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Neonatal Jaundice Risk Factors and Multidirectional Intensive Phototherapy Management at Azadi Teaching Hospital in Kirkuk City

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Abstract

Background: A common illness in infants, neonatal jaundice is caused by high bilirubin levels in the first few days of life, which results in yellowing of the skin and eyes. **Aim:** This study aims to explore neonatal jaundice risk factors and assess the efficacy of multidirectional intensive phototherapy management at Azadi Teaching Hospital in Kirkuk City. **Patients and Methods:** In this retrospective cross-sectional study spanning from April 1st, 2021, to October 1st, 2021, a total of 497 newborns were examined. Jaundiced neonates underwent intensive phototherapy utilizing the Bilisphere 360 system, which featured a chamber with 16 cylindrical, blue TL 20W/52 fluorescent tubes. The newborns were positioned on a gauze hammock suspended at the chamber's center, illuminated on all sides. **Results:** A study found that neonatal jaundice affects 50.70% of studied neonates, primarily in the 16-21-day age group, with males accounting for 57.95% of the sample. 94.84% of neonates experience jaundice due to ABO blood group incompatibility and 88.10% due to Rh incompatibility. Additionally, 77.78% of term deliveries are associated with jaundice. Infants with jaundice have higher Thyroid Stimulating Hormone (TSB) and Thyroid Stimulating Hormone (TSH) levels and a younger mean age compared to non-jaundiced infants. Bilisphere 360 proves significantly more effective in the critical 12 to 48 hours after admission, with a mean total bilirubin of 10.71 ± 1.01 mg/dl compared to 14.65 ± 1.71 mg/dl for Neonatal Exchange Transfusions (P-Value: 0.001). Factors like blood group incompatibility, labor duration, and birth weight influence TSB levels in jaundiced neonates. The Bilisphere 360 method is found to be more effective in managing neonatal jaundice than Neonatal Exchange Transfusions in reducing total bilirubin levels.

Keywords: Neonates, Neonatal jaundice, Total Serum Bilirubin, Phototherapy, Exchange transfusion

Introduction

Neonatal jaundice is a common clinical problem that affects a significant number of babies worldwide each year. It is shocking to learn that 1.1 million infants suffer from severe hyperbilirubinemia, which may cause bilirubin encephalopathy and raise the risk of problems (1). Notably, the majority of these occurrences occur in South Asia and sub-Saharan Africa. Even so, there are still a lot of gaps in knowledge and treatment options when it comes to the factors that contribute to newborn jaundice in sub-Saharan Africa. Consequently, it is crucial to

investigate the contributing aspects of newborn jaundice in great detail. Such an inquiry is essential to reducing infant morbidity and death related to jaundice, as well as to pinpoint the underlying causes and risk factors (2). Gaining an understanding of these factors is essential to creating preventive and therapeutic approaches that are more effective, which will improve the newborn healthcare environment as a whole. Regions like South Asia and sub-Saharan Africa are particularly impacted by this problem. Surprisingly, the frequency in developing nations like Nigeria is almost 100 times higher than in developed ones (3). Acute bilirubin encephalopathy or kernicterus, which increase the risk of neonatal death and long-term neurological problems, are associated with severe neonatal jaundice. Hospitalization is frequently required, putting a financial and emotional burden on families, communities, and the medical community. Neonatal jaundice in affluent countries is mostly caused by blood incompatibility; in underdeveloped countries, contributory factors include prematurity, low birth weight, G6PD deficiency, infections, and traditional practices (4,5). Maintaining control over hyperbilirubinemia is essential to avoiding consequences like kernicterus. Exchange transfusion (ECT) and phototherapy are the two main treatments for managing jaundice. Phototherapy is a widely accessible and trouble-free treatment. The light dose, wavelength, and exposed surface area are some of the variables that affect how effective phototherapy is. Exchange transfusion is required if phototherapy is unable to produce the desired reduction in total serum bilirubin (TSB) levels, even though phototherapy is frequently the first option (6). Exchange transfusion is an intrusive treatment that has some risk of morbidity and mortality, even if it is effective in lowering TSB levels. When deciding whether to do an exchange transfusion, one should carefully compare the advantages of lowering TSB levels to prevent kernicterus against the risks associated with the process (7, 8). A viable substitute that can quickly bring TSB levels below the cutoff point for exchange transfusion is intense phototherapy. This development in phototherapy offers a non-invasive, efficient method that may lessen the need for exchange transfusion and the hazards that go along with it. A thorough evaluation of each patient's circumstances should be used to determine which of these therapies is best, making sure that the advantages of lowering bilirubin levels outweigh any potential drawbacks (10). Phototherapy is a known and well-established method for the treatment of severe hyperbilirubinemia in Baghdad (10, 11).

