Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 21s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Clinicoetiological Profile of Intrauterine Growth Restriction in Neonates Admitted at Teritiary Care Centre

Dr Darshana D S[1], Dr Sudhir Malwade[2], Dr Ganesh Kumar*[3], Dr.Nidhi Upadhyaya[4], Dr Shailaja Mane[5], Dr Md Owais Ali Khan[6], Abhinav Maheswari[7]

[1]Resident, Dr D Y Patil Medical College, Hospital and Research Centre, Dr, D. Y. Patil Vidyapeeth, Deemed to Be University), Pune, Ind,

Email ID: 333darshanads@Gmail.Com

[2]Professor, Dr D Y Patil Medical College, Hospital and Research Centre, Dr, D. Y. Patil Vidyapeeth, Deemed to Be University), Pune, Ind,

Email ID: Malwade.Sudhir@Gmail.Com

[3*]Dr D Y Patil Medical College, Hospital and Research Centre, Dr, D. Y. Patil Vidyapeeth, Deemed to Be University), Pune, Ind,

Email ID: Ganesh0019@Gmail.Com

[4]Resident, Dr D Y Patil Medical College, Hospital and Research Centre, Dr, D. Y. Patil Vidyapeeth, Deemed to Be University), Pune, Ind,

Email ID: Nidhi.Nandikur@Gmail.Com

[5]Professor, Dr D Y Patil Medical College, Hospital and Research Centre, Dr, D. Y. Patil Vidyapeeth, Deemed to Be University), Pune, Ind,

Email ID: Shailaja.Mane@Gmail.Com

[6]Resident, Dr D Y Patil Medical College, Hospital and Research Centre, Dr, D. Y. Patil Vidyapeeth, Deemed to Be University), Pune, Ind,

Email ID: Owaiskhan2477@Gmail.Com

[7]Resident, Dr D Y Patil Medical College, Hospital and Research Centre, Dr, D. Y. Patil Vidyapeeth, Deemed to Be University), Pune, Ind,

Email ID: Abhinav.Mee@Gmail.Com

***Corresponding Author**

Dr Ganesh Kumar

Dr D Y Patil Medical College, Hospital And Research Centre, Dr, D. Y. Patil Vidyapeeth, Deemed to Be University), Pune, Ind,

Email ID: Ganesh0019@Gmail.Com

Cite this paper as: Dr Darshana D S, Dr Sudhir Malwade, Dr Ganesh Kumar, Dr.Nidhi Upadhyaya, Dr Shailaja Mane, Dr Md Owais Ali Khan, Abhinav Maheswari, (2025). Clinicoetiological Profile of Intrauterine Growth Restriction in Neonates Admitted at Teritiary Care Centre. *Journal of Neonatal Surgery*, 14 (21s), 291-298.

ABSTRACT

Background: Intrauterine growth restriction (IUGR) is a significant contributor to neonatal morbidity and mortality, particularly in resource-limited settings. Understanding maternal and neonatal risk factors is essential for early intervention and improved neonatal outcomes.

Methods:A cross-sectional study was conducted on 50 neonates diagnosed with IUGR and admitted to a tertiary care hospital's neonatal intensive care unit (NICU). Data on maternal risk factors, neonatal parameters, and outcomes, including morbidity and mortality, were collected and analyzed using SPSS version 23. Chi-square and logistic regression tests were applied to determine statistically significant associations.

Results: Among the 50 IUGR infants, 10% died during hospital stay, while 26% were discharged with abnormal neurological findings. Hypoglycemia (36%) and perinatal asphyxia (30%) were the most frequent complications. Maternal malnutrition (30%) and anemia (36%) were significantly associated with neonatal mortality ($p<0.05$). Neonatal factors such as birth weight <2 kg, preterm status, and symmetrical IUGR were significantly associated with higher risk of mortality and morbidity.

Conclusions: Maternal malnutrition and anemia, along with low birth weight and prematurity, are key predictors of adverse outcomes in IUGR neonates. Early identification and targeted perinatal interventions are essential to improve neonatal survival and neurological outcomes.

