e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(1); 149-155

Original Research Article

A Hospital-Based Analytical Assessment of Neonatal Morbidity and Mortality between Late-Preterm IUGR and AGA Infants of the Same Gestational Age

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Received: 10-11-2022 / Revised: 05-12-2022 / Accepted: 20-12-2022
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Conflict of interest: Nil

Abstract

Aim: The aim of this study was to compare neonatal morbidity and mortality between late-preterm IUGR and AGA infants of the same gestational age.

Methods: The present study was conducted in the department of Pediatrics, Lord Buddha Koshi Medical College & Hospital, Saharsa, Bihar, India for six months and we analyzed 100 singleton pregnancies, including 50 pregnancies involving infants with a birth weight of or below the 10th percentile (IUGR) delivered between 34 weeks and 36 6/7 weeks of gestation due to maternal and/or fetal indications. The control group consisted of 50 singleton pregnancies with spontaneous preterm delivery at the same gestational age, in which the birth weight ranged from the 11th to 89th percentile (AGA).

Results: There was no significant difference in maternal age which ranged from 16 to 45 years (mean ± standard deviation: 25.1 ± 5.5 years) ($P > .05$). Among mothers of the IUGR group, 39 (78%) presented some underlying disease or obstetric complication in addition to IUGR, whereas 11 (22%) did not. Hypertensive syndromes were the most frequent condition and were observed in 24 (48%) women of the IUGR group. Heart disease was observed in 5 (10%) mothers of this group, systemic lupus erythematosus in 4 (8%), and other underlying diseases in 6 (12%) (pulmonary disease, hepatitis, thrombophilia, anemia, etc.).

Conclusion: In conclusion, our study showed that late-preterm IUGR infants present a significantly higher risk of neonatal complications and a significantly longer NCIU and hospital stay when compared to late-preterm AGA infants.

Keywords: Late Preterm; Intrauterine Growth Restriction; Morbidity; NICU

Introduction

IUGR is the term used to designate a fetus that has not reached its potential growth [1]. Intrauterine growth restriction is one of the causes of late preterm delivery, and it occurs more often in late preterm infants than term ones. IUGR itself is associated with perinatal morbidities and contributes to increased metabolic disease and poor neurodevelopmental outcome.

Late preterm birth is defined as birth between 34 0/7 weeks and 36 6/7 weeks of gestation [2]. They are the fastest-growing

in the preterm group in the last decade. In the United States in 2005, LP births account for more than 70% of all preterm births [15]. The number increased from 10.9% in 1990 in 12.8% in 2007 [3]. Now it is known that in the late preterm infants, the morbidity and mortality are higher than in term neonates. [4]

IUGR is an important cause of high-risk pregnancies and elective preterm deliveries. IUGR is present only in a small percentage of deliveries, but an increased frequency has been observed among women who go into preterm labour followed by premature delivery. Preterm infants and with intrauterine growth restriction are vulnerable to the complications of prematurity and IUGR as well, though there are conflicting findings in the literature about late preterm IUGR and AGA morbidity. [5] It appears normal, unchanged in the IUGR group compared to AGA LP infants suggesting an advantage to the stress of poor growth. [6] The prevalence of IUGR is high in high-risk pregnancies. As a consequence, this condition is common among elective preterm deliveries and is therefore associated with late prematurity, with the observation of a recent increase in the incidence of these electively delivered late-preterm infants. [7]

Late-preterm birth is defined as birth between 34 weeks and 36 6/7 weeks of gestation. [8] During the past decade, the proportion of all U.S. births defined as late-preterm births has increased by 16%. [9] The overall rate of preterm births in the United States increased from 10.9% in 1990 to 12.8% in 2007, an increase of 16.6%. [10] This increase was mainly due to an increase in late-preterm births. In Brazil, approximately 88% of the 188,223 pre-term births recorded in 2005 occurred at gestational age above 32 weeks. [11]

Individuals who had IUGR experience a range of poorer developmental outcomes, encompassing cognitive, socioemotional, and behavioral domains, compared with individuals who were born appropriate for gestational age (AGA). [13] Regarding cognitive outcomes, gold standard measures include IQ, mental quotient, and cognitive developmental quotient, which are all concise indicators of general cognitive functioning. Previous systematic reviews and meta-analyses. [12,14]

The aim of this study was to compare neonatal morbidity and mortality between late-preterm IUGR and AGA infants of the same gestational age.

Methods

The present study was conducted in the department of Pediatrics, Lord Buddha Koshi Medical College & Hospital, Saharsa, Bihar, India and we analyzed 100 singleton pregnancies, including 50 pregnancies involving infants with a birth weight of or below the 10th percentile (IUGR) delivered between 34 weeks and 36 6/7 weeks of gestation due to maternal and/or fetal indications. The control group consisted of 50 singleton pregnancies with spontaneous preterm delivery at the same gestational age, in which the birth weight ranged from the 11th to 89th percentile (AGA).

