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Rebound Hyperbilirubinemia in Neonates after Phototherapy and Factors Affecting It

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Abstract

Aims and Objectives:

1. To determine the incidence of significant bilirubin rebound 24 hours after stopping phototherapy in neonates with hyperbilirubinemia.

2. To correlate the significant bilirubin rebound with prematurity, gestational age, birth weight and mode of feeding.

Study Design: *This was a prospective cohort study done in the department of paediatrics a tertiary care hospital in a metropolitan city.*

Materials and Methods: *The study was approved by the Institutional ethical committee. The neonates in neonatal intensive care units and neonatal wards who were clinically icteric were enrolled in the study as per the given criteria. It was a prospective, cohort study conducted on neonates having hyperbilirubinemia requiring phototherapy or neonates requiring readmission for phototherapy.*

Results: *All 300 babies had icterus. Out of the studied cases 148 (49.3%) were females and 152 (50.7%) were males with female: male ratio of 1:1.02. The mean birth weight was 2.43 +/- 1.12 kg and mean gestational age was 36.5+/- 5.1 weeks. Most of the babies had birth weight more than 2.5 kg (64%) followed by birth weight between 1.5-2.5 kg (25%) and 1-1.5 kg (11%). There was no neonate with a birth weight less than 1 kg. Majority of the neonates enrolled in this study were full term (67.4%) followed by gestational age less than 35 weeks (18.3%) and between 35-37 weeks (14.3%). 249 babies were receiving direct breast feeding while 39 babies were kept till by mouth and 12 babies were being fed through orogastric tube. All babies received either single surface phototherapy (56%), double surface phototherapy (38%) or intensive phototherapy (6%) depending upon serum bilirubin levels. The mean bilirubin levels at termination of phototherapy were 13.4 +/- 1.5mg/dl and 11.5+/-4.6 mg/dl in term and preterm neonates respectively. While the mean rebound bilirubin levels after 24 hours of terminating phototherapy were 12.1+/- 2.08 mg/dl and 11.0+/-4.1 mg/dl in term and preterm neonates respectively. The difference in both bilirubin levels were 1.6 +/- 0.68 mg/dl in term and 1.7+/- 2.6 mg/dl in preterm newborns. Incidence of rebound was found to be 11%. The most common cause of hyperbilirubinemia was found to be physiological jaundice (64.7%) followed by prematurity (27%), polycythemia (3.7%) and sepsis (3.3%). 4 cases (1.3%) were found to be having pathological jaundice secondary to ABO incompatibility. Rebound hyperbilirubinemia was seen in 14 preterm neonates (4.6%), 5 neonates with physiological jaundice (1.7%), 6 neonates with polycythemia, ABO incompatibility and sepsis*

each (2% each). Neonates with prematurity, physiological jaundice, polycythemia, very low birth weight, gestational age less than 35 weeks, those kept till by mouth, those who received double surface or intensive phototherapy and sepsis were found to be statistically significantly associated with significant bilirubin rebound. ABO incompatibility and low birth weight (1.5-2.5 kg) were not found to be statistically significantly associated with significant bilirubin rebound. Gestational age of 37 weeks or more and direct breast feeding were Factors associated with statistically significant decreased risk of developing rebound hyperbilirubinemia.

Conclusion: *Our study focused on the study of significant hyperbilirubinemia after termination of phototherapy and factors affecting it. We found that rebound of bilirubin levels was of significant importance in preterm neonates with gestational age less than 35 weeks, in very low birth weight babies and neonates with polycythemia and sepsis. Babies who have been treated with intensive phototherapy were found to be prone foe developing rebound hyperbilirubinemia while breast fed babies and neonates who had physiological jaundice were found to have less likelihood of developing significant bilirubin rebound.*

Keyword: *Neonatal hyperbilirubinemia, significant bilirubin rebound, Risk factors, phototherapy.*

Introduction

Jaundice is a common and one of the most vexing problems that occurs in the newborn [1]. Jaundice is observed during the first week of life in approximately 60% of term infants and 80% of preterm infants [2]. The normal adult serum bilirubin level is less than 1 mg/dI [3]. While in newborns chemical hyperbilirubinemia, which is defined as Total serum bilirubin (TSB) levels of 2.0 mg/dl or more is virtually universal during the first week of life [4]. Most of the adults appear jaundiced when serum bilirubin exceeds 2 mg/dl however neonates appear jaundiced when serum bilirubin is greater than 7mg/dl. A serum bilirubin level greater than 15 mg/d1 is found in 3% of normal term babies'".

Bilirubin is derived front the breakdown of heme-containing proteins in the reticuloendolhelial system. The daily production of bilirubin in a normal newborn is 6 to 10 mg/kg/day as opposed to 3 to 4 mg/kg/day in an adult. Jaundice may be present at birth or may appear during neonatal period depending on etiology. Jaundice becomes apparent in cephalocaudal manner.