The aim of this study is to investigate the risk factors associated with neonatal jaundice and evaluate the effectiveness of multidirectional intensive phototherapy management at Azadi Teaching Hospital in Kirkuk City.

Materials and Methods

A retrospective cross-sectional study was conducted at Azadi Teaching Hospital from 1/4/2021 to 1/10/2021 and included 497 neonates, data was performed, collating information from hospital records. The inclusion criteria involved all neonates born at the hospital over study period, excluding cases with incomplete or missing data. Cases with direct hyperbilirubinaemia, critically-ill newborns, those with multiple congenital anomalies and inborn errors of metabolism were excluded

Total serum bilirubin (TSB) levels were used to classify neonates as jaundiced or non-jaundiced during the data collection process. A TSB threshold was used, which was based on generally recognized clinical recommendations for the diagnosis and treatment of neonatal jaundice. During the study period, our NICU followed established guidelines from credible organizations, such the American Academy of Pediatrics (AAP), to assess if an infant had jaundice. (10). Risk factors, comorbidities, and demographic traits were evaluated.

Preterm: Refers to infants born before completing 37 weeks of gestation.

Term: Describes infants born between 37 and 42 weeks of gestation.

Postterm: Pertains to infants born after 42 weeks of gestation.

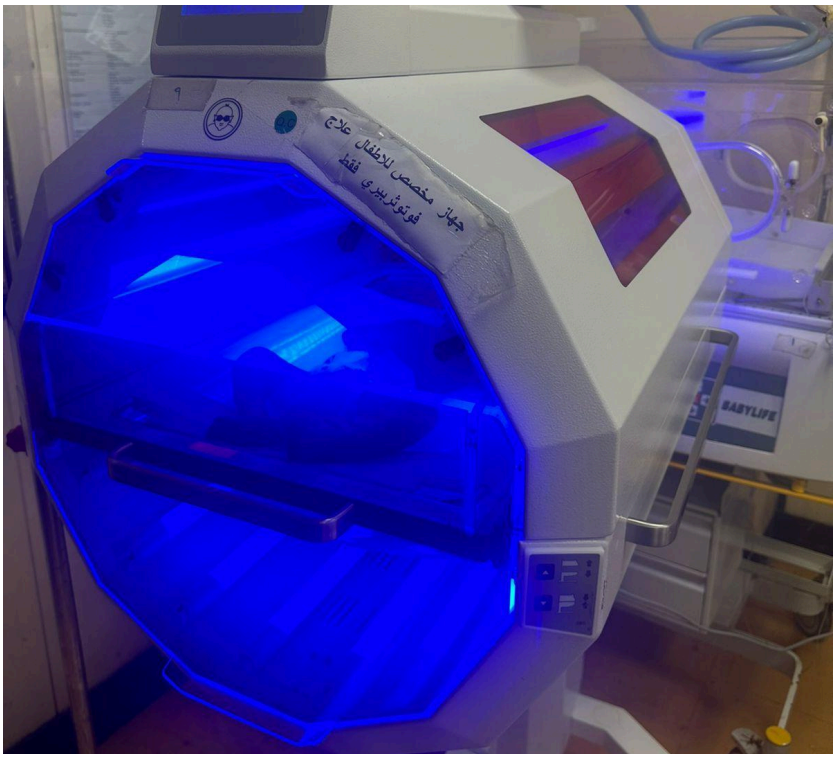

Figure 1: Bilisphere 360 system for phototherapy

Using the Bilisphere 360 device, jaundiced infants undergo intense phototherapy as part of the process. The baby is placed within a cylindrical chamber that has sixteen blue TL 20W/52 fluorescent tubes placed inside of it in a cylinder pattern. The infant is supported by a gauze hammock in the middle of the room, giving them full access to the blue light coming from all directions. The treatment works on the basis of the idea that blue light, in a particular wavelength range, changes the bilirubin in the body of the neonate into more soluble forms, which makes it easier for the body to excrete the bilirubin. The homogeneous illumination provided by the fluorescent bulbs' cylindrical design maximizes the effectiveness of phototherapy. This medication is given to the jaundiced newborns in an effort to lower their excessive bilirubin levels and lessen their jaundice symptoms. To guarantee the safety and efficacy of the therapy, routine monitoring and modification are necessary. All cases were assessed upon admission, including total and direct serum bilirubin, complete blood count (CBC), reticulocyte count, blood group, Rh of mother and neonate, and Direct Coombs test utilizing antiglobulin reagent specific for IgG. After receiving phototherapy as soon as they were admitted, all of the neonates under study had their TSB assessed six hours later. All the while, phototherapy was given, with the exception of feeding, nursing care, and blood work. With the exception of eye coverings and diapers, the babies were treated nude. Total bilirubin was assessed during phototherapy at different intervals based on risk factors, gestational age, and days of life. The frequency of ECT before and after using Bilisphere 360 served as the main outcome measure. Days spent in the NICU for patients receiving intense phototherapy and the pace at which serum bilirubin declined were the secondary outcome indicators.

