

Clinical Pattern and Outcome of Intrauterine Growth Retardation (IUGR) Babies admitted in the Sick Neonatal Nursery (SNN) of a Tertiary Care Centre in South Tamilnadu, India

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Abstract

Introduction: Intra-Uterine Growth Retardation (IUGR) is failure to attain optimal intrauterine growth. Next to preterm birth, IUGR is the second leading cause of perinatal mortality. As many as 53% of preterm stillbirths and 26% of term stillbirths are growth restricted. Given the immediate and long-term implications of IUGR and its high prevalence in India, a focus on IUGR is both rational and strategic.

Objectives: 1) To study the Clinical pattern and outcome of IUGR babies and their Outcome during hospital stay. 2) To find out the Factors associated with Morbidity and Mortality of IUGR babies.

Methodology: This Cross sectional Descriptive Study was carried out in the Department of Pediatrics, Sick Neonatal Nursery(SNN) ward, Department of Pediatrics, Tirunelveli Medical College Hospital. 120 babies were selected by systematic random sampling. The socio-demographic and antenatal characteristics were collected by interviewing the mother using a structured proforma. The outcome measures like morbidity pattern and condition at discharge were quantified.

Results: Of 120 IUGR babies 22 (18.3%) are Preterm babies and 98 (81.7%) are Term babies. Hypoglycemia (63.3%) and Perinatal Asphyxia (45.0%), Sepsis (33.3%), Hypocalcaemia (30.0%), Hypothermia (28.3%) and Thrombocytopenia (25.0%) are the common complications. 22 (18.3%) have died at hospital and 98 (81.7%) have been discharged. Perinatal asphyxia and Meconium Aspiration are significantly associated with abnormal neurological examination at Discharge. Lower gestational age, Normal delivery and Lower weight of the baby are the statistically significant risk factors associated with mortality.

Conclusion: Hypoglycemia and Perinatal Asphyxia are the commonest complications of IUGR. Perinatal asphyxia, Meconium Aspiration, Gestational age, Delivery category and Weight of the baby are significant risk factors associated with morbidity and mortality.

Keywords: Intrauterine Growth Retardation, IUGR Babies, Morbidity, Complications of IUGR, Risk factors.

Introduction

Intrauterine Growth restriction (IUGR) is a common complication of pregnancy that carries significant short and long-term sequelae that reaches out to adulthood (Henry, 2008). Next to preterm birth, IUGR is the second leading cause of perinatal mortality (Pallotto, 2006). Intra-Uterine Growth Retardation (IUGR) is failure to attain optimal intrauterine growth which is

defined as either birth weight less than the 10th percentile for gestational age or as birth weight less than 2 standard deviations below the mean value for gestational age.

When compared with normally grown fetuses after exclusion of aneuploidic and anomalous fetuses, mortality rates are increased 10-fold with perinatal mortality rates as high as 120 per 1000 for all cases of IUGR. As many as 53% of preterm stillbirths and 26% of term stillbirths are growth restricted. Up to 50% of survivors will experience intrapartum asphyxia, which adds to the already increased risk of end-organ injury (Neelam Kle, 2009).

However, the IUGR condition provides numerous challenges to both researchers of the condition and the clinician caring for the patient and includes the following: varied etiologies and definitions, altered fetal behavioral and vascular responses to IUGR, severely limited treatment options and uncertainty regarding the timing of delivery.

Intra uterine growth-retarded babies face problems not of immaturity, but of in-utero hypoxia, poor nutrition and the resultant stress (Chard T, 1993). There is a substantial overlap between their problems and those that premature babies face. The effects of this disadvantageous start, however, tend to persist. IUGR babies exhibit poor catch-up growth and impaired cognitive and neurobehavioral development (Erich Cosmi, 2011). In addition, emerging evidence suggests that they are also more likely than normal weight babies to suffer from degenerative diseases like hypertension, diabetes and cardiovascular diseases in adulthood (Barker, 1998).

