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Original Research Article

Intrauterine Growth Restriction (IUGR): Approach and Monitoring

Anjali[1], Anisha Buddhapriya[2], Minu Sharan[3]

[1]Senior Resident, Department of Obstetrics and Gynaecology, PMCH, Patna, Bihar, India
[2]Senior Resident, Department of Obstetrics and Gynaecology, PMCH, Patna, Bihar, India
[3]Professor, Department of Obstetrics and Gynaecology, PMCH, Patna, Bihar, India

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Corresponding Author: Dr. Anisha Buddhapriya
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Abstract:

Background: Intrauterine Growth Restriction (IUGR), also referred to as Fetal Growth Restriction (FGR), is a pathological condition in which a fetus fails to achieve its genetically determined growth potential, typically defined as an estimated fetal weight below the 10th percentile for gestational age. IUGR is associated with increased perinatal morbidity and mortality, including prematurity, hypoxia, stillbirth, and long-term neurodevelopmental impairment. The approach to IUGR begins with early identification through routine antenatal surveillance, including serial fundal height measurements and ultrasound biometry. Once suspected, diagnosis is confirmed using ultrasonographic assessment of estimated fetal weight, abdominal circumference, amniotic fluid volume, and Doppler velocimetry of uterine and umbilical arteries. Differentiation between constitutionally small fetuses and true growth restriction is essential for appropriate management. Monitoring strategies focus on fetal well-being and timely intervention. Serial growth scans are typically performed every 2–4 weeks. Doppler studies of the umbilical artery, middle cerebral artery, and ductus venosus provide information on placental function and fetal adaptation. Non-stress testing (NST) and biophysical profile (BPP) are used to assess fetal condition. Management decisions depend on gestational age, severity of Doppler abnormalities, and maternal condition.

The timing of delivery balances the risks of prematurity against intrauterine compromise. Early-onset IUGR (<32 weeks) requires intensive monitoring and often tertiary-level care, whereas late-onset IUGR (>32 weeks) is more common and may require delivery at term or near term. Multidisciplinary care and individualized management plans are essential to optimize perinatal outcomes. Early detection, structured monitoring, and evidence-based timing of delivery remain the cornerstone of improving outcomes in pregnancies complicated by IUGR.

Conclusion: Intrauterine Growth Restriction (IUGR) is a significant obstetric condition associated with increased perinatal morbidity and mortality. Early identification through routine antenatal screening and accurate diagnosis using ultrasound and Doppler studies are essential for distinguishing true growth restriction from constitutionally small fetuses. Close and structured monitoring of fetal growth and well-being—using serial biometry, Doppler velocimetry, and fetal surveillance tests—plays a crucial role in guiding management decisions. The timing of delivery should be individualized, balancing the risks of prematurity against the risk of intrauterine compromise. A multidisciplinary and evidence-based approach, combined with timely intervention, is key to improving short-term neonatal outcomes and reducing long-term complications in pregnancies complicated by IUGR.

Keywords: Intrauterine Growth Restriction (IUGR); Fetal Growth Restriction (FGR); Placental insufficiency; Doppler velocimetry; Umbilical artery Doppler; Middle cerebral artery Doppler; Biophysical profile (BPP); Non-stress test (NST); Fetal surveillance; Perinatal morbidity; Early-onset IUGR; Late-onset IUGR; Timing of delivery; Antenatal monitoring.

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Introduction

Intrauterine Growth Restriction (IUGR), also known as Fetal Growth Restriction (FGR), is a significant obstetric complication characterized by a fetus that fails to achieve its genetically predetermined growth potential. It is commonly defined as an estimated fetal weight below the 10th percentile for gestational age, although more severe cases fall below the 3rd percentile. IUGR must be distinguished from small-for-gestational-age (SGA) fetuses, which may be constitutionally small but otherwise healthy. IUGR affects approximately 5–10% of pregnancies worldwide and remains a major contributor to perinatal morbidity and mortality, including preterm birth, fetal distress, stillbirth, neonatal intensive care admission, and long-term neurodevelopmental impairment. The most common underlying cause is uteroplacental insufficiency, though maternal, fetal, and placental factors all play important roles.

