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Original Research

Incidence of neonatal jaundice requiring intervention in low-birth-weight babies: A comparative study from a tertiary care centre

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Abstract

Background: According to WHO, low birth weight (LBW) refers to birth weight <2500 grams (5.5 pounds). LBW is the main cause of newborn morbidity and death. Jaundice affects 60–70% of all term babies to some extent, but it affects 80% of low-birth-weight babies, of whom 4–6% have severe neonatal hyperbilirubinemia. Compared to neonates of normal birth weight, LBW babies are more vulnerable to hyperbilirubinemia-related brain damage and other complications at lower bilirubin levels.

Objective: Present study aims to investigate the incidence of neonatal jaundice requiring intervention in LBW babies in a tertiary care centre and to compare the profile of jaundice in LBW infants between the AGA and SGA subgroups.

Methodology:100 neonates born with birth weight <2.5kgs were included in the study. The infants were classified as AGA if the weight for GA was between the 10th to 90th centile and SGA if the weight is less than the 10th centile for the GA. A separate category was made for weight less than 3rd centile.

Results:44% subjects were AGA and 56% were SGA and a higher proportion of female gender (55%) was observed in study population. Mean TSB was 14.66 ± 2.99 in AGA group and 14.46 ± 2.99 in SGA group. Phototherapy was administrated in SGA group at significantly higher rates (92.9%) as compared to the AGA group (79.5%). Mean Phototherapy duration was also significantly higher in the SGA group (30.03 ± 8.01) as compared to the AGA group (26.74 ± 6.40).

Conclusion: Rate of phototherapy andmean phototherapy duration was significantly higher in the SGA group as compared to the AGA group.More studies with ample sample size are required to validate the findings of present study.

Keywords: Phototherapy, low birth weight, hyperbilirubinema, AGA, SGA.

Introduction

WHO described low-birth-weight (LBW) as BW<2500 grams (5.5 pounds) (1). The UNICEF-WHO LBW Estimates for 2020 indicate that approximately 15 percent or 19.8 million newborns worldwide, which amounts to one in seven babies, were born with low birthweight (2).In terms of geographical variances, South Asia has the greatest prevalence of LBW newborns (28%), accounting for almost 95% of births in impoverished countries. In terms of the overall percentage of LBW newborns in South Asia, India is in third place behind Yemen (32%), Pakistan (35%), and Mauritania (35%). 7.5 million babies, or around 30% of all newborns in India, are born weighing less than 2,500 grams. This is the biggest load of any nation, accounting for 42% of the world burden. The NFHS-3 found that 22% of Indians were LBW (3). About 18.24% of newborns in India were LBW, according to the NFHS-5, with the percentage being much higher in rural than in urban regions (18.58% vs. 17.36%) (4).

Perinatal health complications and death are more prevalent in SGA than in appropriate for gestational age (AGA) babies, regardless of whether they are born at full term or prematurely. A population-based study that examined the rise in perinatal death found that newborns with severe SGA (BW less than the fifth percentile) had the greatest rate. Infants diagnosed with Foetal Growth Restriction or identified as SGA are at elevated risk of complications from birth through childhood and beyond (5). The main concerns noted among babies classified as SGA included perinatal asphyxia , sepsis jaundice, hypothermia, apnoea, hypoglycaemia , polycythaemia, hypocalcaemia and bleeding issues (5, 6). Prematurity may be linked with an elevated risk of

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death in infants with foetal growth restriction/SGA (5, 6).

The most typical transitional finding in the neonatal stage is Neonatal Jaundice. It refers to yellowish skin discoloration due to elevatedTSB. Almost all babies have an elevated bilirubin concentration during the first few days of life, usually greater than 2 mg/dl. Clinical manifestation occurs at concentrations greater than 5 mg/dl. Frequently, it is completely benign and goes away without any further care or consequences (7, 8). In neonates, when bilirubin >5 mg/dl, it is visible in skin and eyes (9). Jaundice affects 60–70% of all term babies to some extent, but it affects 80% of low-birth-weight babies, of whom 4–6% have severe neonatal hyperbilirubinemia (10). The incidence has risen to 10–14% over time, most likely as a result of more advanced diagnostic tools (11). Jaundice is the most prevalent morbidity, affecting 80% of term and 60% of preterm newborns. It is also the most common reason for readmission following hospital discharge (12).Neonatal hyperbilirubinemia occurs due to higher bilirubin burden on hepatocytes, reduced hepatic absorption from plasma, poor conjugation, and delayed excretion, making newborns more susceptible to hyperbilirubinemia and this being exaggerated in preterm and LBW infants (12).