The study employed statistical analysis approaches to evaluate the impact of age, TSB, and thyroid-stimulating hormone (TSH) on neonatal jaundice. Specifically, the means and standard deviations of the jaundiced and non-jaundiced groups were compared. Additionally, an analysis was conducted on the relationship between TSB and a number of risk variables, including birth weight, labor duration, and blood group incompatibility. The prevalence of jaundice in neonates and its distribution across age groups and genders were presented using descriptive statistics. In order to compare means and find correlations between risk factors and TSB levels, inferential statistical techniques such as t-tests and ANOVA were used. The research complied with ethical guidelines and protected patient privacy. Statistical software was utilized for the analysis, and a significance threshold of $p < 0.05$ was established. .

Results

The prevalence of neonatal jaundice in Kirkuk city accounting for approximately half (50.70%) of the total 497 studied neonates.

Table 1: Prevalence of neonatal jaundice in the study

Studied neonates	No.	%
Neonatal Jaundice	252	50.70
No jaundice	245	49.30
Total	497	100

Table 2 presents the demographic characteristics of neonates in the study, with a specific focus on the comparison between those with neonatal jaundice and those with low to normal bilirubin levels. The distribution across age groups reveals that the prevalence of neonatal jaundice is notably higher in the 16-21 days age group at (42.86%), compared to the 1-7 days and 8-15 days groups, which stand at (26.59%) and (30.56%) respectively. While these differences are not statistically significant (P-value = 0.16), they provide valuable insights into the age-specific occurrence of jaundice. Sex-wise, the table indicates a marginal difference in prevalence between males and females, with (57.54%) of males and (42.46%) of females experiencing neonatal jaundice. Again, the (P-value of 0.22) suggests non-significance in this sex distribution.

Table 2: Demographic characteristics of neonates in the study

Demographic characteristics	Neonatal Jaundice		Low to normal jaundice		Total		P-value
Age groups (days)	No.	%	No.	%	No.	%	
1-7	67	26.59	110	44.9	177	35.61	0.16 (Non-significant)
8-15	77	30.56	49	20	126	25.35	

16-21	108	42.86	86	35.1	194	39.03	
Total	252	100	245	100	497	100	
Sex	No.	%	No.	%	No.	%	
Males	145	57.54	143	58.37	288	57.95	0.22 (Non-significant)
Females	107	42.46	102	41.63	209	42.05	
Total	252	100	245	10	497	100	

Table 3 delineates the correlation between neonatal jaundice and various risk factors, including ABO blood group incompatibility, Rh incompatibility, and delivery time. The data underscores statistically significant associations, with 94.84% of neonates experiencing jaundice in cases of ABO blood group incompatibility (p-value = 0.001) and 88.10% in instances of Rh incompatibility (p-value = 0.001). Moreover, the table reveals a noteworthy connection between term deliveries and neonatal jaundice, with 77.78% of term deliveries associated with jaundice compared to 87.76% in non-term deliveries (p-value = 0.001).

