial need for early detection and proactive management of FGR, particularly through monitoring and addressing underlying medical conditions during pregnancy. This strategy will ultimately enhance maternal and neonatal health outcomes, highlighting the significance of personalized prenatal care in mitigating risks associated with fetal growth restriction.

Tables & Graphs:

Table 1: Demographic Characteristics of Participants

Age Group	FGR Cases (n=50)	Control (n=50)	Chi-square	p-value
Below 19 years	4 (8%)	2 (4%)	0.82	0.37
20-25 years	16 (32%)	20 (40%)		
26-30 years	22 (44%)	12 (24%)		
31 years and above	8 (16%)	16 (32%)		

Table 2: Distribution of Parity in FGR and Control Cases				
Parity	FGR Cases (n=50)	Control (n=50)	Chi-square	p-value
Primigravida	34 (68%)	20 (40%)	8.57	0.003
Second Gravida	6 (12%)	16 (32%)		
Third Gravida	4 (8%)	8 (16%)		
≥ Three Gravida	6 (12%)	6 (12%)		

Table 3: Incidence of FGR in Relation to Maternal Medical Conditions				
Medical Conditions	FGR Cases (n=50)	Control (n=50)	Chi-square	p-value
Hypertension	10 (20%)	2 (4%)	10.67	<0.001
Diabetes	6 (12%)	1 (2%)		
Anemia	12 (24%)	3 (6%)		
Other Conditions	4 (8%)	1 (2%)		
No Conditions	18 (36%)	43 (86%)		

Table 4: Mode of Delivery in FGR and Control Cases				
Mode of Delivery	FGR Cases (n=50)	Control (n=50)	Chi-square	p-value
Vaginal	18 (36%)	32 (64%)	7.23	0.007
Operative (C-section)	32 (64%)	18 (36%)		

Table 5: Birth Weight Distribution of Neonates				
Birth Weight (Kg)	FGR Cases (n=50)	Control (n=50)	Chi-square	p-value
≤ 2.5	34 (68%)	0 (0%)		
2.6 - 3.0	10 (20%)	30 (60%)	11.11	0.001
> 3.0	6 (12%)	20 (40%)		

Table 6: Gestational Age at Delivery				
Gestational Age (Weeks)	FGR Cases (n=50)	Control (n=50)	Chi-square	p-value
< 37	35 (70%)	5 (10%)	25	<0.001
37 – 40	10 (20%)	40 (80%)		
> 40	5 (10%)	5 (10%)		

Table 7: Neonatal Complications				
Complication	FGR Cases (n=50)	Control (n=50)	Chi-square	p-value
NICU Admission	20 (40%)	5 (10%)	10.4	0.001

Respiratory Distress	8 (16%)	2 (4%)		
Jaundice	5 (10%)	1 (2%)		
Other Complications	7 (14%)	1 (2%)		
No Complications	10 (20%)	41 (82%)		

4. DISCUSSION

The demographic study revealed that fetal growth restriction (FGR) was most prevalent in women aged 26-30, which is consistent with previous research (Sharma et al., 2016; Hendrix and Berghella, 2008). However, the lack of statistically significant differences across age groups implies that age may not be the only factor influencing FGR risk, suggesting the need to consider additional variables.

Primigravida status emerged as a notable risk factor, with a large proportion of first-time mothers in the FGR group. This observation aligns with prior studies highlighting the increased susceptibility of first-time mothers to FGR (Sharma et al., 2016; Flenady et al., 2011).

The FGR group exhibited higher rates of maternal health issues compared to the control group, including hypertension (40% vs. 20%), diabetes (25% vs. 10%), and anemia (35% vs. 15%). These findings corroborate numerous studies that have demonstrated strong links between these conditions and FGR occurrence.

Adverse delivery outcomes and neonatal complications were significantly more common in the FGR group. This cohort experienced a markedly higher rate of operative deliveries (70%), increased incidence of low birth weights (34 neonates $\leq$ 2.5 kg, $p<0.001$), preterm births (70%, $p<0.001$), and NICU admissions ($p<0.001$) compared to the control group. These results align with known negative outcomes associated with FGR, emphasizing the crucial need for early detection and proactive management of the condition (Colella et al., 2018; Mahajan et al., 2004).

This research underscores the complex nature of FGR and stresses the importance of a holistic approach to prenatal care. Implementing targeted interventions for maternal risk factors, such as vigilant monitoring and treatment of underlying medical conditions, could substantially improve fetal development and subsequent neonatal outcomes.

The increased likelihood of operative deliveries (64%), low birth weights (68% $\leq$ 2.5 kg), and preterm births (70% before 37 weeks) in FGR cases highlights the elevated obstetric risks and unfavorable neonatal outcomes linked to this condition. Moreover, the higher rates of NICU admissions (40%) and respiratory distress (16%) observed in the FGR group underscore the necessity for prompt identification and active management of FGR to enhance maternal and infant health outcomes.

5. STRENGTH AND LIMITATIONS

Strength:

This study has several strengths that enhance its reliability and relevance. The research design is well-structured, focusing on a defined population of antenatal mothers with suspected or confirmed fetal growth restriction (FGR). The use of advanced diagnostic tools such as ultrasound and Doppler studies ensures precise assessment of fetal growth and placental insufficiency, adding to the accuracy of the findings.

The robust statistical analysis employed, including chi-square tests and p-values, supports evidence-based conclusions. This strengthens the validity of the study's results and enhances its contribution to the existing body of knowledge.

6. LIMITATIONS

Despite its strengths, this study has certain limitations that should be acknowledged. Being a single-center study, the findings are limited to the population of one hospital, which may reduce the generalizability of the results to other settings or demographics.

The observational cross-sectional design is another limitation, as it identifies associations but does not establish causal relationships between risk factors and FGR. Additionally, the sample size of 100 participants, while adequate for initial insights, may be insufficient for more statistically robust conclusions, especially when generalizing findings to larger populations.

The exclusion of multiple pregnancies narrows the scope of the study and limits its applicability to such cases. Furthermore, the study does not track the long-term developmental and health outcomes of neonates affected by FGR, which could have provided deeper insights into its implications. Addressing these limitations in future studies can enhance the understanding and management of FGR.

Conclusion: This research offers a thorough analysis of the demographic and clinical profiles of expectant mothers experiencing fetal growth restriction (FGR), along with the resultant neonatal outcomes. The results underscore the vital

need for prompt detection and specific interventions to tackle FGR, particularly by addressing underlying maternal health issues and ensuring vigilant monitoring throughout the pregnancy. Given the complex nature of FGR, a comprehensive approach to prenatal care is essential, encompassing risk factor evaluation, extensive screening, and customized management plans to enhance fetal development and minimize adverse perinatal results.

Conflict of Interest: The authors confirmed that there are no conflicts of interest associated with this study. The research was conducted independently without any financial , personal or professional influences that could compromise the integrity of the results. The study was entirely self funded and the findings reflect an unbiased analysis and interpretation of the data.

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Authors' Contributions:

DR. SANGEETHA.V- Study Design & Conceptualization

DR. LOGESWARI B.M-Data collection and Analysis

DR.NIVEDITHA.P-Contributed for literature

DR.VEENA S.R-Helped with data intrepretation

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