Original Article

Indian Journal of Maternal-Fetal and Neonatal Medicine
Volume 8 Number 1, January – June 2021
DOI: http://dx.doi.org/10.21088/ijcd.2395.6631.8121.2

Study of Rebound Hyperbilirubinemia in Post–Phototherapy Neonates: A Prospective Observational Study

[1]Aditya Dehury, [2]Vasanth N Kumar, [3]Asghar Imran, [4]Hassan Farogh

How to cite this article:
Aditya Dehury, Vasanth N Kumar, Asghar Imran, Hassan Farogh, Study of Rebound Hyperbilirubinemia in Post–Phototherapy Neonates: A Prospective Observational Study. Indian J Comm Dis. 2021;7(1):15–20.

Author's Affiliations: [1,3]Department of Pediatrics, Bokaro General Hospital, Bokaro Steel City, Jharkhand 827004, India. [2]Department of Pediatrics, Chamarajnagar Institute of Medical Sciences, Chamarajnagar, Yadapura, Karnataka 571313, India. [4]Department of Pediatrics, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, Uttar Pradesh 202001, India.

Corresponding Author: Vasanth N Kumar, Department of Pediatrics, Chamarajnagar Institute of Medical Sciences, Chamarajnagar Yadapura, Karnataka 571313, India.

E-mail: drvasanth1986@gmail.com

Abstract

Aim: To study rebound hyperbilirubinemia in post-phototherapy neonates. **Methods:** A prospective observational study was conducted in pediatric tertiary care hospital. 156 neonates were recruited in the study and phototherapy was given according to guidelines. After consent, detailed history was taken and clinical examination were carried out for both groups. They were subsequently estimated for rebound hyperbilirubinemia usually 24±6 hrs after cessation of phototherapy. Serum bilirubin (total and direct) was measured at the end of phototherapy, after 24±6 hours of stopping phototherapy. **Results:** Statistically significant association found with risk factors include gestational age <35 weeks (p value 0.004), low birth weight (<2000gms) (p =0.047),, haemolytic causes(p value <0.001), age at onset of jaundice, duration of primary phototherapy <72 hrs(p value of 0.034). 50% neonates recovered within 24-48hours of phototherapy & 44.4% required phototherapy for ≥48 hours. This result bears significant statistical correlation (p value 0.002).The mean duration of hospital stay is 5.32 ± 1.85 days and it was observed that majority of babies (56.4%) with significant post-phototherapy rebound hyperbilirubinemia had stayed for 5-8 days in the hospital before discharge. **Conclusion:** In this study it is found that rise of serum bilirubin to a significant level after phototherapy cessation is present in 11.5% of cases. The etiological risk factors include gestational age <35 weeks, low birth weight (<2000gms), haemolytic causes, age at onset of jaundice, duration of primary phototherapy <72 hrs. Retreatment with phototherapy was found to be an effective therapy for neonates with significant post phototherapy rise of serum bilirubin.

Keywords: Phototherapy; Rebound Hyperbilirubinemia; Serum Bilirubin.

Introduction

Neonatal Hyperbilirubinemia is a common and benign problem in most cases during the first week of life after birth in neonates with prevalence of approximately 60% in full term infants and 80% in preterm infants.[1] This is the most common cause of re-admission after discharge from birth hospitalisation.[2]

Although outcome for majority is benign, infants with severe hyperbilirubinemia if not treated immediately, might develop kernicterus; a chronic neurologically devastating condition resulting from bilirubin toxicity. Management of hyperbilirubinemia in neonates is based on the principle of avoiding these potentially 'neurotoxic' levels of bilirubin.[3]

Intensive phototherapy in neonatal hyperbilirubinemia rapidly decreases serum total bilirubin (STB) below the threshold for treatment.[4] because hyperbilirubinemia may not yet have resolved by the time phototherapy is discontinued; 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 pointed

previously by few observational studies.[5,6,7]

However, data presently available are not adequate to formulate recommendations for or against post-phototherapy bilirubin testing. The reports on the subject to date, have been flawed by comprising retrospective chart reviews, analysis of rebound by determining the mean bilirubin value rather than peak post-treatment values, pooling of data from term and extremely preterm neonates, or exclusion of neonates with haemolytic conditions from the analysis. Therefore, we proposed to conduct this study to determine the incidence of post-phototherapy bilirubin rebound needing reinstitution of phototherapy.

Methods

A prospective observational study conducted in Special Care Baby Unit (SCBU), a level II NICU in Dept of pediatrics, Bokaro General Hospital, Bokaro Steel City, Jharkhand**.** Study was conducted from August 2016 to July 2017.