Maternal risk factors include hypertensive disorders of pregnancy, diabetes, malnutrition, anemia, chronic renal disease, smoking, and substance abuse. Fetal causes include chromosomal abnormalities, congenital infections, and structural anomalies. Placental abnormalities such as infarction, abruption, or abnormal implantation also contribute significantly. Early recognition and appropriate monitoring are essential to optimize pregnancy outcomes. Advances in ultrasound biometry, Doppler velocimetry, and fetal surveillance techniques have improved the ability to detect and manage IUGR. A systematic and individualized approach is required to balance the risks of prematurity with those of continued intrauterine compromise.

Understanding the pathophysiology, risk factors, diagnostic criteria, and monitoring strategies of IUGR is crucial for improving both immediate neonatal outcomes and long-term health trajectories.

Materials and Methods

This prospective observational study was conducted in the Department of Obstetrics and Gynecology at Patna Medical College and Hospital Patna, Bihar. Study duration is one years. And tertiary care Center. A total of 65 pregnant women diagnosed with suspected Intrauterine Growth Restriction (IUGR) were included during the study period.

Study Population: Pregnant women with singleton pregnancies beyond 28 weeks of gestation and ultrasound findings suggestive of fetal growth restriction (estimated fetal weight <10th percentile for gestational age) were enrolled. Gestational age was confirmed based on first-trimester ultrasound or reliable last menstrual period.

Inclusion Criteria

- Singleton pregnancy
- Gestational age ≥28 weeks
- Estimated fetal weight <10th percentile for gestational age
- Willingness to participate in the study

Exclusion Criteria

- Multiple gestation
- Major fetal congenital anomalies
- Intrauterine fetal demise at presentation
- Uncertain gestational age

Data Collection

Detailed maternal history including age, parity, socioeconomic status, medical disorders (e.g., hypertension, diabetes, anemia), and obstetric history was recorded. General physical examination and obstetric evaluation were performed at admission.

Diagnostic Evaluation

All patients underwent:

- Ultrasound biometry (biparietal diameter, head circumference, abdominal circumference, femur length)
- Estimated fetal weight calculation
- Amniotic fluid index (AFI) measurement
- Doppler velocimetry of umbilical artery and middle cerebral artery

Monitoring Protocol: Patients were followed with serial ultrasound examinations every 2–3 weeks to assess fetal growth. Doppler studies were repeated as indicated based on severity. Non-stress test (NST) and biophysical profile (BPP) were performed for fetal surveillance.

Management and Outcome Measures: Management decisions were individualized based on gestational age, Doppler findings, maternal condition, and fetal well-being. The primary outcomes measured included gestational age at delivery, mode of delivery, birth weight, Apgar score, need for NICU admission, and perinatal morbidity and mortality.

Statistical Analysis: Data were compiled and analyzed using appropriate statistical methods. Continuous variables were expressed as mean ± standard deviation, and categorical variables were presented as percentages. This methodology aimed to evaluate the clinical approach, monitoring strategies, and perinatal outcomes in 65 pregnancies complicated by IUGR.

Results

A total of 65 pregnant women diagnosed with intrauterine growth restriction (IUGR) were included in the study and followed until delivery.

Maternal Characteristics: The majority of patients were between 20–30 years of age. Primigravidae constituted a higher proportion of cases compared to multigravidae. Hypertensive disorders of pregnancy were the most common associated maternal risk factor, followed by anemia and gestational diabetes.

Gestational Age at Diagnosis: Most cases were diagnosed after 32 weeks of gestation (late-onset IUGR), while a smaller proportion presented before 32 weeks (early-onset IUGR).

Doppler Findings: Abnormal umbilical artery Doppler findings (elevated systolic/diastolic ratio, absent or reversed end-diastolic flow) were observed in a significant number of cases. Middle cerebral artery Doppler showed brain-sparing effect in several fetuses. Patients with abnormal Doppler findings required closer surveillance and earlier delivery.

Mode of Delivery: A higher rate of cesarean section was observed, primarily due to fetal distress and abnormal Doppler findings. Vaginal delivery was

achieved in cases with stable maternal and fetal conditions.

Neonatal Outcomes

- Most neonates had birth weights below the 10th percentile.
- A considerable number required NICU admission due to low birth weight and respiratory distress.
- Apgar scores at 5 minutes were satisfactory in the majority of cases.
- Perinatal morbidity was mainly related to prematurity and low birth weight.
- Perinatal mortality was low but observed in severe early-onset cases with significant Doppler abnormalities.

Summary of Findings

The study demonstrated that hypertensive disorders were the leading maternal risk factor for IUGR. Abnormal Doppler studies were strongly associated with adverse perinatal outcomes. Early diagnosis, structured monitoring, and timely intervention contributed to improved neonatal survival.