Although bilirubin may have physiological role as an antioxidant but elevated unconjugated bilirubin is neurotoxic. The term Bilirubin encephalopathy ie Kernicterus represents clinical and pathologic abnormalities resulting from deposition of unconjugated bilirubin in the basal ganglion and brainstem. The definite level at which bilirubin can cause brain damage has not yet been exactly determined. Neurologic injury including kernicterus occurs at lower level in preterm babies, in presence of asphyxia, intraventricular hemorrhage, hemolysis, metabolic acidosis, hypoproteinemia, septecimia or drugs that displace bilirubin from albumin. Clinical manifestations can range from subtle behavioral changes such as lethargy and irritability to overt seizures, hearing defects, choreo-athetoid movements, cerebral palsy, mental retardation and even death [5,6].

A rise of 12 mg/d1 in serum bilirubin is in physiologic range in term neonates. In preterms, peak may be 10-12 mg/dl on day 5 Possibly rising greater than 15 mg/dl without any specific abnormality in bilirubin metabolism.

Detection of jaundice is commonly done by-

1. Physical examination this is not a reliable measure cf hyperbilirubinemia. Dermal pressure may reveal anatomic progression of jaundice. (Modified krammer's rule) but it is an unsafe indicator to evaluate severe hyperbilirubinemia [7, 8].
2. Transcutaneous bilirubinometer- This is noninvasive safe and can correlate with serurn bilirubin levels and may be used to screen infants.
3. Total serum bilirubin (TSB) estimation:- most frequently performed test. it is a reliable rnethod to predict dangerous neonatal hyperbilirubinemia and its toxic

effects [9]. But estimation of single TSB level is inadequate and will lead to conflicting results hence repeated sampling is required.

Regardless of the cause, the goal of therapy is to prevent indirect-reacting bilirubin related neurotoxicity. Phototherapy and exchange transf-usion remain the primary treatment modalities used to keep the TSB below the pathologic range. Phototherapy is used worldwide for neonatal jaundice. It is convenient easy to use, cost effective and noninvasive method for managing indirect hyperbilirubinemia. Bilirubin absorbs light maximally in blue range (420-470) nanometers. Broad spectrum white, blue, and special narrow spectrum (super) blue lights have been effective in reducing bilirubin levels. One of the major product from phototherapy is unconjugated configurational isomer which is excreted in bile without conjugation. The other major product from phototherapy is lumirubin which is an irreversible structural isomer excreted by kidneys. The use of phototherapy has decreased the need for exchange transfusion in term and preterm infants with hemolytic and non-hemolytic jaundice.

Underlying alteration in bilirubin production and excretion may persist and can cause bilirubin rebound after stopping phototherapy [10]. A rebound in the total serum bilirubin level of 1 to 2 mg/dl and occasionally more can occur after phototherapy is discontinued [11,12]. Factors reported to influence incidence of serum bilirubin rebound (SBR) include proportion of premature neonates and hemolytic jaundice. Severity and onset of hyperbilirubinernia, mode of feeding and presence of other risk factors like glucose6-phosphate dehydrogenase (G6PD) deficiency and sepsis [13].

This study aim to determine the incidence of post-phototherapy rebound of bilirubin needing reinstitution of phototherapy and factors affecting the rebound.

Materials and Methods

Study Design:-The present study was conducted prospectively in department of Pediatrics of a tertiary care hospital in a metropolitan city over a period of 2 years. The study group consisted Of 300 Inborn neonates needing phototherapy for hyperbilirubinemia or requiring readmission for initiation of phototherapy.

Inclusion Criteria- 1. Neonates with hyperbilirubinemia requiring phototherapy.

Exclusion Criteria: 1. Neonates with hyperbilirubinemia under exchange transfusion range. (2) Neonates with obstructive jaundice. (3) Neonates with jaundice secondary to congenital hepatic enzymes deficiency (Dubin-johnson, Rotor, Crigler–Najjar).

Approval of the Institutional Ethics Committee was obtained. Neonates in Neonatal Intensive Care units and in post natal wards, who were clinically icteric, were enrolled in the study. They were investigated for hyperbilirubinemia and were treated by phototherapy in accordance with NICU protocols. Total serum bilirubin (TSB) was done for every neonate after obtaining informed verbal consent from parents. The rebound of bilirubin was checked after 24 hours of stopping phototherapy and this was correlated with various factors which Included prematurity, hemolytic jaundice, severity and onset of hyperbilirub-inemia, mode of feeding and presence of other risk factors like glucose 6 phosphate dehydrogenase (G6PD) deficiency, and sepsis. Data was collected in a pre-decided proforma. Details were obtained from direct questioning of the concerned mother and examination of the newborn. Maternal variables included obstetric status. gestational age, any significant obstetric history and drug history were collected from maternal case file.