Pregnancies complicated by diabetes (preexisting or gestational) and premature membrane rupture, pregnancies with fetal anomalies and pregnancies with unknown or conflicting dating criteria were excluded. Maternal characteristics included age, preexisting medical problems and pregnancy complications. Delivery characteristics included gestational age at delivery, birth weight, route of delivery, indication of elective birth, and Apgar scores. Neonatal data included death, transient tachypnea of the newborn (TTN), neonatal sepsis, intraventricular hemorrhage (IVH), hypoglycemia, jaundice, total number of days the infant was in the neonatal intensive care unit (NICU), and length of hospital stay. Gestational age at delivery

was defined based on the mother's last menstrual period and was confirmed by early ultrasound examination.

Preexisting medical problems included hypertensive disorders (chronic hypertension and pre-eclampsia), heart diseases, systemic lupus erythematosus and others (pulmonary disease, hepatitis, thrombophilia, anemia, etc.). Antepartum complications included oligohydramnios and fetal distress. Possible signs of fetal distress were a constant decrease in fetal heart rate variability, the occurrence of late or variable decelerations upon cardiotocography, or a high systolic/diastolic ratio in the umbilical artery. Amniotic fluid volume was estimated during the evaluation of the fetal biophysical profile. Neonatal acidosis was defined as an arterial umbilical cord pH less than 7.2. [15]

Diagnostic criteria for each neonatal problem are applied concurrently by neonatologists as follows: (1) TTN: clinical and radiographic features identified during the first hours of life, followed by characteristic resolution during the subsequent 24–48 hours; (2) neonatal sepsis: positive blood culture and clinical manifestations, or clinical manifestations, radiologic findings and laboratory indicators; (3) IVH: identified by serial cranial ultrasonography (all infants have head US); (4) hypoglycemia: blood glucose level below 40 mg/dL; (5) hyperbilirubinemia; (6) neonatal thrombocytopenia: platelet count less than 150.000/μL (150 × 109/L); (7) apnea of prematurity: prolonged respiratory pause (20 s or longer) accompanied by cyanosis, pallor or bradycardia. The discharge criteria for preterm infants included weight > 2 kg and good suction upon breast-feeding accompanied by adequate weight gain.

Statistical analysis

Categorical data were compared between IUGR and AGA pregnancies by X2 analysis and Fisher's exact test. Ordinal measures were compared using the Kruskal-Wallis test. IUGR was considered to be significantly related to outcome when P < .005.

Results

Table 1: Maternal characteristics and indications for elective preterm delivery in the IUGR

Underlying disease/ obstetric complications	N%	Indications for elective resolution	N%
Systemic Lupus Erythematosus	4(8%)	Oligohydramnios	20(51.3%)
Heart diseases	5(10%)	Severe maternal Disease	8(20.5%)
Hypertensive	24(48%)	Cardiotocographic Disorders Abnormalities	6(15.4%)
Others	6(12%)	FBP or Doppler alterations Fetal maturity	3(7.7%) 2(5.1)

There was no significant difference in maternal age which ranged from 16 to 45 years (mean ± standard deviation: 25.1 ± 5.5 years) (P > .05). Among mothers of the IUGR group, 39 (78%) presented some underlying disease or obstetric complication in addition to IUGR, whereas 11 (22%) did not. Hypertensive syndromes were the most frequent condition and were observed in 24 (48%) women of the IUGR group. Heart disease was observed in 5 (10%) mothers of this group, systemic lupus erythematosus in 4 (8%), and other underlying diseases in 6 (12%) (pulmonary disease, hepatitis, thrombophilia, anemia, etc.)

Table 2: Comparison of neonatal outcomes between the IUGR and AGA groups

Outcome	IUGR group	AGA group	P
Length of stay (days)			
Mean	16.36	4.58	
Median	16.5	3.0	0.0001
SD	10.77	2.18	
Length of NICU stay (days)			
Mean	5.92	1.28	
Median	2.5	0.0	<0.0001
SD	7.71	2.28	
Phototherapy (days)			
Mean	5.78	3.19	
Median	5.0	3.0	0.005
SD	3.71	2.11	

There was a significant difference in mean birth weight between the two groups (IUGR: 1810 g and AGA: 2695 g, P = .0001). The frequency of cesarean sections was 92% in the IUGR group and 25% in the AGA group (P < .0001). No difference in mean umbilical cord pH or the presence of neonatal acidosis was observed between groups. Only one newborn of the IUGR group and none of the AGA infants presented Apgar scores <7 at 5 minutes. The length of stay of the newborn in the nursery, as well as the need for and duration of hospitalization in the NICU, differed significantly between the two groups.