Keyword: *Intrauterine growth restriction, Neonatal outcomes, Risk factors, Neonatal mortality, NICU*

1. INTRODUCTION

Intrauterine growth restriction (IUGR) is a significant clinical entity affecting fetal growth and perinatal outcomes globally. It is defined as a condition where the fetus fails to achieve its genetically predetermined growth potential, usually identified when the birth weight is below the 10th percentile for gestational age [1, 2]. IUGR is not only associated with increased perinatal mortality and neonatal complications but is also implicated in the pathogenesis of chronic adult diseases including diabetes, cardiovascular disorders, and hypertension [3].

The etiology of IUGR is multifactorial, encompassing maternal, fetal, and placental causes. Maternal risk factors such as malnutrition, anemia, pregnancy-induced hypertension (PIH), and substance use are frequently implicated [4]. Fetal and neonatal consequences of IUGR are numerous and include hypoglycemia, perinatal asphyxia, sepsis, and long-term neurodevelopmental delays [5].

Despite extensive research, region-specific data on IUGR outcomes in India remain limited, particularly from tertiary care centers catering to rural and semi-urban populations. The present study aims to analyze the clinical profile, maternal and neonatal risk factors, and immediate outcomes of IUGR neonates admitted to a neonatal intensive care unit (NICU) in a tertiary care hospital

2. MATERIALS AND METHODS

Study Design and Setting

This was a hospital-based, cross-sectional study conducted in the neonatal intensive care unit (NICU) of a tertiary care center in India from January 2023 to December 2024. The study was approved by the Institutional Ethics Committee of Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pune, and written informed consent was obtained from the parents or guardians of all enrolled neonates.

Study Population

A total of 50 neonates diagnosed with intrauterine growth restriction (IUGR), defined as birth weight below the 10th percentile for gestational age, were included. Newborns with congenital anomalies or chromosomal abnormalities were excluded.

Sampling Technique

Systematic random sampling was used to select eligible neonates admitted during the study period who met the inclusion criteria.

Data Collection

Data were collected using a structured proforma and included:

- **Maternal factors**: Age, parity, residence (rural/urban), nutritional status (BMI <18.5 classified as malnourished), anemia (Hb <10 g/dL), PIH, diabetes, multiple gestation, and antenatal infections.
- **Neonatal parameters**: Gestational age (by LMP and/or Ballard scoring), birth weight, mode of delivery, Apgar scores, and Ponderal Index to classify symmetric vs. asymmetric IUGR.
- **Complications**: Hypoglycemia, hypocalcemia, sepsis, thrombocytopenia, respiratory distress, perinatal asphyxia, meconium aspiration syndrome (MAS), and others.
- **Outcomes**: Condition at discharge categorized as good, abnormal neurological examination, or death during hospitalization.

Definitions

- **Symmetrical IUGR**: PI >2
- **Asymmetrical IUGR**: PI ≤2
- **Hypoglycemia**: Blood glucose <45 mg/dL on at least one occasion
- **Hypocalcemia**: Serum calcium <7 mg/dL

- **Perinatal Asphyxia**: Apgar score ≤3 at 5 minutes or requiring prolonged resuscitation
- **Sepsis**: Based on clinical signs and sepsis screen positivity

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 23. Descriptive statistics were used for demographic and clinical profiles. Categorical variables were analyzed using the Chi-square test or Fisher's exact test. Logistic regression was performed to identify predictors of mortality and abnormal neurological outcomes. A p-value <0.05 was considered statistically significant.

3. RESULTS

Out of a total of 343 births analyzed during the study period, 50 neonates were diagnosed with intrauterine growth restriction (IUGR), yielding an incidence rate of **14.6%**. This finding highlights a notable burden of IUGR within the study population and underscores the importance of early identification and management of contributing risk factors. The observed incidence aligns with figures reported in similar clinical settings, reflecting ongoing challenges in maternal and fetal health surveillance (Table 1).