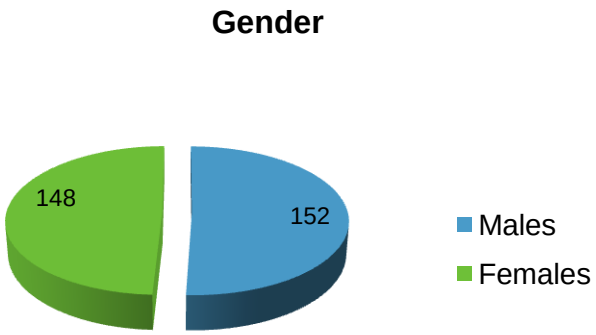
Different modes of feeding the babies Were receiving were noted down and categorized as nil by mouth (NBM), Gauge feeding (Oro-gastric tube feeding-OGT) and Direct breast milk (DBM). A detailed examination of the neonate was carried out which included temperature. Cry, tone activity

(CTA), Capillary refilling time (CRT), pallor, gestational age (determined by new ballard score), weight and head circumference. Head to toe examination was done and features such as cephalhematoma and caput succedanium were noted. All patients underwent detailed systemic examination. Clinical assessment of severity of jaundice was done by modified Kramer index. Phototherapy was started in accordance with the guidelines given by American Academy Of Paediatrics. Phototherapy was stopped in accordance with the protocols followed in NICU. Repeat bilirubin was estimated after 24 hours of stopping phototherapy. Significant bilirubin rebound (SBR) is defined as post-phototherapy bilirubin level needing reinstitution of phototherapy). In this study charts used were recommended by the American Academy of Pediatrics but recommenced phototherapy if the rebound bilirubin level was above the value which was appropriate for the patient's age and risk factors. This is of importance as the accepted level for reinstitution of phototherapy cannot be assumed to be similar for birth hospitalization or readmission groups, depending on the age of the patients.

Additional appropriate investigations were done in neonates to identify the cause of hyperbiliru-binemia like coombs (direct and indirect) in cases of ABO incompatibility, CBC,CRP and CSF examination in neonates with suspected sepsis etc. The data was tabulated and presented in an excel sheet and analyzed statistically using SPSS 17 software and 13' value was calculated by Fisher's exact test for 22 contingency table and a value of <0.05 was considered statistically significant.

Results

In our study 300 newborns were enrolled and all had icterus clinically. All newborns were divided into four groups according to birth weight and in three groups according to gestational age. Out of 300 newborns, 148 (49.3%) were females and 152 (50.7%) were males female: male ratio being 1:1.02. The mean birth weight in our study was 2.43± 1.12 kg with mean gestational age being 36.5 ±5.1 weeks.



Graph 1 Gender Distribution of the studied cases.

All newborns were divided in four groups according to birth weight. Mean birth weight of the neonates was 2.43 kg. Group P consisted of neonates having birth weight less than 1000 gms, group Q with birth weight 1000-1500 gms, group R with birth weight 1500- 2500 gms and group S having birth weight greater than 2500 gms. There were no patients in group P, 33 patients (11%) in group Q, 75 patients (25%) in group R and 192 patients (64%) in group S.

Table 1: Birth weight distribution of the studied cases

Birth Weight	Group	No	Percentage
< 1000 gms	P	0	0%
1000-1500 gms	Q	33	11%
1500-2500 gms	R	75	25%
> 2500 gms	S	192	64%
Total		300	100%

All newborns were also categorized on the basis of gestational age. There were three groups. Group A consisted of neonates with gestational age less than 35 weeks, group B consisted of neonates with gestational age 35-37 weeks. and group C had neonates of gestational age greater than 37 weeks. The total number of patients in group A were 55 (18.3%), group B were 43 (14.3%) and group C were 202 (67.4%).

Table 2 : Distribution of the cases according to gestational age.

Gestational Age	Group	No	Percentage
< 35 weeks	A	55	18.3%
35-37 weeks	B	43	14.3%
> 37 weeks	C	202	67.4%
Total		300	100%

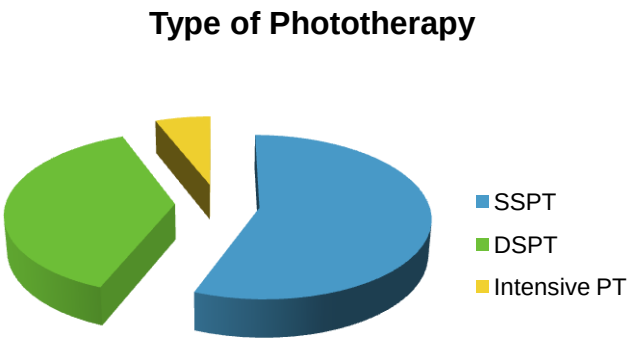
Newborns were on different modes of feeding like Direct breast milk (DBM), gavage feeding (Oro gastric tube feeding -OGT) and parenteral nutrition (Nil by mouth-NBM) during study period. Total number of neonates on DBM were 249 (83%), OGT were 12 (4%).and NBM were 39(13%).

Table 3 : Mode of feeding in study sample.

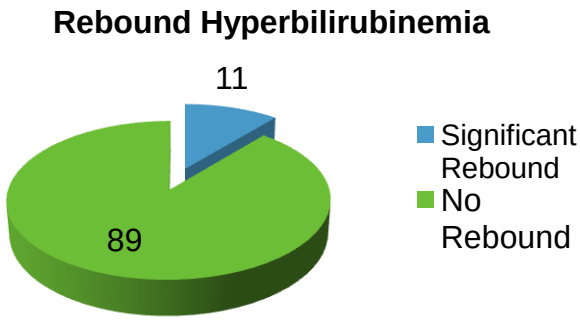
Mode Of Feeding	No	Percentage
Direct Breast Feeding	249	83%
Oro-Gastric Feeding	12	4%
Nil By Mouth	39	13%
Total	300	100%

All neonates were started on conventional phototherapy depending upon their TSB levels. The numbers of neonates on SSPT were 170 (56%), on DSPT were 113(38%) and on intensive phototherapy were 17 (6%).