Table 3: Relation of neonatal jaundice blood group incompatibility and delivery time

Risk factors	**Neonatal Jaundice**		**No jaundice**		**Total**		**P-value**
ABO Blood group incompatibility	**No.**	**%**	**No.**	**%**	**No.**	**%**	
Yes	239	94.84	49	20	288	57.95	0.001 (Significant)
No	13	5.16	196	80	209	42.05	
Total	252	100	245	100	497	100	
Rh **incompatibility**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
Yes	222	88.10	77	31.43	288	57.95	0.001
No	30	11.90	168	68.57	209	42.05	
Total	252	100.00	245	100.00	497	100	
Delivery time	**No.**	**%**	**No.**	**%**	**No.**	**%**	
Term Delivery	196	77.78	215	87.76	411	82.7	0.001 (Significant)
Preterm Delivery	40	15.87	15	6.12	55	11.07	
Post Term Delivery	16	6.35	15	6.12	31	6.24	
Total	252	100	245	100	497	100	

The comparison of means between jaundiced and normal groups revealed significantly higher levels of Total Serum Bilirubin (TSB), Thyroid Stimulating Hormone (TSH), and lower age in the jaundiced group compared to the normal group (p-value = 0.001 for each variable), indicating substantial differences in these parameters. Specifically, the jaundiced group exhibited markedly elevated TSB levels (14.05 mg/dl vs. 2.72 mg/dl in the normal group), elevated TSH levels (20.56 mIU/L vs. 4.91 mIU/L in the normal group), and younger mean age (7.77 days vs. 10.32 days in the normal group). However, no significant difference in baby weight was observed

between the two groups (p-value = 0.17), with marginal variation in means for jaundiced (3.29 Kg) and normal (3.34 Kg) groups, indicating a similarity in this parameter.

Table 4: The comparison of some variable between jaundiced and normal groups

Variable	Studied neonates	No.	Mean	SD.	P-value
TSB (mg/dl)	Jaundice	252	14.05	1.86	0.001 (Significant)
	Normal	245	2.72	0.93	
TSH (mIU/L)	Jaundice	252	20.56	11.28	0.001 (Significant)
	Normal	245	4.91	2.34	
Age (days)	Jaundice	252	7.77	4.98	0.001 (Significant)
	Normal	245	10.32	9.50	
Birth Weight (Kg)	Jaundice	252	3.29	0.58	0.17 (Non-significant)
	Normal	245	3.34	0.59	

In the neonatal jaundice group (the comparison across different age groups demonstrated significant variations in Total Serum Bilirubin (TSB) and Thyroid Stimulating Hormone (TSH) levels but not in baby weight (p-values: TSB 0.016, TSH 0.001, Baby Weight 0.19). Specifically, for TSB, the 16-21-day age group displayed the highest mean (15.66 mg/dl), followed by 8-15 days (13.22 mg/dl) and 1-7 days (14.16 mg/dl), indicating a moderate increase as age progresses. Similarly, for TSH, the 8-15-day age group exhibited the highest mean (28.63 mIU/L), followed by 16-21 days (14.00 mIU/L) and 1-7 days (13.20 mIU/L), signifying a considerable elevation in TSH levels in the older age group. However, in terms of baby weight, although slight variations were observed, the means did not significantly differ between the age groups, suggesting a relatively consistent weight regardless of age within the neonatal jaundice population.

Table 5: Relation of TSB, TSH, and Baby Weight in Neonates with Jaundice with their age

Variable of neonates with jaundice	Age groups (days)	No.	Mean	SD.	P-value
TSB (mg/dl)	1-7	67	14.16	1.84	0.016 (Significant)
	8-15	77	13.22	1.52	
	16-21	108	15.66	1.85	
TSH (mIU/L)	1-7	67	13.20	11.90	0.001 (Significant)
	8-15	77	28.63	9.49	
	16-21	108	14.00	11.43	
Baby Weight (Kg)	1-7	67	3.11	0.56	0.19 (Non-significant)
	8-15	77	4.23	0.59	
	16-21	108	3.58	0.68	

Table 5 presents the relationship between Total Serum Bilirubin (TSB) levels and various risk factors among neonates with jaundice. The mean TSB levels significantly differ concerning blood group incompatibility, with compatible groups showing a mean TSB of 11.16 mg/dl, while incompatible groups exhibit substantially higher mean TSB at 20.67 mg/dl (p-value = 0.001). In terms of labor, preterm neonates display a mean TSB of 17.20 mg/dl, post-term neonates at 13.34

mg/dl, and term labor at a notably lower mean of 7.63 mg/dl (p-value = 0.001). Additionally, while birth weight between normal and low categories doesn't exhibit a significant difference in means, the trend within the study portrays slightly higher mean TSB in the low birth weight category (3.58 mg/dl) compared to the normal birth weight category (3.11 mg/dl) with a p-value of 0.19. These results emphasize the impact of blood group incompatibility, labor duration, and to some extent, birth weight on TSB levels among neonates with jaundice.