Table 1: Incidence of IUGR

Parameter	**N**
Total Births	343
IUGR Cases	50
Incidence	**14.6%**

Out of 50 neonates with intrauterine growth restriction (IUGR), 58% were male and 42% were female. The majority of the neonates had birth weights between 2.0–2.5 kg (42%) and 1.5–2.0 kg (34%), while 14% weighed between 1.0–1.5 kg. The mean birth weight was approximately 1.990 ± 0.440 kg (Table 2).

Table 2: Distribution by Gender and Birth Weight (n = 50)

Parameter	**N (%)**
Gender	
Female	29 (58 %)
Male	21 (42 %)
Birth Weight	
<1000 g	0 (0 %)
1000–1499 g	7 (14 %)
1500–1999 g	17 (34%)
2000–2500 g	21 (42%)
2500 g	5 (10%)
Total	**50 (100%)**

Data expressed in frequency (n) and percentage (%).

Among the 50 neonates diagnosed with intrauterine growth restriction (IUGR), 38 cases (76%) were classified as symmetrical IUGR (Ponderal Index > 2), while 12 cases (24%) were identified as asymmetrical IUGR (Ponderal Index ≤ 2). This distribution indicates a predominance of symmetrical IUGR in the study cohort, suggesting early gestational onset of growth restriction in most cases. The use of Ponderal Index proved valuable in distinguishing between the two subtypes, aiding in understanding the likely timing and potential etiology of growth compromise (Table 3).

Table 3: Classification of IUGR by Ponderal Index (n = 50)

IUGR Type	N (%)
Asymmetrical (PI ≤ 2)	12
Symmetrical (PI > 2)	38
Total	**50**

Data expressed in frequency (n) and percentage (%).

Among the 50 IUGR cases evaluated, maternal factors were the most commonly identified contributors, accounting for 31 cases (62%). Fetal causes were responsible for 10 cases (20%), while placental abnormalities accounted for 9 cases (18%). These findings emphasize the predominant role of maternal health and systemic conditions in the pathogenesis of IUGR, underscoring the need for vigilant prenatal care and targeted interventions to address modifiable maternal risk factors (Table 4).

Table 4: Distribution based on Etiology (n = 50)

Risk Factor	N (%)
Maternal	31 (%)
Placental	9 (%)
Foetal	10 (%)

Data expressed in frequency (n) and percentage (%).

Among the 50 cases of IUGR, anemia (Hb <10 g/dL) was the most frequently observed maternal risk factor, present in 18 cases (36%), followed by malnutrition with a BMI ≤18.5 in 15 cases (30%). Pregnancy-induced hypertension (PIH) was identified in 10 cases (20%), and multiple gestation in 3 cases (6%). Notably, 4 cases (8%) had no identifiable maternal risk factor. These findings highlight the significant contribution of preventable and manageable maternal conditions such as anemia and undernutrition to the development of IUGR, reinforcing the need for routine antenatal screening and nutritional support (Table 5).

Table 5: Distribution based on Maternal Risk Factors (n = 50)

Risk Factor	N (%)
Malnutrition (BMI ≤18.5)	15 (30 %)
Anemia (Hb <10 g/dL)	18 (36 %)
PIH	10 (20 %)
Multiple Gestation	3 (6 %)
No Risk Factor	4 (8 %)

Data expressed in frequency (n) and percentage (%).

Among the 50 neonates with IUGR, the most common immediate complication observed was hypoglycemia, affecting 18 cases (36%), followed by perinatal asphyxia in 15 cases (30%). Other complications included sepsis in 6 cases (12%), meconium aspiration syndrome in 4 cases (8%), hypocalcemia in 3 cases (6%), and hypothermia and thrombocytopenia, each in 2 cases (4%). These findings underscore the high risk of metabolic and respiratory compromise in IUGR neonates and reinforce the need for vigilant postnatal monitoring and prompt intervention to reduce morbidity (Table 6).