Graph 2: Type of phototherapy in studied cases.

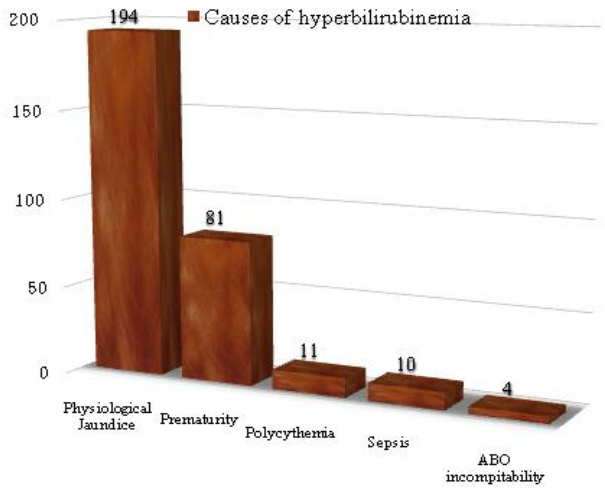


The mean bilirubin levels at termination of phototherapy were 13.4 +/- 1.5 mg/dl and 11.5 +/- 4.6 mg/dl in term and preterm neonates respectively. While the mean rebound bilirubin levels after 24 hours of terminating phototherapy were 12.1 +/- 2.08 mg/dl and 11.0 +/- 4.1 mg/dl in term and preterm neonates respectively. The difference in both bilirubin levels were 1.6 +/- 0.68 mg/dl in term and 1.7 +/- 2.6 mg/dl in preterm newborns. Significant bilirubin rebound (SBR) was found in 33 neonates with the incidence of bilirubin rebound thus being 11 % in our study.



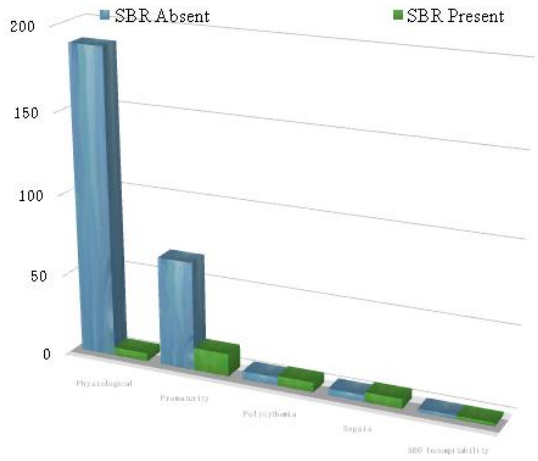
Graph 3 Incidence of rebound hyperbilirubinemia in studied cases

The relationship of bilirubin rebound was studied with parameters that included birth weight, gestational age. causes of rebound hyperbilirubinemia and mode of feeding. During the study. the most common cause of hyperbilirubinemia was physiological hyperbilirubinemia which was seen in 194 cases (64.7%) followed by 81 cases (27%) of prematurity, 11 cases (3.7%) of polycythemia. 10 cases (3.3%) of sepsis and 4 cases(1.3%)of ABO incompatibility.



Graph 4: Causes of hyperbilirubinemia in studied cases

Out of these causes, rebound hyperbilirubinemia was seen in 14 preterm neonates(4.6%) ; followed by 5 in physiological hyperbilirubinemia (1.7%), 6 polycythemia cases (2%), 6 cases of sepsis (2%) and 2 cases of ABO incompatibility (0.7%).



Graph 5 Causes of Rebound Hyperbilirubinemia

Table 4 : Percentage distribution of significant bilirubin rebound.

Causes Of Hyperbillirubinemia	No Of Cases with SBR	Percentage
Prematurity	14	42.4%
Polycythemia	6	18.2%
Sepsis	6	18.2%
Physiological	5	15.2%
ABO incompatibility	2	6%
Total	33	100%

Table 5 : Comparison of significant bilirubin rebound and prematurity.

Etiology	SBR Present	SBR Absent	Sum
Prematurity	14	67	81
Others	19	200	219
Total	33	267	300

Fisher's exact test was applied to above 2x2 table in which prematurity was compared to the other causes of SBR. It was found that the comparison was statistically significant with the two tailed P.-value being 0.039; which was suggestive of an increased likelihood of premature babies developing rebound hyperbilirubinemia.

Table 6 : Comparison of significant bilirubin rebound and physiological jaundice.

Etiology	SBR Present	SBR Absent	Sum
Physiological Jaundice	5	189	194
Others	18	78	96
Total	33	267	300

Applying Fisher's exact test to above 2x2 contingency tab, the two tailed P-value was 0.0001 which is extremely statistically significant. This suggests that babies developing physiological jaundice had very less probability of SBR.

Table 7 : Comparison of significant bilirubin rebound and polycythemia.