Table 5: Relation of TSB with different risk factors in Neonates with Jaundice

Variable		No.	TSB (mg/dl)		
			Mean	**SD.**	**P-value**
Blood group incompatibility	Compatible	239	11.16	1.84	0.001
	Incompatible	13	20.67	1.85	
Labor	Preterm	196	17.20	11.90	0.001
	Post Term	40	13.34	11.43	
	Term	16	7.63	9.49	
Birth weight	Normal	120	3.11	0.56	0.19
	Low	132	3.58	0.68	

The Bilisphere 360 phototherapy method exhibits a distinct advantage over Neonatal Exchange Transfusions in terms of total bilirubin decline rates, as illustrated in Table 6 and Figure 2. While both interventions show comparable total bilirubin levels on admission and 6 hours after admission, Bilisphere 360 proves significantly more effective in the critical 12 to 48 hours after admission, with a mean total bilirubin of 10.71 ± 1.01 mg/dl compared to 14.65 ± 1.71 mg/dl for Neonatal Exchange Transfusions (P-Value: 0.001).

Table 6: Bilirubin decline rate in both groups (neonatal exchange transfusions and Bilisphere 360)

Intervention Type	**No.**	Mean Total Bilirubin (mg/dl)			**P-Value**
		On admission	**6 hours after admission**	**12 to 48 hour after admission**	
Bilisphere 360	215	18.65 ± 2.11	16.98 ± 1.18	10.71 ± 1.01	0.001
Neonatal Exchange Transfusions	37	18.22 ± 1.99	17.13 ± 1.98	14.65 ± 1.71	0.01
P-Value		0.88	0.08	0.001	

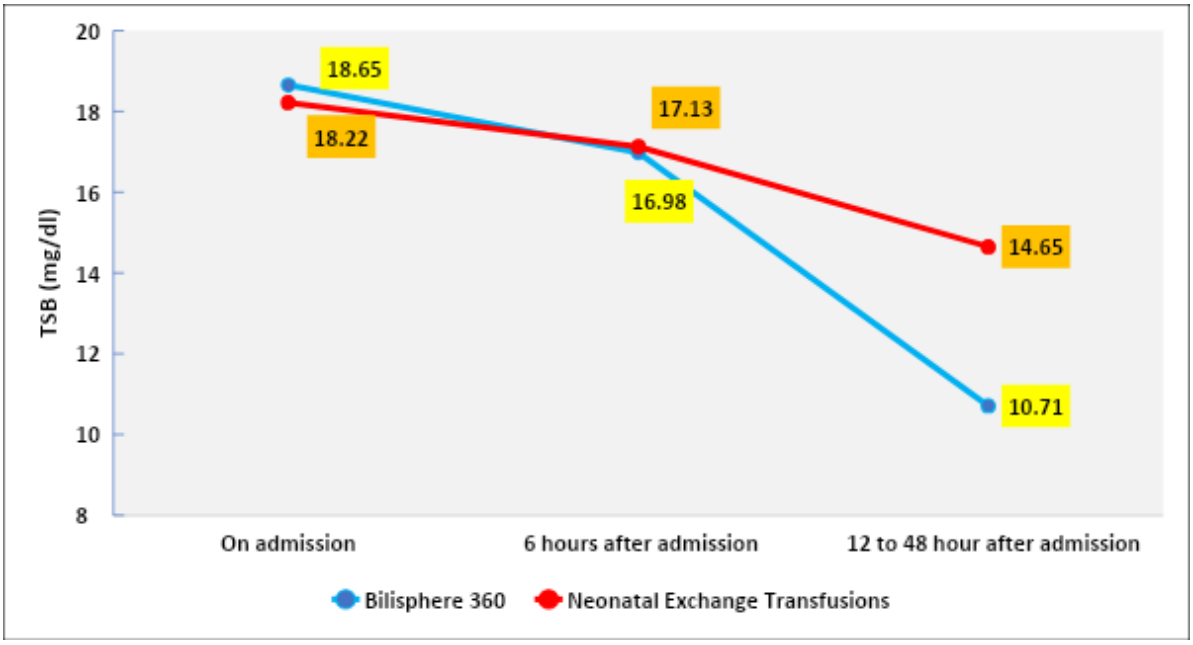

Figure 2: Bilirubin decline rate in both groups (neonatal exchange transfusions and Bilisphere 360).