Given the immediate and long-term implications of IUGR and its high prevalence in India, a focus on IUGR is both rational and strategic from a public health perspective. A 20% approximate prevalence of IUGR in India implies that it is a significant public health problem (De Onis, 1998). IUGR is strategic from the point of view of neonatal and infant mortality and adulthood morbidity. So this study was attempted to find the mortality and morbidity pattern and associated the risk factors in IUGR babies admitted in a tertiary care hospital.

Objectives

The Objectives of the study are:

- 1) To study the Clinical pattern and outcome of IUGR babies admitted in the Sick Neonatal Nursery of Tirunelveli Medical College Hospital and their Outcome during hospital stay.
- 2) To find out the Factors associated with Morbidity and Mortality of IUGR babies.

Methodology

Study design and setting

This is a Cross Sectional study. This study was carried out in the Department of Pediatrics, Neonatal Unit, Tirunelveli Medical College Hospital between November 2008 and October 2010. According to the following sample size calculation formula, 120 IUGR babies were included in the study: Sample size (n) = $4pq/d^2$. [p = prevalence; q= 1-p; d= error allowed (25% of p)]. Based on the prevalence of IUGR as 35%, total of 120 babies were included in this study.

The following Inclusion and exclusion criteria were used to select the samples.

Inclusion Criteria:

- Newborns with IUGR defined by Birth weight less than 10th percentile (Annexure: 2) and Ponderal Index admitted in the SNN ward of Tirunelveli Medical College Hospital.

Exclusion Criteria:

- Newborns with chromosomal abnormalities.
- Newborns with congenital anomalies.

Method of data collection

Among all the IUGR babies admitted in SNN during the above study period, the 120 babies who satisfied the Inclusion criteria were selected by systematic random sampling. Informed consent of their parents was taken after explaining in detail about the method and procedures involved in the study in their vernacular language. The socio demographic profile and relevant information of individual babies and their respective mothers were collected by interviewing the mother using a structured proforma. The clinical details, complications and outcome at discharge were noted down.

The following investigations were carried out for all the babies under study:

- 1) CBC – Hb, PCV, TC, DC, Platelet Count, ESR
- 2) Blood Sugar, Urea and Serum Creatinine
- 3) Serum calcium
- 4) Chest X Ray
- 5) Total and Direct Bilirubin (Only for Icteric babies)
- 6) Sepsis Screening (Only for the suspected sepsis babies) - Peripheral smear for band forms and Toxic granules, Blood culture and sensitivity, CSF Analysis with culture and sensitivity.

The following criteria were kept in mind while analyzing the data:

- a) Hb: Hemoglobin less than 13 mg/dl was considered as Anemia.
- b) PCV: The value of PCV more than 65% was taken as Polycythemia.
- c) Total WBC count: A total count of < 5,000/cu.mm or >20,000/cu.mm was taken as abnormal and considered as suspicious of sepsis.
- d) Differential count: Differential count was considered mainly to find out Neutropenia which is indicative of sepsis. Absolute Neutrophil count less than 2000 was considered as Neutropenia.
- e) Platelet Count: Platelet count less than 1,00,000 was considered as Thrombocytopenia.
- f) ESR: Micro ESR value more than 15mm at one hour was considered as sepsis.
- g) Blood Sugar: Blood sugar value less than 45 mg/dl in one or more occasions were considered as hypoglycemia.
- h) Blood Urea and Serum Creatinine: Value of Blood urea more than 40mg/dl associated with the value of Serum Creatinine more than 1mg/dl was considered as acute renal failure.
- i) Serum calcium: Serum Calcium less than 7mg/dl was considered as hypocalcaemia.
- j) Peripheral smear for band forms and Toxic granules: Presence of band forms and toxic granules in peripheral smear study was considered as abnormal and considered as sepsis.

The outcome measures like Immediate Complications, Condition at discharge and risk factors associated with IUGR were identified.

Statistical analysis

Data were entered in Excel spreadsheet and analysed using SPSS version 13.0. The results were analysed using the statistical test like simple proportions, Risk ratio and Chi-square test. The p- value < 0.05 was considered as statistically significant.