Etiology	SBR Present	SBR Absent	Sum
Polycythemia	6	5	11
Others	27	262	289
Total	33	267	300

On apply, Fisher's exact test to above 2x2 contingency table, the two tailed P-value was 0.0004 this means that is result is highly statistically significant. This suggests that in newborns having polycythemia there is more probability of developing SBR.

Table 8 : Comparison of significant bilirubin rebound and sepsis

Etiology	SBR Present	SBR Absent	Sum
Sepsis	6	4	10
Others	27	263	290
Total	33	267	300

Applying Fisher's exact test to above table. the two tailed P-value was 0.0002 which means that result is highly statistically significant. This

suggests that sepsis in neonates increase likelihood of developing rebound hyperbilirub-inemia.

Table 9 : Comparison of significant bilirubin rebound and ABO incompitability.

Etiology	SBR Present	SBR Absent	Sum
ABO incompatibility	2	2	4
Others	31	265	296
Total	33	267	300

Applying Fisher's exact test to above table. the two tailed P-value was 0.06 which means that result is not statistically significant.

Among four groups of birth weight P,Q,R and S, SBR was more common in group Q which accounted for 42.4% (14) of the cases. Group R had 12 cases (36.4%) and group S had 7 cases (21.2%).

Graph 6 : SBR amongst different groups of birth weights

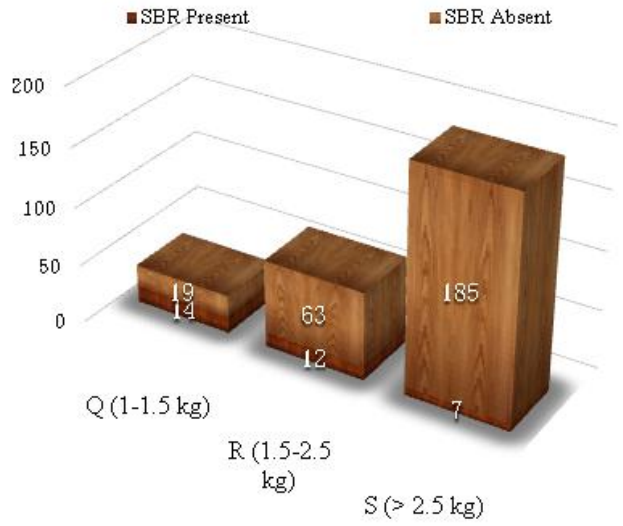


Table 10 : patient with SBR comparison between group Q (VLBW) and the rest.

Group	SBR Present	SBR Absent	Sum
Q (1-1.5 kg)	14	19	33
Others	19	248	267
Total	33	267	300

On applying the Fisher's exact test to the above 2x2 contingency table, the two tailed P- value was .0001 which is highly significant statistically. This suggests that the patients under very low birth weight have an increased probability of developing SBR when compared to patients with normal and low birth weight.

Table 11: patient with SBR comparison between group R (LBW) and the rest.

Group	SBR Present	SBR Absent	Sum
R (1.5-2.5 kg)	12	63	75
Others	21	204	225
Total	33	267	300

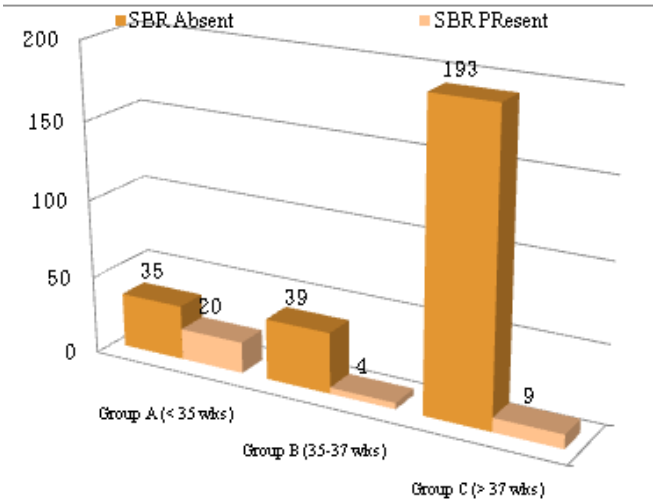
On applying the Fisher's exact test to the above 2x2 contingency table, the two tailed P-value was 0.138 wt. is not significant statistically. This suggests that the patients under low birth weight do not have an increased probability of developing SBR as compared to patients with normal and very low birth weight

Table 12: patient with SBR comparison between group S (Normal birth weight) and the rest

Group	SBR Present	SBR Absent	Sum
S (> 2.5 kg)	7	185	192
Others	26	82	108
Total	33	267	300

On applying the Fisher's exact test to the above 2x2 contingency table the P-Value was not significant.

Patients with SBR —Comparison among patients with different gestational ago - Among 55 cases of group A 20 cases(60.6%) had SBR, 43 cases of group B, 4 cases (12.1%) had SBR: and 202 cases of group C , 9 cases (27.3%) had SBR.



Graph 7: SBR amongst different groups of gestational age.