Inclusion Criteria:

- Neonates having clinically significant icterus.
- Neonates undergoing phototherapy for jaundice.

Exclusion Criteria:

- Irregularly treated neonates.
- Neonates having conjugated hyperbilirubinemia.
- Very sick neonates or/with birth weight less than 1000gm.
- Neonates having serum bilirubin concentration >25mg/dl.

Written informed consent was taken from parent/guardian of eligible neonates. A detailed history was taken regarding birth and obstetric history, gestational age at delivery, various risk factors, day of appearance of jaundice in baby and physical examinations were conducted at the time of admission in a specified proforma meant for the purpose. All newborns were evaluated using clinical data, essential routine investigations or employing standard laboratory tests.

Initiation of phototherapy

Clinically suspected and jaundiced babies were given phototherapy on the basis of AAP guideline chart.[8] For neonates born before 35 completed weeks' of gestation or with body weight <2500gm,phototherapy was initiated when serum bilirubin: >5mg/dl in 1st 24hours of post gestational age/ >10mg/dl or 0.8% of body weight when 24-48 hours of post gestational age (which was lower)/ >15mg/dl or 0.8% of birth weight when >48 hours of post gestational age (which was lower).

Stopping phototherapy:

Phototherapy was stopped when TSB <14mg/dl in 2 Consecutive measurements at least 6-12hours apart in hemolytic jaundice or when single value of TSB <14mg/dl in non hemolytic jaundice. Phototherapy was stopped when TSB falls 2mg/dl below the level at which phototherapy initiated.

Serum bilirubin (total and direct) was measured at the end of phototherapy, after 24±6 hours of stopping phototherapy. The serum bilirubin rebound status was recorded in predesigned proforma and neonates who required retreatment, treatment was provided as per standard guidelines.

The course of event during phototherapy i.e. age of onset, duration, rate of fall of serum bilirubin, any other complications and the outcomes of the cases as per the duration of hospital stay, number of cases relieved/discharged/expired were also recorded.

Approximately 4 ml of blood was drawn using aseptic technique by peripheral venous phlebotomy. Approximately 2 ml blood was transferred to plain vials for measuring serum bilirubin (total &direct) level. Remaining 2 ml blood for complete blood count, ABO/Rh typing and Direct Coomb's test was transferred to EDTA vials. Total serum bilirubin (TSB) was estimated by Diazo method with sulfanilic acid. Ethical approval was taken from the ethical committee.

Statistical Methods:

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0. Continuous variables were presented as mean±SD or median (IQR) for non-normally distributed data. Categorical variables were expressed as frequencies and percentages. The comparison of normally distributed continuous variables between the groups (post-phototherapy rebound hyperbilirubinemia –Yes, No) was performed using Student's t test. Non-normal distribution continuous variables were compared using Mann Whitney U test. Nominal categorical data between the groups was compared using Chi squared test or Fisher's exact test as appropriate. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

Results

A total of 156 jaundiced neonates (both term and preterm neonates) admitted to NICU during the study period were screened for recruitment in the study and phototherapy was given according to guidelines. Blood samples were drawn from all newborns for measurement of routine blood tests, post-phototherapy estimation and blood group according to predetermined schedule. Mother blood group was also noted to detect any Rh or ABO incompatibility. They were subsequently estimated for rebound hyperbilirubinemia usually 24±6 hrs after cessation of phototherapy. Out of total 156neonates, for whom post-phototherapy serum bilirubin was measured, 18(11.5%) developed "SBR" following termination of phototherapy.

The highest incidence of jaundice was observed between 2nd-4th days of postnatal life, which account for 85.2% of all cases of neonatal hyperbilirubinemia. In 66.7% of babies with "SBR", onset of jaundice was within 1st 3days of life. A slight male preponderance is observed in the present study. Babies with Significant Serum Bilirubin Rebound, 61.1% were males and 38.9% were

females. After termination of phototherapy, among the significant bilirubin rebound group, 77.8% delivered by NVD whereas 11.1% delivered by complicated vaginal delivery and LSCS each. The study revealed that mode of delivery is not a risk factor for "SBR" (p value 0.666) & it is comparable among the neonates with or without "SBR. In this series of total 156 neonates, among the weight group "<2000gms", who were initially treated with primary phototherapy, 11 out 81 i.e., 13.5% showed significant bilirubin rebound. By clubbing the neonates as "<2000gms" & "<2000gms" group and categorizing the babies as with or without significant rebound hyperbilirubinemia, the p value was found to be 0.047 which again statistically significant. So birth weight <2000gms found to be a significant risk factor for "SBR".