Results

Table 1: Characteristics of IUGR babies

Character	Category	Number	Percent
Gender	Male	65	54.2
	Female	55	45.8
Gravida	Primi	82	68.3

	2 nd Gravida	28	23.3
	3 rd Gravida	8	6.7
	4 th Gravida	2	1.7
Grstational Age	Preterm	22	18.3
	Term	98	81.7
Mode of Delivery	Normal Vaginal	72	60.0
	Assisted	10	8.3
	LSCS	38	31.7
Birth Weight	< 1000 gm	6	5.0
	1000 – 1499 gm	10	8.3
	1500 – 1999 gm	38	31.7
	2000 – 2500 gm	66	55.0
Ponderal Index Group	Asymmetrical (PI ≤ 2)	82	68.3
	Symmetrical (PI > 2)	38	31.7

Among the total study population of 120 IUGR babies, 65 (54.2%) are males and 55 (45.8%) are females. As per the gestational age of the respective mothers of the study population, 82 (68.3%) mothers are primi and 28 (23.3%) are 2nd gravida mothers. The 3rd gravida mothers are 8 (6.7%) and only 2 (1.7%) are the 4th gravida mothers.

22 (18.3%) are Preterm babies and 98 (81.7%) are Term babies. 72 (60.0%) have been delivered by normal vaginal delivery and 10 (8.3%) have been delivered by Assisted delivery. 38 (31.7%) have been delivered by Caesarian section. Of the 120 babies 66 (55.0%) are in the birth weight category of 2.0 - 2.5 kg and 38 (31.7%) are in the birth weight category of 1.5 – 2.0 kg. 10 (8.3%) babies are in the category of 1.0 – 1.5 kg and 6 (5.0%) babies are in less than 1.0 kg category. Among the 120 study population 82 (68.3%) babies were classified as asymmetrical IUGR and 38 (31.7%) babies were classified as symmetrical IUGR as per Ponderal Index.

Table 2: Morbidity pattern of IUGR babies

Complications	Number	Percent
Metabolic		
Hypoglycemia	76	63.3
Hyperglycemia	10	8.3
Hypocalcaemia	36	30.0
Hematological		
Neutropenia	6	5.0
Polycythemia	6	5.0
Anemia	24	20.0
Thrombocytopenia	30	25.0
Organ Dysfunction		
Acute Renal Failure	22	18.3
Perinatal Asphyxia	54	45.0

Meconium Aspiration	20	16.7
Pulmonary Hemorrhage	6	5.0
Persistent Pulmonary Hypertension	4	3.3
Infection/ Others		
Sepsis	40	33.3
Meningitis	6	5.0
Hypothermia	34	28.3
Hyperbillirubinaemia	20	16.7

The above table 2 shows that hypoglycemia (63.3%) and Perinatal Asphyxia (45.0%) are the commonest complications. Other commoner are Sepsis (33.3%), hypocalcaemia (30.0%), hypothermia (28.3%) and thrombocytopenia (25.0%).

Table 3: Mortality in IUGR babies

	Number	Percent
Dead	22	18.3
Discharged	98	81.7
Total	120	100

Of the 120 IUGR babies 22 (18.3%) have died at hospital and 98 (81.7%) have been discharged.

Table 4: Outcome of IUGR

Outcome	Number	Percent
Dead	22	18.3
Abnormal Neurological Exam. at Discharge	19	15.3
Good condition at Discharge	79	66.3
Total	120	100

Of the 120 babies 22 (18.3%) have died in the hospital. 19 (15.5%) have been discharged with abnormal neurological examination and 79 (66.3%) have been discharged with Good condition at Discharge condition.