Table 13: Patient with SBR – Comparison between neonates in group A (< 35 weeks) and the rest

Group	SBR Present	SBR Absent	Sum
Group B (<35weeks)	20	35	56
Others	13	232	244
Total	33	267	300

On applying Fishers exact test on above 2x2 contingency table; the two tail. P-value was 0.0001 which is statistically highly significant. This means that gestational age <35 weeks have more likelihood of developing rebound hyperbilirubinemia.

Table 14: Patient with SBR – Comparison between neonates in group B (35-37 weeks) and the rest.

Group	SBR Present	SBR Absent	Sum
Group B (35-37 weeks)	4	39	43
Others	29	228	257
Total	33	267	300

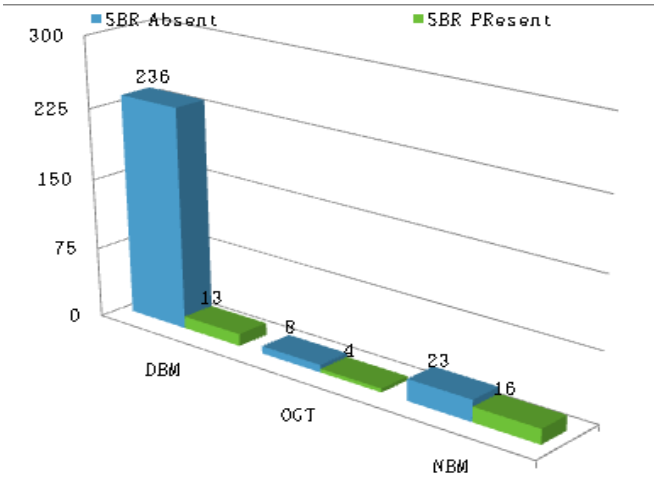
On applying Fishers exact test on above 2x2 contingency table; the two tail. P-value was found to be statistically highly significant.

Table 15: Patient with SBR – Comparison between neonates in group B (35-37 weeks) and the rest.

Group	SBR Present	SBR Absent	Sum
Group C (> 37 weeks)	9	193	201
Others	24	74	99
Total	33	267	300

Applying Fisher's exact test to above 2x2 contingency table: the two tailed P-value was 0.0001 which is statistically highly significant. This suggests that in term and post term neonates (>37 weeks) there is less probability of SBR.

Among 39 patients who received parenteral nutrition (NBM), 16 cases (48.5%) had SBR: out of 249 cases who were on DBM, 13 cases (39.4%) had SBR while 4 cases(12.1%) among 12 patients who were on OGT feed, had SBR.



Graph 8 - Patients with SBR- Comparison amongst patients subjected to different modes of feeding.

Table 16: Patients with SBR, NBM Vs Enteral Feeds.

Mode Of Feeding	SBR Present	SBR Absent	Sum
NBM	16	23	39
Others	17	244	261
Total	33	267	300

Application of Fisher, test to above contingency table, results in two-tailed P-value as 0.0001 this means that result is statistically significant. And hypothesis states that if neonate is on parenteral nutrition there are more chances of SBR.

Table 17: Patients with SBR, DBM Vs Other modes (NBM+ OGT)

Mode Of Feeding	SBR Present	SBR Absent	Sum
DBM	13	236	249
Others	20	31	51
Total	33	267	300

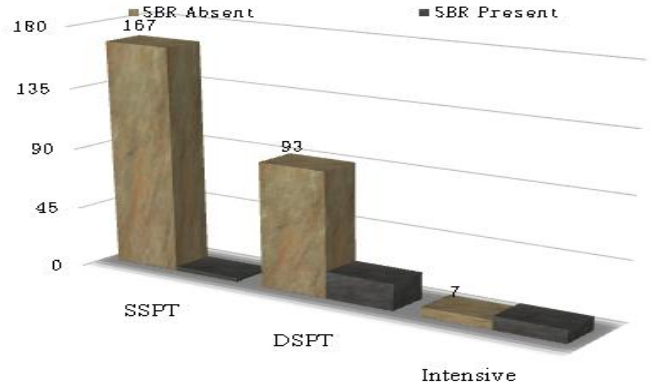
Applying Fisher's exact test to above contingency table. the twc-tailec P-value was 0.0001 this means that result is statistically significant This suggests that newborns who were on DBNI had less likelihood of developing SBR.

Table 18: Patients with OGT Vs Other modes (NBM+ DBM).

Mode Of Feeding	SBR Present	SBR Absent	Sum
OGT	4	8	12
Others	29	259	288
Total	33	267	300

Applying Fisher's exact test to above contingency table. the two-tailed P-value was 0.0001 this means that result is statistically significant.

Among 17 cases of intensive phototherapy 30.3./o (10 cases) had SBR, out of 113 cases on DSPT 60.6%(20 cases)had SBR and out of 170 cases of SSPT 9.1%(3 cases) had SBR.



Graph 9 : Patients with SBR- Comparison amongst patients subjected to different types of conventional phototherapy.

Table 19: Type of phototherapy and its relation with SBR.

Type Of Phototherapy	SBR Present	SBR Absent	Sum
Intensive + DSPT	30	100	130
Others (SSPT)	3	167	170
Total	33	267	300

Applying fisher's exact test to above contingency table reveal two-tailed P-value 0.0001 which is extremely statistically significant. This signifies that probability of SBR is more when newborn is on intensive phototherapy and DSPT as compared to only on SSPT.