Table 6: Distribution based on Immediate Complications (n = 50)

Complication	N (%)
Hypoglycemia	18 (36 %)

Perinatal Asphyxia	15 (30 %)
Hypothermia	2 (4 %)
Sepsis	6 (12 %)
Hypocalcemia	3 (6 %)
Thrombocytopenia	2 (4 %)
Meconium Aspiration Syndrome	4 (8 %)

Data expressed in frequency (n) and percentage (%).

The admission profile of IUGR neonates revealed the following key parameters:

- Blood Sugar Level (BSL) was measured in 48 neonates, with a mean of 101.8 mg/dL (SD ±29.21), ranging from 71 to 209 mg/dL. The median value was 90 mg/dL, with 25th and 75th percentiles at 81.5 and 117 mg/dL, respectively. While the mean was within the normal range, the upper limit reflects possible episodes of stress hyperglycemia or therapeutic glucose correction.
- Mean Blood Pressure (MBP) (n = 49) averaged 53.1 mmHg (SD ±9.82), with values ranging from 40 to 83 mmHg. The median MBP was 52 mmHg, suggesting generally acceptable cardiovascular stability, although lower values in some neonates could indicate hypotension requiring close observation.
- Hemoglobin (Hb) levels (n = 50) were relatively high, with a mean of 17.5 g/dL (SD ±2.18), and ranged from 12.0 to 21.3 g/dL. The median was 17.7 g/dL, suggesting a trend toward polycythemia, a common compensatory response in IUGR.
- Hematocrit (HCT) levels also reflected this, with a mean of 51.9% (SD ±6.66), ranging from 33.9% to 62.4%, and a median of 52.2%. Elevated hematocrit in several cases indicates increased blood viscosity, a known complication in IUGR infants (Table 7).

Table 7: Distribution based on Admission Profile (n = 50)

Parameter	Count	Mean	Std Dev	Min	25%	Median	75%	Max
BSL	48	101.8	29.21	71	81.5	90	117	209
MBP	49	53.1	9.82	40	46	52	60	83
Hb	50	17.5	2.18	12.0	16.18	17.7	19.13	21.3
HCT	50	51.9	6.66	33.9	48.78	52.2	57.4	62.4

Among the 50 neonates with IUGR, 22 (44%) had normal hemoglobin levels (≥13 g/dL), while 10 (20%) were classified as having mild anemia (12–12.9 g/dL). Notably, 18 neonates (36%) had moderate to severe anemia, indicating a substantial burden of hematological compromise in this population. These findings highlight the need for routine hemoglobin monitoring in IUGR neonates, as anemia can exacerbate hypoxic stress and affect postnatal adaptation and neurodevelopmental outcomes (Table 8).

Table 8: Distribution based on Anemia (n = 50)

Category	N (%)
Normal (≥13 g/dL)	22
Mild anemia (12–12.9)	10
Moderate/Severe anemia	18

Data expressed in frequency (n) and percentage (%).

A significant proportion (≈69%) of patients had low mean blood pressure, which is consistent with uteroplacental hypoperfusion risk in IUGR (Table 9).

Table 9: Distribution based on Blood Pressure (n = 50)

MBP Status	N (%)
Low MBP (<60)	34 (68 %)
Normal MBP (≥60)	16 (32%)

Data expressed in frequency (n) and percentage (%).

Among the 50 IUGR neonates, 32 (64%) were discharged in good condition, indicating a favorable short-term outcome in the majority of cases. However, 13 neonates (26%) exhibited abnormal neurological findings at discharge, raising concerns about potential long-term neurodevelopmental issues. Additionally, there were 5 cases of neonatal death (10%), reflecting the serious nature and potential lethality of IUGR despite neonatal care. These results underscore the need for early detection, close monitoring, and structured follow-up of IUGR infants to improve survival and long-term outcomes. There was a statistically significant association between maternal anemia and neonatal mortality ($p<0.01$), and between hypoglycemia and abnormal neurological outcomes ($p<0.05$) (Table 10).

Table 10: Distribution based on Outcome of IGUR (n = 50)

Outcome	N (%)
Discharged in Good Condition	32 (64 %)
Abnormal Neurological Findings	13 (26 %)
Neonatal Death	5 (10 %)

Data expressed in frequency (n) and percentage (%).