Table 5: Morbidity pattern and outcome

Complications	Good condition at Discharge (N=79)	Abnormal N E at Discharge (N=19)	p – Value	Dead (N=22)	p – Value
Metabolic					
Hypoglycemia	52 (65.8%)	8 (42.1%)	0.057	16 (72.7%)	0.541

Hyperglycemia	8 (10.1%)	2 (10.5)	0.959	0 (0.0%)	0.120
Hypocalcaemia	21 (26.6%)	5 (26.3%)	0.981	10 (45.5%)	0.090
Hematological					
Neutropenia	4 (5.1%)	0 (0.0%)	0.317	2 (9.1%)	0.480
Polycythemia	3 (3.8%)	1 (5.3%)	0.772	2 (9.1%)	0.311
Anemia	20 (25.5%)	4 (21.1%)	0.156	4 (18.2%)	0.482
Thrombocytopenia	20 (25.5%)	2 (10.5%)	0.165	8 (36.4%)	0.318
Organ Dysfunction					
Acute Renal Failure	14 (17.7%)	4 (21.1%)	0.736	4 (18.2%)	0.960
Perinatal Asphyxia	27 (34.2%)	13 (68.4%)	0.006	14 (63.6%)	0.013
Meconium Aspiration	7 (8.9%)	9 (47.4%)	0.000	4 (18.2%)	0.215
Pulmonary Hemorrhage	0 (0.0%)	0 (0.0%)	---	6 (27.3%)	0.000
Persistent Pulmonary Hypertension	0 (0.0%)	0 (0.0%)	---	4 (18.2%)	0.000
Infection/ Others					
Sepsis	24 (30.4%)	8 (42.1%)	0.328	8 (36.4%)	0.594
Meningitis	2 (2.5%)	2 (10.5%)	0.114	2 (9.1%)	0.163
Hypothermia	22 (27.8%)	8 (42.1%)	0.226	4 (18.2%)	0.359
Hyperbilirubinaemia	10 (12.7%)	4 (21.1%)	0.348	6 (27.3%)	0.097

The above table 5 shows the distribution of various morbidity conditions of IUGR babies with their Outcome. Perinatal asphyxia and Meconium Aspiration are significantly associated with abnormal neurological examination at Discharge. Perinatal asphyxia, Pulmonary hemorrhage and Persistent pulmonary hypertension are significantly associated with Death during the hospital stay.

Table 6: Fetal risk factors and mortality

Fetal Factors	Death N= 22	No Death N= 98	Odds Ratio	95% CI	Chi-2 Value	P- Value
Sex- Male	13 (59.1%)	52 (53.1%)	1.28	0.50 – 3.26	0.263	0.608
Weight ≤ 2 kg	15 (68.9%)	39 (39.8%)	3.24	1.11 – 9.76	5.850	0.015
GA - Preterm	8 (36.4%)	14 (14.3%)	3.43	1.22 – 9.67	5.849	0.016
Symmetrical IUGR	10 (45.5%)	28 (28.6%)	2.08	0.81 – 5.37	2.367	0.124

Normal Delivery	18 (81.8%)	54 (55.1%)	3.67	1.16 – 11.63	5.343	0.021
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The above table 6 shows that Weight \leq 2 kg, Preterm and Normal delivery have the statistically significant association with mortality (p - value $<$ 0.05).

Discussion

Regarding the complications, Hypoglycemia (63.3%) and Perinatal Asphyxia (45.0%) are the commonest of the complications observed in this study. Carbohydrate metabolism is seriously disturbed and these infants are highly susceptible to hypoglycemia as the consequence of diminished glycogen reserves and decreased capacity to gluconeogenesis (Kliegman, 1989). IUGR infants frequently do not tolerate labor and vaginal delivery, and signs of fetal distress are common.

Other commoner are Sepsis (33.3%), hypocalcaemia (30.0%), hypothermia (28.3%) and thrombocytopenia (25.0%). Other complications are Hyperglycemia (10 - 8.3%), Neutropenia (6 - 5.0%), Polycythemia (6 - 5.0%), Anemia (24 - 20.0%), Acute Renal Failure (22 - 18.3%), Meconium Aspiration (20 - 16.7%), Pulmonary Hemorrhage (6 - 5.0%), Persistent Pulmonary Hypertension (4 - 3.3%) and Meningitis (6 - 5.0%).