Discussion

Neonatal hyperbilirubinemia is an extremely common phenomenon In neonatal practice. Management of neonatal hyperbilirubinemia is a subject of considerable discussion because of jaundice-associated neurotoxicity. Depending on Total Serum bilirubin (TSB) level, treatment modalities vary in term and preterm neonates. Phototherapy Is the most common and widely used treatment modality for neonatal hyperbilirubinemia. It is a relatively simple and safe method of treatment with minimal side effects. In the absence of hemolytic disease in healthy term infants, the cessation of phototherapy results in mild rebound in bilirubin levels. However, in the presence of hemolytic disease or sick or low birth weight infants, the rebound depends not only on effectiveness of phototherapy but also on the severity of the bilirubin production.

Underlying alteration in bilirubin production and excretion may persist and cause bilirubin rebound after stopping phototherapy. The need of measurement of bilirubin rebound after stopping phototherapy has been addressed previously by many observational studies. Unfortunately, no internationally accepted definition of post-phototherapy bilirubin rebound exists. In our study Significant bilirubin rebound (SBR) was defined as post-phototherapy bilirubin level

needing reinstitution of phototherapy according to AAP guidelines.

Our study focussed on finding out incidence of rebound hyperbilirubinemia and different factors affecting it. In this study there were 300 neonates out of which 33 (11%) had SBR. Among these 300 cases202 cases (37.4%) were term neonates and 98cases (32.6%) were preterm neonates.AII neonates were divided into groups on the basis of birth weight, gestational age, types of phototherapy and mode of feeding received by neonates

The study conducted by Lazar et al on neonates with non Hemolytic hyperbilirubinemia it was found that there was no need for reinstitution of phototherapy: neither were there any complications with bilirubin rebound. The basic difference of this study from our study was that this study didn't take into consideration factors like hemolytic hyperbilirubinemia, sepsis, polycythemia and mode of feeding in relation to bilirubin rebound. The fact that all these factors are associated with an increased risk of hyperbilirubinemia was not into consideration [14].

The study conducted by Yetman et al in 1998 concluded that infants who are otherwise healthy don't require follow-up for rebound bilirubin levels. In their study they didn't find the difference between mean TSB levels at discontinuation of phototherapy and mean TSB at rebound. Moreover, there were no statistically significant differences among infants in smaller weight categories, regardless of coomb's test result. In our study out of 33 cases (11%) of rebound hyperbilirubinemia 14 were preterm neonates (42.4%), which was statistically significant. Also, neonates with birth weight 1-1.5kg (VLBW) had incidence of rebound 42.4% which was also statistically significant [15]. Results of our study on healthy term neonates on breast feeding without any other morbidities agrees with Tolman et al that neonates developing physiological jaundice had loss likelihood of SBR and did not require follow up. Hence in our study there was an association between preterm status, low birth weight and rebound of bilirubin.

M.T Del Vecchio et al In their study in 1999 on terms and near terms, weighing >1800 grams had majority of the newborns on breast feeding. In this study only ono neonate out of 48 neonates had rebound. The average bilirubin at discontinuation of phototherapy was 15.1 mg/dl and average bilirubin level at rebound was 14.9 mg/dl in 47 neonates [16]. The major difference between this study and our study was that our study included high risk infants like premature, those with ABO incompatibility, Premature and low birth weight babies.

Al-saedi SA et al studied rebound bilirubin levels within 24 hours of discontinuing phototherapy in term neonates. They took 301 infants with female: male ratio being 0.8:1. Mean birth weight was 3200.0 grams. Mean gestational age was 39.4 +/- 1.4 weeks. Mean TSB at termination of phototherapy 193 +/- 46 micromole/lit and at follow up (rebound) was 188 +/- 45 micromole/ litre irrespective of direct coombs test (OCT). This difference was significant. But the difference between the mean TSB levels and follow up TSB level in patients with positive DCT was insignificant they measured rebound levels at 8.3 +/- 5.3 hours. However, in our study among 300 neonates female male ratio was 1:1.02, mean birth weight was 2430 +/- 1120 grams: mean gestational age was36.5 +/- 5.1 weeks. In term neonates mean TSB at termination of phototherapy was 13.4+/-1.5 mg/dl. Mean TSB levels of rebound were 12.1 +/- 2.08 mg/dl and rebound levels were checked after 24 hours of terminating phototherapy. Our study agrees with the finding of the Al-saedi SA et al that term neonates having physiological hyperbilirubinemia irrespective of DCT and had less likelihood of developing significant hyperbilirubinemia [17].

Our results were similar to the results of those studies which included the high risk neonates prone for developing hyperbilirubinemia. The differences our study had with other studies mainly was due to the fact that those studies didn't

include high risk infants like premature, low birth weight or babies with ABO incompatibility.

Natural history of bilirubin levels after stopping phototherapy is still unclear. Management of hyperbilirubinemia in neonates is based on the principle of avoiding potentially neurotoxic levels of unconjugated bilirubin [18]. Neurotoxic level of bilirubin may vary with postnatal age, maturity of blood-brain barrier, rate of rise of serum bilirubin, serum albumin concentration, presence of hemolysis and co morbidities. The neurotoxic levels of bilirubin in late neonatal period, and whether untreated rebound bilirubin may reach those levels are issues for further Investigation [19, 20].