Compared to neonates of normal BW, LBW babies are more vulnerable to hyperbilirubinemia-related brain damage and other complications at lower bilirubin levels (13). LBWnewborns are more likely to experience severe, prolonged jaundice due to the immaturity of their physiological processes, which increases the risk of brain harm. Severe hyperbilirubinemia causes free bilirubin to build up and penetrate the blood–brain barrier, causing irreparable brain damage (14).This study is being conducted to evaluate the burden of Hyperbilirubinemia in Low-LBW infants in Northern India for early risk detection and management. Data is especially scarce on neonatal jaundice in AGA and SGA babies. Through a comparison of SGA and AGA neonates, this study aims to better understand the role of being SGA and AGA in prevention and management of Neonatal Hyperbilirubinemia in such babies.Understanding the incidence of jaundice in low birth weight babies is crucial for healthcare providers to implement appropriate monitoring and treatment strategies to ensure the well-being of these vulnerable infants. Early detection and intervention are key in managing jaundice effectively and preventing long-term complications in newborns, particularly those with low birth weight.

Methodology

Study design: The study was conducted in the Dept. of Pediatrics at MMIMSR, Mullana, Ambala. 100 neonates born with BW <2.5kgswho are clinically icteric were included in this study. Neonates with G6PD deficiency, asphyxia, sepsis, any other systemic illness, presence of cephalhematoma, history of maternal drug intake affecting liver of foetus and non-consenting parents were excluded from the study.

New Ballard Scoring and Fenton's Growth Chart: All infants born with BW <2.5kgs were included in the study. The Gestational age was calculated using LMP, USG and New Ballard Scoring. Assignment to AGA and SGA was done according to Fenton's Growth Chart. The infants were classified as AGA (10th-90th centile) and SGA (<10th centile). A separate category was made for weight less than 3rd centile. Fenton's chart was used. Babies were followed up till day 5 of post-natal life and Serum bilirubin was sent for clinically icteric baby with correlating TCB values.

Serum bilirubin estimation: 1ml of peripheral blood was collected in plain red vial and was sent for estimation. Bilirubin was estimated by Diazo method. Repeat sample for serum bilirubin estimation was sent again as and when required in first three days of post-natal life.

Statistical analysis:SPSS 27.0 was used to carried out the data analysis. Chi-square test was used to compare two categorical variables whereas unpaired t-test was used to compare two numerical variables. Appropriate tables and graphs were used to depict the data. A p value <0.05 was taken as statistically significant.

Results

A higher proportion of female gender was observed in the study population. There were 45% male and 55% female with no significant difference in sex ratio between AGA and SGA group.Gravida in 100 cases indicate that 49% cases were G1, 31% cases were G2, 11% cases were G3, 4% cases were G4, 4% cases were G5 and 1% case was G6.Mode of delivery was LSCS in 51% cases and NVD was observed in 49% cases. Study population was divided into 4 groups based on Period of Gestation. POG was between 32 to 34+6 weeks in 21% cases, 35 to 36+6 weeks in 34% cases, 37 to 40+6 weeks in 44% cases and more than equal to 40 weeks in 1% cases. Significantly higher cases of SGA (64.3%) were reported in in POG 37-40+6 Wks as compared to AGA (18.2%) in same POG.There was no significant difference in the AGA and SGA group in terms of mode of delivery.ABO/RH incompatibility was present at a significantly higher rate in the SGA group (35.7%) as compared to the AGA group (11.4%) (Table 1).

Variable	Domain	AGA		SGA		P Value
		N	%	N	%	
Gender	Male	20	45.5	25	44.6	0.935

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	Female	24	54.5	31	55.4	
Gravida	G1	17	38.6	32	57.1	0.116
	G2	14	31.8	17	30.4	
	G3	8	18.2	3	5.4	
	G4	1	2.3	3	5.4	
	G5	3	6.8	1	1.8	
	G6	1	2.3	0	0	
Mode of delivery	LSCS	27	61.4	24	42.9	0.066
	NVD	17	38.6	32	57.1	
Period of gestation	32-34+6 Wks	18	40.9	3	5.4	0.000*
	35-36+6 Wks	18	40.9	16	28.6	
	37-40+6 Wks	8	18.2	36	64.3	
	>=40 Wks	0	0	1	1.8	
ABO incompatibility	Present	6	13.6	20	35.7	0.012*

Table 1: Sociodemographic and clinical determinants of study population.

Out of a total of 100, 87% subjects required Phototherapy. Phototherapy was administrated in SGA group at a significantly higher rate (92.9%) as compared to the AGA group (79.5%).Mean Phototherapy duration was significantly higher in the SGA group (30.03 ± 8.01) as compared to AGA group (26.74 ± 6.40).Phototherapy duration was >24 hours in 48.1% cases in SGA which is significantly higher than in AGA (20%).Rebound TSB requiring intervention in 8% cases. There was no significant difference in the AGA and SGA group in terms of rebound TSB requiring intervention (Table 2).