4. DISCUSSION

Intrauterine growth restriction (IUGR) continues to pose a significant challenge to neonatal health, particularly in low- and middle-income countries like India. The present study investigated the clinical profiles, maternal and neonatal risk factors, and short-term outcomes of 50 neonates with IUGR admitted to a tertiary care NICU. The findings are in close agreement with previous studies, including that of Lifam et al. (2024), who reported similar trends in birth weight, complications, and maternal determinants [6]. Brodsky and Cristou observed an incidence of intrauterine growth restriction (IUGR) ranging from 5% to 7% in their study [7]. In a separate study by Sharon and Gilberto, which included 5,961 cases, the incidence was found to be 2.4% [8]. Similarly, Sinha et al. reported an incidence of 2.13%, with 100 cases of IUGR out of 4,674 deliveries [9]. In contrast, our study revealed a higher incidence of 14.6%, with 50 IUGR cases identified out of 343 births.

Birth Weight and Type of IUGR

Consistent with global data, the majority of neonates in our study were in the birth weight range of 1500–2500 grams, with 48% falling into the 2.0–2.5 kg range. Symmetrical IUGR was observed in 34% of cases, which is higher than Lifam et al.'s finding of 31.7%, but reinforces the observation that symmetrical growth restriction, often linked to early gestational insults, is a significant contributor to poor outcomes [6]. Sinha et al. found that 61% of cases had a birth weight between 1.5 and 2.5 kg, 25% had a birth weight ranging from 1 to 1.5 kg, and 5% weighed less than 1 kg. Additionally, 83% of the cases exhibited asymmetrical intrauterine growth restriction (IUGR), while 17% had symmetrical IUGR [9].

Maternal Risk Factors

Malnutrition (30%) and anemia (36%) were the most prevalent maternal risk factors and were significantly associated with neonatal mortality. This parallels the study by Lifam et al., which identified maternal malnutrition (40%) and anemia (34.2%) as leading contributors to adverse outcomes [6]. These findings support longstanding evidence that nutritional deficits and hematologic compromise in pregnancy directly influence placental efficiency and fetal growth [10]. Other factors, such as PIH (20%) and multiple gestation (6%), were present but showed weaker statistical associations with poor outcomes.

Neonatal Morbidity

The most frequent neonatal complication was hypoglycemia (36%), a finding different to the 63.3% reported by Lifam et al [6]. IUGR infants are particularly vulnerable to hypoglycemia due to depleted glycogen reserves and immature glucose regulatory mechanisms [11]. Perinatal asphyxia (30%), hypothermia (4%), and sepsis (12%) were also notable complications, reflecting the fragile physiological status of these infants. Hypocalcemia and thrombocytopenia were less frequent but contributed to the morbidity burden. Similar complication profiles have been observed in other Indian NICU studies [9].

Neonatal Outcomes

The mortality rate of 10% observed in this study is comparable to the 18.3% reported by Lifam et al. Notably, a higher proportion of deaths occurred in neonates with symmetrical IUGR, birth weight <2 kg, or those born preterm—highlighting the compounded risk these factors confer [6]. Preterm birth further exacerbates outcomes due to immature lung and immune development [12]. Moreover, 26% of neonates were discharged with abnormal neurological findings, with most cases associated with perinatal asphyxia. This aligns with the observation by Lifam et al. that perinatal asphyxia and meconium aspiration were significantly associated with neurological morbidity [6].

Interpretation and Implications

The study reinforces the interplay between maternal health, socioeconomic determinants, and neonatal outcomes. It emphasizes the urgent need for enhanced antenatal care, early identification of high-risk pregnancies, and comprehensive management strategies for IUGR neonates in NICU settings.

Limitations

The lack of placental pathology data and long-term follow-up of neurological development limited this study. Additionally, some biochemical markers and detailed socio-demographic variables were not captured systematically.