Discussion

Notable is the prevalence of newborn jaundice found in Kirkuk city according to this study. A significant number of newborns were involved in the study; neonatal jaundice afflicted 50.70 percent of the 497 neonates in total. This finding suggests that, in the particular context of Kirkuk city, newborn jaundice is a somewhat common disorder. Nearly equivalent results were also observed in several additional research (1,2,3). A prevalence rate exceeding 50% indicates that newborn jaundice poses a serious health risk to this particular demographic. Such a high incidence could be caused by a number of variables, such as environmental influences, genetic predispositions, or medical procedures (4).

While the frequency of jaundice is higher in the 16–21 day age group (42.86 percent) than in the 1–7 day and 8–15 day age groups (26.59 and 30.56 percent, respectively), the differences do not reach statistical significance (P=0.16).

The sex distribution is not statistically significant (P=0.22), and the sex-wise analysis shows a minor difference, with 57.54 percent of males and 42.46 percent of females exhibiting jaundice. This outcome is consistent with several investigations. Males made up (59%) of the sample size in Baghdad (8). Additionally, there were more men (59%) than women (41%), in Al-Najaf (11). In Bahrain, 51.7% of the population was male and 48.3% was female (12). Additionally, an Ethiopian study revealed that male sex (58.4%) and female (41.6 percent). 18

Blood type incompatibility and jaundice are significantly correlated; in cases involving incompatibility, 94.84 percent of cases had jaundice, compared to 5.16 percent without (P=0.001). This emphasizes how important blood group matching is to the health of newborns.

Additionally, a statistically significant relationship was found between the time of delivery and the incidence of neonatal jaundice (P=0.001). Term deliveries had a lower rate of neonatal jaundice (77.78%) than preterm (15.87%) and postterm (6.35%) deliveries. In terms of gestational age, full term newborns (66.7%) were the most often occurring instances, followed

by preterm babies (33.3%), with no discernible difference. This is consistent with prior research. In a research on the risk factors for newborn jaundice conducted in Baghdad, 75% of the sample overall was term, meaning that the remaining 25% was pre-term (8). A study conducted in the province of Al-Najaf revealed that the percent of newborn jaundice rate increased with gestational age, with the gestational age group > 36 weeks (60.4 percent) having a higher rate than the group = < 35 weeks (39.6 percent). However, there was no significant difference in the TSB and study parameter levels between the two groups based on gestational age (11). A study conducted in Kirkuk City revealed that 22.8 percent of jaundiced newborns were preterm and 77.1 percent were term19. In Mosul, term birth rates are 82% while preterm birth rates are 18%. A cross-sectional study conducted in Bahrain on infants with indirect hyperbilirubinemia revealed that 21.8% of jaundiced neonates were preterm and 78.2 percent were term (12). According to a Northern Ethiopian study, 48.3 percent of cases were term and 38.3 percent were preterm (13).

In the present investigation, subjects with normal weight (66.7 percent) accounted for the high TSB level with no discernible variation. Neonatal weight (mean ± SD) is 2.698 kg ±. (693 g). Our study's outcome was confirmed by numerous other investigations. Upon admission, the average weight of a newborn in Baghdad was (2.922 kg ± 493 gm). There was a marginally positive but statistically insignificant relationship between the newborn's weight at admission and total serum bilirubin (r = 0.133, n = 160, P =.095). (11). According to a study conducted in Mosul, Iraq, the average newborn weight was 2.674 kg ± 570.35 mg, with normal weight accounting for 63% of the total and low body weight accounting for 34%. (10). According to an Indian survey, the average body weight was (2.949 kg) 20.

Total Serum Bilirubin (TSB), Thyroid Stimulating Hormone (TSH), and age were considerably greater in the jaundiced group than in the normal group, suggesting significant variations in these parameters. Research has looked into the connection between thyroid function and newborn jaundice. Some studies indicate a connection between thyroid disease and newborn jaundice, albeit this is not a general finding. Increased TSH levels in newborns with jaundice may be a sign of underlying thyroid problems or malfunction, though different studies may find different associations with these values (14-16). Total Serum Bilirubin (TSB) and Thyroid Stimulating Hormone (TSH) levels varied dramatically amongst neonatal jaundice patients according to age groups, with TSB levels rising somewhat with age and TSH levels rising noticeably with age.