Variable	AGA		SGA		P Value
	N or mean	% or SD	N or mean	% or SD	
Phototherapy required	35	79.5	52	92.9	0.049*
Mean Phototherapy duration	26.74	6.40	30.03	8.01	0.045*
Phototherapy duration <=24 Hrs	28	80	27	51.9	0.007*
Phototherapy duration >24 Hrs	7	20	25	48.1	
Rebound TSB requiring intervention	4	11.4	3	5.8	0.432

Table 2: Details of phototherapy in AGA and SGA group.

Duration of phototherapy was significantly higher (>24 Hrs) in cases with TSB>=15 (58.3%) (Table 3).

Phototherapy duration	TSB<15		TSB>=15		P Value
	N	%	N	%	
<=24 Hrs	35	89.7	20	41.7	0.000*
>24 Hrs	4	10.3	28	58.3	

Table 3: Phototherapy duration according to TSB.

Rebound Hyperbilirubinemia was seen in 9.4% cases with post-natal age >72 Hrs of life and in 7.3% cases with post-natal age <72 Hrs. There was no significant relationship found between the occurrence of rebound hyperbilirubinemia and the age at which phototherapy was initially started (Table 4).

Rebound TSB	Post natal age >72 Hrs		Post natal age <72 Hrs		Total		P Value
	N	%	N	%	N	%	
No	29	90.6	51	92.7	80	92	0.728
Yes	3	9.4	4	7.3	7	8	

Table 4: Rebound TSB requiring intervention and post-natal age.

Discussion

In the present study, a total of 100 LBW neonates were taken, out of which 87% developed Neonatal Hyperbilirubinemia necessitating intervention. Phototherapy was the only intervention given. None of the subjects required exchange transfusion. Pabbati et al comprising of 424 LBW babies , 40% developed Neonatal Jaundice(3). A similar study conducted by Mansour et al revealed that the jaundice was significantly higher in LBW infants at 35.6% as compared to normal BW infants which was 16.9%(15). Another study conducted by Shaikh et al in Pakistan revealed that 40% LBW babies developed Jaundice(16). In Narang et al conducted a study at PGI, Chandigarh cited that A total of 76.6% Very LBW babies developed clinical jaundice requiring

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phototherapy(11). Another study conducted by Sahani et al, out of 200 neonates with LBW , 12.5% developed jaundice(17).

In the current study, 44% subjects were AGA newborns and 56% were SGA. In Mallick et al. study, 30% were SGA babies and 70% were AGA babiesand out of these SGA 41.1% were <3rd centile(18). Likewise, a study conducted by Bartal et al 18.4% subjects were SGA and 81.6% subjects were AGA(19). Among the comprised subjects in our study, a higher proportion of female gender was observed in study population. There were 45% male and 55% female with no significant difference in sex ratio between AGA and SGA groups. In the study by Reddy and Varghese, a similar gender distribution was observed with 55% females and 45% male (20). In the study by Sahoo et al., there were 67% males and 33% females (21). In a study from Chandigarh done by Narang et al, incidence of hyperbilirubinemia in males was 64.2% (22). While in the study by Singhal et al, incidence of hyperbilirubinemia in males was 56.8% (23). In the study by Bedi et al., 63 cases were female and 65 cases males (24). In the study by Iqbal et al., 61.65% babies were male and 38.39% were female (25).

Gravida in 100 cases indicate that 49% cases were G1, 31% cases were G2, 11% cases were G3, 4% cases were G4, 4% cases were G5 and 1% case was G6. In the study by Bedi et al., nearly 33% of babies were delivered to primigravida mothers (24). In the study by Bartal et al 53.8% SGA babies were born to Nulliparous women whereas 40.7% AGA babies were born to Nulliparous women(19).In the primary study, mode of delivery was LSCS in 51% cases and NVD was observed in 49% cases. There was no significant difference in the AGA and SGA group in terms of mode of delivery. In the study by Bedi et al., 33.5% of newborn were delivered by LSCS and rest 66.4% babies were delivered by vaginal route (24). In the study by Gilbert and Baburaj, 306/506 were NVD and 194/506 wereLSCS. Phototherapy was required in 15 NVD and 6 LSCS cases (26).