There are totally 22 preterm babies. Among them only 7 (31.8%) babies have Respiratory Distress Syndrome. This is due to as *McIntire DD et al* explained in their study that in IUGR babies, accelerated fetal pulmonary maturation occurs secondary to chronic intra uterine stress (McIntire, 1999).

Perinatal asphyxia and Meconium Aspiration are significantly associated with abnormal neurological examination at Discharge. Perinatal asphyxia, Pulmonary hemorrhage and Persistent pulmonary hypertension are significantly associated with Death during the hospital stay.

Weight \leq 2 kg, Preterm and Normal delivery have the statistically significant association with mortality (p - value $<$ 0.05) (Table 4.3). *Hack M, Fanaroff AA* in their study on outcome of extremely low birth weight and gestational age IUGR babies found that lower birth weight and lower gestational age are significantly associated with morbidity and mortality (Hack, 2000). It is consistent with study done by *McIntire DD et al* (McIntire, 1999). Table 4.3.1 details how the birth weight is associated with mortality during hospital.

Table 6 depicts how lower gestational age is significantly associated with higher chance of Death during hospital stay as compared to higher gestational ages. *Garite TJ et al* found that preterm infants have higher incidence of abnormalities than the general population because they are subjected to the risk of prematurity in addition to the risks of IUGR. IUGR infants delivered before 28 – 30 weeks had worse outcomes (Garite, 2004). In this study also, of the 8 Infants born before 32 weeks, 7 have died. This is statistically significant (p - value $<$ 0.01).

Morbidity in IUGR is significantly associated with Normal delivery than other mode of deliveries (p - value $<$ 0.01) in our study. IUGR babies frequently have birth asphyxia as they tolerate the stress of labour poorly. This is consistent with other studies by *Hawdon JM et al* (Hawdon, 1993) and *Pérez-Escamilla R et al* (Perez-Escamilla, 1992). This may be due to labour is stressful for IUGR fetuses. Skilled resuscitation should be available because perinatal depression is common. The availability of pediatrician for the skillful resuscitation also may contribute for the favorable outcome of IUGR in assisted delivery / caesarian section.

Conclusions

The following are the observations and conclusions of the study.

1. In this study, of the 120 IUGR babies 65 (54.2%) are male and 55 (45.8%) are female.
2. According to Ponderal Index 82 (68.3%) babies are asymmetrical IUGR and 38 (31.7%) are symmetrical IUGR. Ratio Asymmetrical: symmetrical = 2.15:1. Symmetrical IUGR is 2.08 times more risk of having mortality as compared to asymmetrical IUGR.
3. Hypoglycemia (63.3%) and Perinatal Asphyxia (45.0%) are the commonest complications of IUGR. Other commoner are Sepsis (33.3%), hypocalcaemia (30.0%), hypothermia (28.3%) and thrombocytopenia (25.0%).
4. Of the 120 babies, 22 (18.3%) died at hospital and 98 (81.7%) have been discharged. Of these 98 babies, 79 (66.3%) have been discharged in good condition and 19 (15.5%) with abnormal neurological examination.
5. Perinatal asphyxia and Meconium Aspiration are significantly associated with abnormal neurological examination at Discharge. Perinatal asphyxia, Pulmonary hemorrhage and Persistent pulmonary hypertension are significantly associated with Death during the hospital stay.
6. Lower gestational age, Normal delivery and Lower weight of the baby are the statistically significant fetal risk factors associated with mortality.

Recommendations

From the conclusions arrived at this study, the following recommendations can be made to prevent the incidence and the complications in IUGR.

1. Hypoglycemia, hypocalcaemia and hypothermia are the common treatable complications in this study which can be easily identified and treated. So in IUGR babies it is important to anticipate these conditions and treat appropriately to prevent further morbidity and mortality.
2. Perinatal asphyxia is the second most common complication observed in this study which is significantly associated with morbidity and mortality. Hence anticipating perinatal asphyxia, effective neonatal resuscitation measures should be made available for every IUGR delivery.

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