Our study recommend that a rebound bilirubin level must be obtained in high-risk neonates like gestational age less than 35 weeks, birth weight being 1-1.5 kg, neonate had been on DSPT or intensive phototherapy and on parenteral nutrition. Discharge may be delayed for this purpose if follow-up is not ensured.

Conclusion

Our study focused on the study of significant hyperbilirubinemia after termination of phototherapy and factors affecting it. We found that rebound of bilirubin levels was of significant importance in preterm neonates with gestational age less than 35 weeks, in very low birth weight babies and neonates with polycythemia and sepsis. Babies who have been treated with intensive phototherapy were found to be prone foe developing rebound hyperbilirubinemia while breast fed babies and neonates who had physiological jaundice were found to have less likelihood of developing significant bilirubin rebound.

Conflict Of Interest: None

References

1. Maisels MJ, JMacdonald M, Mullet M, Seshia M. Jaundicein newborn : Avery's neonatology pathophysiology of management of the newborn.6th ed. Philadelphia: Lippincott — Williams of Wilkins. 2005, pp.: 768-846
2. Piazza AJ, Stoll BJ, Jaundice and hyperbilirubinemia in the newborn.ln:Kliegman, editor. Nelson Textbook of Pediatrics. 18th edition. Philadelphia Elsevier; 2008. P- 756-766
3. Cloherty JP, Martin CR. Neonatal hyperbilirubinemia. In:Clotherty JP, editor. Manual of neonatal care. 6. edition.Philadelphia : Lippincott Williams and Wilkins;2008. P- 181212.
4. Bhutani VK, Johnson L, Keren R. Diagnosis and management of hyperbilirubinemia in term neonate: For safer first week. Pediatr. Clin N Am, 2004, 51: 843-861.
5. Ip S, Glicken S, Kulig J et al. Management of neonatal hyperbilirubinemia. Rockville M.D. : US Department of Health and Human Services; AHRQ publication 2003; 03: El 1
6. Kramer LI. Advancement of dermal icterus in the jaundiced newborn; Am J Dis Child, 1969. 118: 454-458 7.
7. Moyer VA, Ahn C, Sneeds S. Accuracy of clinical judgment in neonatal jaundice; Arch. Pediatr. Adolse Med 2000, 154 : 391-394
8. Davidson LT, Merritt KK, Weech AA. Hyperbilirubinemia in newborn; Am J Dis Child 1941, 61 : 958-980
9. Brown AK, Johnson L , Loss of concern about jaundice and re-emergence of kernicterus in fullterm infant in the era of managed care; Yearbook of neonatal and perinatal medicine, 1996. p xvii-xxviii.
10. Indian National Neonatology Forum [Internet]. Teaching Aids on Newborn Care, Neonatal Jaundice. New Delhi; 1993[2000-2011] Available from www.nniforg
11. Bansal A, Jain S, Parmar V.R, Chawla D. Bilirubin Rebound After Intensive Phototherapy For Neonatal Jaundice.

Indian pediatrics . 17 July 2010: 47: 607-609

12. Maisels MJ, Kring E. Rebound in serum bilirubin level following intensive phototherapy. Arch PediatrAdolesc Med 2002; 156: 669-672
13. Kaplan M, Kaplan E, Hammerman C, Algur N, Bromiker R, Schimmel MS, et al.Postphototherapy neonatal bilirubin rebound: a potential cause of significant hyperbilirubinaernia. Arch Die Child 2006; 91: 31-34.
14. Lazar L, Litwin A, Merlob P. Phototherapy for Neonatal Nonhemolytic Hyperbilirubinemia: Analysis of Rebound and Indications for Discontinuing Therapy. ClinPediatr. Mat 1993:32(5): 264-267.
15. Yetman RJ, Parks DK, Huseby V, Mistry K, Garda J. Rebound bilirubin levels in infants receiving phototherapy. J Pediatr 1998; 133: 705-707.
16. Del Vecchio MT, Benstock MA, Sundel ER. Bilirubin rebound. J Pediatr.1999: 135(4):531-2. Available from Pubmed: http://www.ncbi.nlm.nih.gov/pubmed/105 18123 62. McDonagh AF. Phototherapy: from ancient Egypt to the new millennium. J Perinatol. 2001 Dec:21Suppl 1:S7-S12.
17. AI-Saedi SA. Rebound hyperbilirubinemia in term infants after phototherapy. Saudi Med J 2002: 23:1394-1397.
18. Gourley GR. Bilirubin metabolism and kernicterus. Adv Pediatr. 1997 ; 44 : 173-229.
19. Erdeve O. Rebound bilirubin: on what should the decision to recommence phototherapy be based? Archives of Disease in Childhood. 2006;91(7):623.
20. Berkwitt A, Osborn R, Grossman M. The utility of inpatient rebound bilirubin levels in infants readmitted after birth hospitalization for hyperbilirubinemia. Hosp Pediatr. 2015 Feb;5(2):74-8.