Table 3: Comparison of neonatal complications between the IUGR and AGA groups

Neonatal complications	IUGR group	AGA group	P
TTN	27 (54%)	22 (44%)	>0.05
Apnea of prematurity	3 (6%)	0	>0.05
Intraventricular hemorrhage	6 (12%)	0	0.037
Neonatal thrombocytopenia	5 (10%)	0	>0.05
Neonatal sepsis	2 (4%)	0	>0.05
Hypoglycemia	12 (24%)	3 (6%)	0.047
Hyperbilirubinemia	49 (98%)	50 (100%)	0.52

TTN or apnea rates did not differ significantly between IUGR and AGA infants. Late-preterm IUGR infants were found to be at a higher risk for IVH. There were only Grade 1 IVH in this sample. No respiratory distress syndrome, pulmonary hemorrhage or bronchopulmonary dysplasia was observed in either group. The frequency of sepsis or thrombocytopenia did not differ between groups. Hypoglycemia was more frequent in the IUGR group. The presence of hyperbilirubinemia was similar in the two groups (98% in the IUGR group versus 100% in the AGA group) (P = 0.52, Fisher's exact test).

Discussion

Late preterm births are an increasing problem in the world nowadays. They account for 70% of all preterm births. They experience a higher incidence of neonatal morbidity and mortality compared to term neonates. [16] On the other hand, IUGR is a problem that complicates their prematurity situation, contributing to an increased morbidity and mortality observed among late preterms. IUGR is a frequent complication in preterm infants and is the cause of most

elective late-preterm deliveries. IUGR may also contribute to the increased morbidity and mortality observed among late-preterm infants. These infants are at risk for hypoglycemia, IVH, prolonged hospital stay and increased need for NICU treatment when compared to AGA infants, thus demonstrating the greater severity of these cases.

Gilbert and Danielsen [18] reported a higher incidence of IVH and higher hospital costs for late-preterm IUGR infants when compared to AGA infants. In contrast to the present results, Sharma et al. [11] observed a lower incidence of RDS in late-preterm infants with IUGR; however, as observed in the present study, these infants required prolonged hospitalization in the nursery. Tyson et al. [17] and Piper et al. [19] compared the incidence of RDS between IUGR and AGA infants but we could not compare our results to theirs because these authors used a different definition of RDS.

Although we did not observe more severe neonatal complications in the present cases (e.g., respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary hemorrhage, necrotizing enterocolitis and neonatal death), hypoglycemia, neonatal sepsis, IVH, thrombocytopenia and hyperbilirubinemia were present in the late-preterm infants studied and were the cause of NICU treatment and prolonged stay in the nursery. The lack of observation of these more severe complications might be explained by the small sample studied since the frequency of these complications is rare in this gestational age group. Mean gestational age was 35.5 weeks in the two groups, a gestational age at which the incidence of respiratory distress syndrome is very low. [20] Thus, the number of newborns necessary to detect cases of this disease would have to be high. In the present series no cases of severe pulmonary complications such as bronchopulmonary dysplasia or pulmonary hemorrhage were observed, a finding thatmight be explained by the small sample size since these complications are also rare in this gestational age group. [21] The absence of neonatal death in the present sample is probably due to the low mortality of these newborns, which is approximately 7.7 per 1000 live births. [22]

In addition, our study only analyzed neonatal morbidity immediately after delivery during the stay of the newborn in the nursery, but not the long-term consequences of late preterm birth. The Institute of Medicine analyzed the late consequences of preterm birth in the United States and demonstrated marked human and economic impacts during childhood resulting from preterm birth. [23] Neonatal sepsis was rare in the present sample and was similar in the two groups (4% versus 0). These findings agree with Arnon et al. [24] who observed an incidence of 5% of neonatal sepsis in neonates born at 34 weeks of gestation and no case among those born at 36 weeks. The exclusion of cases with premature membrane rupture may have contributed to this result [24]. Neonatal jaundice was very common in both groups (98% versus 100%). Furthermore, IUGR infants required phototherapy for a longer period of time than AGA infants, that is, jaundice was more severe in this group. Late-preterm birth poses various risks to the newborn and the obstetrician should always weigh the risks and benefits in each case to decide whether to interrupt pregnancy between 34 weeks and 36 weeks and 6 days of gestation. We believe that the technological advances in obstetrics that have occurred over the last few years permit a better control of high-risk pregnancies. Thus, the priority of the obstetrician is to strive for delivery as close to term as possible. [25]

Conclusion

In the present study, we analyzed 100 singleton pregnancies, including 50

pregnancies involving infants with a birth weight of or below the 10th percentile (IUGR) delivered between 34 weeks and 36 6/7 weeks of gestation due to maternal and/or fetal indications. There were only Grade 1 IVH in this sample. No respiratory distress syndrome, pulmonary hemorrhage or bronchopulmonary dysplasia was observed in either group. The frequency of sepsis or thrombocytopenia did not differ between groups. In conclusion, our study showed that late-preterm IUGR infants present a significantly higher risk of neonatal complications and a significantly longer NCIU and hospital stay when compared to late-preterm AGA infants. Thus, evaluation of the birth weight percentile for gestational age may provide a more realistic expectation of outcome among late-preterm infants.

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