5. CONCLUSION

This study highlights that intrauterine growth restriction (IUGR) remains a major concern in neonatal health, with significant contributions from preventable maternal factors like malnutrition and anemia. Neonates with low birth weight, prematurity, and symmetrical IUGR are particularly vulnerable to complications such as hypoglycemia, perinatal asphyxia, and adverse neurological outcomes. The findings underscore the critical importance of strengthening antenatal care—especially nutritional and hematological support—to identify at-risk pregnancies early and initiate timely interventions. Focused perinatal strategies, including NICU readiness and structured postnatal follow-up, are essential to improve both survival and long-term quality of life for these vulnerable infants

REFERENCES

[1] Sharma D, Shastri S, Sharma P. Intrauterine growth restriction: Antenatal and postnatal aspects. Clin Med Insights Pediatr [Internet]. 2016;10:67–83. Available from: http://dx.doi.org/10.4137/CMPed.S40070

[2] Darby JRT, Varcoe TJ, Orgeig S, Morrison JL. Cardiorespiratory consequences of intrauterine growth restriction: Influence of timing, severity and duration of hypoxaemia. Theriogenology [Internet]. 2020;150:84–95. Available from: http://dx.doi.org/10.1016/j.theriogenology.2020.01.080

[3] Fasoulakis Z, Koutras A, Antsaklis P, Theodora M, Valsamaki A, Daskalakis G, et al. Intrauterine growth restriction due to gestational diabetes: From pathophysiology to diagnosis and management. Medicina (Kaunas) [Internet]. 2023;59(6). Available from: http://dx.doi.org/10.3390/medicina59061139

[4] Dapkekar P, Bhalerao A, Kawathalkar A, Vijay N. Risk factors associated with Intrauterine growth restriction: A case-control study. Cureus [Internet]. 2023;15(6):e40178. Available from: http://dx.doi.org/10.7759/cureus.40178

[5] Malhotra A, Allison BJ, Castillo-Melendez M, Jenkin G, Polglase GR, Miller SL. Neonatal morbidities of fetal growth restriction: Pathophysiology and impact. Front Endocrinol (Lausanne) [Internet]. 2019;10:55. Available from: http://dx.doi.org/10.3389/fendo.2019.00055

[6] Lifam A, Malagi NAN, Thobbi AN. Study on clinical profile, risk factors, morbidity and mortality patterns of intrauterine growth restricted babies admitted in neonatal intensive care unit of tertiary care hospital, Vijayapura. Int J Contemp Pediatr [Internet]. 2024;11(10):1357–64. Available from: http://dx.doi.org/10.18203/2349-3291.ijcp20242729

[7] Brodsky D, Christou H. Current concepts in intrauterine growth restriction. J Intensive Care Med [Internet]. 2004;19(6):307–19. Available from: http://dx.doi.org/10.1177/0885066604269663

[8] Durousseau, S., & Chavez, G. F. (2003). Associations of intrauterine growth restriction among term infants and maternal pregnancy intendedness, initial happiness about being pregnant, and sense of control. Pediatrics, 111(5 Pt 2), 1171–1175.

[9] Sinha S, Kurude VN. Study of obstetric outcome in pregnancies with intrauterine growth retardation. Int J Reprod Contracept Obstet Gynecol [Internet]. 2018;7(5):1858. Available from: http://dx.doi.org/10.18203/2320-1770.ijrcog20181918

[10] Rasool A, Alvarado-Flores F, O'Tierney-Ginn P. Placental impact of dietary supplements: More than micronutrients. Clin Ther [Internet]. 2021;43(2):226–45. Available from: http://dx.doi.org/10.1016/j.clinthera.2020.11.017

[11] Abramowski A, Ward R, Hamdan AH. Neonatal Hypoglycemia. [Updated 2023 Sep 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537105/

[12] 12.Moschino L, Bonadies L, Baraldi E. Lung growth and pulmonary function after prematurity and bronchopulmonary dysplasia. Pediatr Pulmonol [Internet]. 2021;56(11):3499–508. Available from: http://dx.doi.org/10.1002/ppul.25380

...