In terms of baby weight, although slight variations were observed, the means did not significantly differ between the age groups, suggesting a relatively consistent weight regardless of age within the neonatal jaundice population. Based on the recommendations of American Academy of Pediatrics (AAP) predischarge Total Serum Bilirubin (TSB) measurements and /or assessment of clinical risk factors should be carried out for every newborn before discharge (10,17,18). In the present study, there is significant correlation between Total bilirubin and TSH in group I and between Total bilirubin and TSH which was similar with the previous studies. (16,18).

The provided data show significant differences in mean Total Serum Bilirubin (TSB) levels depending on blood group incompatibility, length of labor, and birth weight, which is consistent with documented trends in neonatal jaundice research. The findings confirms previous research highlighting the significance of ABO and Rh incompatibility as risk factors for jaundice by showing elevated mean TSB levels in infants with blood group incompatibility. Furthermore, the observed variations in TSB levels between labor categories (preterm, post-term, and term) are consistent with the established effect of gestational age on bilirubin metabolism. While not

statistically significant, the slightly higher mean TSB in low birth weight infants is consistent with a trend observed in previous research (19,20).

While jaundice in infants is frequent and usually harmless, the central nervous system of the neonate may be harmed by extremely high TSB levels. If the newborn's jaundice is either at risk of increasing to potentially dangerous levels or has already reached them, phototherapy and/or ECT continue to be the mainstays of treatment. 10 Compared to ECT, phototherapy is less expensive and safer. Furthermore, ECT necessitates a higher degree of complexity in care as well as specialized training. It has been demonstrated that high intensity phototherapy works well to quickly lower TSB levels and lessen the requirement for ECT. A brand-new neonatal phototherapy tool called Bilisphere 360 is made to optimize treatment area coverage and irradiance (21). Table 6 and Figure 1 show that the Bilisphere 360 approach clearly outperforms Neonatal Exchange Transfusions in terms of total bilirubin reduction rates. While total bilirubin levels at admission and six hours later are similar for both interventions, Bilisphere 360 is much more successful in the crucial 12-48-hour period following admission, showing a mean total bilirubin of 10.71 ± 1.01 mg/dl as opposed to 14.65 ± 1.71 mg/dl for Neonatal Exchange Transfusions. The outcomes are consistent with earlier studies showing that high intensity phototherapy may be a more effective way to regulate a newborn's serum bilirubin levels than traditional techniques (20). There was no statistically significant difference in the bilirubin drop rate between the newborn exchange transfusion group and the Bilisphere group from admission to six hours. On the other hand, it was clear that there was a statistically significant difference between the two groups in terms of the bilirubin drop rate from 6 hours to 48 hours. This could be explained by the large proportion of cases receiving ECT within the first six hours of therapy when receiving newborn exchange transfusions. After examining the effects of Bilisphere 360 intense phototherapy on TSB blood levels in a jaundiced newborn over the course of 20 hours of treatment, Shehadeh et al. (22) came to the conclusion that the device can reduce TSB levels by an average of 15%, 26%, and 37% at hours 4, 10, and 20, respectively. According to recent research, the TSB levels decreased by 23% after 6 hours of high intensity phototherapy. This rate of reduction was nearly identical to the current study's 24.9 percent after 6 hours (23,24,25). Bilisphere 360 phototherapy reduces hospital stays, which has a positive impact on cost-effectiveness because more patients can be treated with fewer phototherapy units due to the shorter treatment period. Secondly, a shorter hospital stay could result from reducing the period of phototherapy. Additionally, there would be a significant decrease in time spent apart from the mother and less disruption of nursing. When compared to traditional phototherapy, prior research has indicated that intensive phototherapy devices exhibit a faster rate of bilirubin drop and a shorter duration of action (27).

In summary, the study found that a number of factors, including blood group incompatibility, length of labor, and birth weight, significantly influenced the total serum bilirubin (TSB) levels among jaundiced neonates. Additionally, the results indicate that the Bilisphere 360 method is more effective at reducing TSB levels than Neonatal Exchange Transfusions. These findings imply that the Bilisphere 360 approach should be taken into account in clinical practices and guidelines as a potentially more successful technique for treating infant jaundice. To evaluate and expand on these findings and provide a more comprehensive understanding of the best therapies for managing newborn jaundice, additional research and clinical trials are advised.

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