In the present study, most common mother blood group was O+ in 42% cases and B+ in 28% cases. The most common baby blood group was B+ in 43% cases and O+ in 26% cases. ABO/Rh incompatibility was present at a significantly higher rate in the SGA group (35.7%) as compared to the AGA group (13.6%). In our study, hemolysis was ruled out by performing necessary investigations. In the study by Gilbert and Baburaj, ABO and Rh incompatibility are found to be a major risk factors, as well as the likelihood that mothers who belong to the B negative and O positive blood groups may experience severe hyperbilirubinemia (26).51.4% AGA neonates developed clinically significant jaundice and phototherapy was initiated before 72 hours of post-natal life and the remaining 48.6% after 72 hours of post-natal life. On the other hand, 62.1% SGA babies developed clinically significant jaundice and phototherapy was initiated before 72 hours of post-natal life and the remaining 37.9% after 72 hours of post-natal life. However, the difference was not statistically significant.

Phototherapy was administrated in SGA group at a significantly higher rate (92.9%) as compared to the AGA group (79.5%). In the study by Gilbert and Baburaj, 21 (4.2%) including 15 full term and 6 late preterm cases required phototherapy (26). Mallick et al in their study concluded that jaundice was significantly more in Late Preterm SGA group as compared to AGA group. Incidence being 41.7% and 17.7% respectively(18). The risk of jaundice was higher in patients with GDM and SGA i.e., SGA <3rd Centile, in the study by Esakoff et al. (27). In the study conducted by Benth et al SGA infants received phototherapy significantly more often than AGA infants(28). Haimovich et al conducted a study which suggested that the SGA newborns had significantly higher rates of hyperbilirubinemia (70% in SGA vs. 40% in AGA, Ps0.0027), phototherapy (66.7% in SGA vs. 36.7% in AGA, Ps0.0067)(29). In the study conducted by Rocha et al , presence of hyperbilirubinemia was similar in the two groups (30). In the study conducted by Civan , no significant difference was found in occurrence of hyperbilirubinemia and mode and treatment of hyperbilirubinemia between SGA and AGA groups(31). In contrast to our study , the study by Bartal et al revealed that SGA babies were at a decreased risk of hyperbilirubinemia(19).

Mean Phototherapy duration was significantly higher in the SGA group (30.03 ± 8.01) as compared to the AGA group (26.74 ± 6.40).Phototherapy duration was >24 hours in 48.1% cases in SGA which is significantly higher in AGA (20%). In the study by Bedi et al., the phototherapy duration was 32.19±20.9 h (24). In the study by Rocha et al neonate required more phototherapy in the IUGR and AGA groups(30). In our study, we noted that there was a significant association between TSB and duration of phototherapy. Our study suggests that higher TSB levels (TSB >= 15) are associated with a significantly higher likelihood of requiring phototherapy for more than 24 hours compared to lower TSB levels (TSB < 15) with a p value of <0.05.

In the current study, incidence of rebound hyperbilirubinemia was 8% with 11.4% AGA babies having rebound hyperbilirubinemia and 5.7% SGA babies having rebound hyperbilirubinemia. The difference was not statistically significant. In a similar study conducted by Almohammaadi et al, incidence of rebound hyperbilirubinemia was 11%(32).Chang et al conducted a similar study and concluded that out of 7048 infants treated with phototherapy 4.6% developed rebound hyperbilirubinemia(33).

Rebound TSB came in range for phototherapy in 9.4% cases with post-natal age >72 Hrs of life and in 7.3% cases with post-natal age <72 Hrs and there was no significant relation between the two. Likewise, In the

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study by Almohammaadi et al , there was no significant relationship between age at phototherapy initiation and rebound hyperbilrubinemia(32)**.** On the contrary ,in the study done by Kaplan et al , more neonates experienced rebound hyperbilirubinemia when phototherapy was initiated within 72 hours (17%) compared to those in whom it was started after 72 hours(34). In the study done by Richa et al Neonates who developed hyperbilirubinemia within 72 hours of birth were significantly more likely to experience rebound(35).

Conclusion

Present study was prospective observational study which analyzed the incidence of neonatal jaundice requiring intervention in low-birth-weight babies in a tertiary care centre. There were 44% AGA cases and 56% SGA cases.Phototherapy was administrated in SGA group at a significantly higher rates as compared to the AGA group.Mean Phototherapy duration was significantly higher in the SGA group as compared to the AGA group. Phototherapy duration was >24 hours in 48.1% cases in SGA which is significantly higher in AGA.We also compared the profile of jaundice in LBW infants between the AGA and SGA subgroups. There was no significant difference in the AGA and SGA group in terms of TCB and TSB.There was no significant difference in the AGA and SGA group in terms of rebound TSB requiring intervention.Duration of phototherapy was significantly higher (>24 Hrs) in cases with TSB>=15.TSB was significantly higher (>=15) in cases with post-natal age >72 Hrs. TSB was significantly higher (>=15) in cases with TSB>=15.More studies with ample sample size are required to validate the findings of present study.

Limitations

Small sample size,a multicentric study with a larger sample size is necessary to
validate the findings of the present study and provide more robust conclusions.

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