Overall, close antenatal surveillance and individualized management significantly influenced perinatal outcomes in the 65 cases studied.

Table 1: Maternal Demographic Characteristics (n = 65)

Variable	Number (n)	Percentage (%)
Age Group (years)		
<20	6	9.2%
20–30	42	64.6%
>30	17	26.2%
Gravidity		
Primigravida	38	58.5%
Multigravida	27	41.5%

Table 2: Associated Maternal Risk Factors

Risk Factor	Number (n)	Percentage (%)
Hypertensive disorders	24	36.9%
Anemia	18	27.7%
Gestational diabetes	7	10.8%
Chronic medical disorders	5	7.7%
No identifiable risk factor	11	16.9%

Table 3: Gestational Age at Diagnosis

Gestational Age	Number (n)	Percentage (%)
<32 weeks (Early-onset)	19	29.2%
≥32 weeks (Late-onset)	46	70.8%

Table 4: Doppler Findings

Doppler Study	Number (n)	Percentage (%)
Normal Doppler	28	43.1%
Abnormal Umbilical Artery	25	38.5%
Brain-sparing (MCA changes)	12	18.4%

Table 5: Mode of Delivery

Mode of Delivery	Number (n)	Percentage (%)
Vaginal Delivery	26	40.0%
Cesarean Section	39	60.0%

Table 6: Neonatal Outcomes

Outcome	Number (n)	Percentage (%)
Birth weight <2.5 kg	52	80.0%
NICU Admission	29	44.6%
Apgar score <7 at 5 min	8	12.3%
Perinatal Mortality	3	4.6%

Discussion

Intrauterine Growth Restriction (IUGR) remains a major contributor to perinatal morbidity and mortality, particularly in developing countries where maternal anemia and hypertensive disorders are prevalent. In the present study of 65 cases, hypertensive disorders of pregnancy emerged as the most common associated risk factor, supporting the established role of uteroplacental insufficiency in

the pathogenesis of IUGR. The majority of cases were diagnosed after 32 weeks of gestation, indicating a predominance of late-onset IUGR. Late-onset IUGR is generally associated with milder Doppler abnormalities but still carries significant risks if not monitored appropriately. Early-onset IUGR, though less common in this study, showed a stronger association with abnormal Doppler findings and adverse neonatal outcomes. This aligns with existing literature, which indicates that early-onset IUGR is often more severe and linked to significant placental dysfunction.

Doppler velocimetry played a crucial role in monitoring fetal well-being. Abnormal umbilical artery Doppler indices and evidence of brain-sparing effect in the middle cerebral artery were significantly associated with increased rates of cesarean delivery, NICU admission, and lower birth weights. These findings highlight the importance of Doppler studies as a predictive tool for fetal compromise and timing of delivery. The cesarean section rate in the present study was relatively high, primarily due to non-reassuring fetal status and abnormal Doppler findings. While vaginal delivery remains feasible in selected stable cases, operative intervention is often required to prevent fetal hypoxia and stillbirth. Neonatal outcomes were largely influenced by gestational age at delivery and severity of growth restriction. Low birth weight and NICU admissions were common, reflecting complications related to prematurity and intrauterine compromise. However, perinatal mortality was relatively low, suggesting that structured antenatal surveillance and timely obstetric intervention contributed positively to outcomes.

Overall, the findings of this study reinforce that early detection, risk stratification using Doppler studies, and individualized management strategies are critical in reducing adverse perinatal outcomes in pregnancies complicated by IUGR. Strengthening antenatal care services and ensuring access to timely referral and neonatal intensive care facilities can further improve prognosis.

Conclusion

Intrauterine Growth Restriction (IUGR) is a significant obstetric condition associated with increased perinatal morbidity and mortality. Early identification through routine antenatal screening and accurate diagnosis using ultrasound and Doppler studies are essential for distinguishing true growth restriction from constitutionally small fetuses. Close and structured monitoring of fetal growth and well-being—using serial biometry, Doppler velocimetry, and fetal surveillance tests—plays a crucial role in guiding management decisions. The timing of delivery should be individualized, balancing the risks of prematurity against the risk of intrauterine compromise. A multidisciplinary and evidence-based approach, combined with timely intervention, is key to improving short-term neonatal outcomes and reducing long-term complications in pregnancies complicated by IUGR.

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