Table 1: Correlation between Jaundice 1st Observed (on day) & Serum Bilirubin Rebound Status.

Jaundice 1st Observed (On Day)	Serum Bilirubin Rebound Status			P Value
	Absent	Present But Insignificant	Significant	
	Frequency	Frequency	Frequency	
1	0 (0.0%)	2 (3.7%)	3 (16.7%)	
2	18 (21.4%)	18 (33.3%)	5 (27.8%)	
3	24 (28.6%)	23 (42.6%)	4 (22.2%)	
4	33 (39.3%)	6 (11.1%)	2 (11.1%)	<0.001
5	7 (8.3%)	4 (7.4%)	2 (11.1%)	
6	2 (2.4%)	1 (1.9%)	2 (11.1%)	
Total	84 (100%)	54 (100%)	18 (100%)	

In this study, 55.6% of babies with significant bilirubin rebound did not have any association with any material risk factor. There was a statistically significant association of maternal illness during pregnancy with "SBR" (p value of <0.001). As per gestational age analysis from 7 out of 47(14.8%) neonates under <35 wks showed significant bilirubin rebound and 11 out of 109 (10%) neonates under ≥35 wks showed significant bilirubin rebound. When statistical analysis done according to gestational age below or above 35 wks, significant association (p value 0.004) was obtained between <35 wks gestational age group and higher incidence of "SBR".

Table 2: Correlation between Weight (grams) & Serum Bilirubin Rebound Status.

Weight (Grams)	Serum Bilirubin Rebound Status			P Value
	Absent	Present But Insignificant	Significant	
	Frequency	Frequency	Frequency	
<1500	10 (11.9%)	10 (18.5%)	6 (33.3%)	
1500-1999	26 (31.0%)	24 (44.4%)	5 (27.8%)	
2000-2499	23 (27.4%)	4 (7.4%)	1 (5.6%)	
2500-2999	19 (22.6%)	12 (22.2%)	4 (22.2%)	
3000-3499	3 (3.6%)	4 (7.4%)	0 (0.0%)	0.012
≥3500	3 (3.6%)	0 (0.0%)	2 (11.1%)	
Total	84 (100%)	54 (100%)	18 (100%)	

In this study, when neonates were grouped according to their final diagnosis, it was observed that, 35.7% cases of haemolytic etiologies of neonatal jaundice (i.e. ABO incompatibility, Rh incompatibility, G-6-PD deficiency together) present with significant bilirubin rebound. 6.5% of all prematurity cases present with significant bilirubin rebound. When neonates with "SBR" having final diagnosis of haemolytic causes of jaundice were compared with other causes, it was observed that there was a significant difference in distribution of babies with "SBR" as compared to others for hemolytic etiologies (p value <0.001).

Table 3: Correlation between Duration of Phototherapy (hours) & Serum Bilirubin Rebound Status.

Duration of Phototherapy (Hours)	Serum Bilirubin Rebound Status			P Value
	Absent	Present But Insignificant	Significant	
	Frequency	Frequency	Frequency	
<24	1 (100%)	0 (0.0%)	0 (0.0%)	
24	33 (89.2%)	3 (8.1%)	1 (2.7%)	
48	36 (48.0%)	30 (40.4%)	9 (12.0%)	<0.001
72	9 (29.0%)	18 (58.1%)	4 (12.9%)	
96	5 (41.7%)	3 (25.0%)	4 (33.3%)	
Total	84 (53.8%)	54 (34.6%)	18 (11.5%)	

When neonates were grouped according to onset primary phototherapy in terms of postnatal age in days, it was found that 61.1% of neonates with significant bilirubin rebound had received primary phototherapy within first 3 day of post-natal life compared to only 38.9% of neonates in same group who had received the primary phototherapy after 3rd day of postnatal life. The study shows no statistically significant association with p value of 0.375 between beginning of phototherapy within <3 days of post-natal life with respect to significant bilirubin rebound.

Table 4: Correlation between Gestational Age & Serum Bilirub in Rebound Status.

Gestational Age (Completed Weeks)	Serum Bilirubin Rebound Status			P Value
	Absent	Present But Insignificant	Significant	
	Frequency	Frequency	Frequency	
<35 Wks	16 (19.0%)	24 (44.4%)	7 (38.9%)	
35 - <37 Wks	38 (45.2%)	15 (27.8%)	7 (38.9%)	0.023
>37 Wks	30 (35.7%)	15 (27.8%)	4 (22.2%)	
Total	84 (100%)	54 (100%)	18 (100%)	

Among the neonates who developed "SBR", 14 (77.7%) had received phototherapy for a duration ≤72 hours. It was observed that there was a significant association (p value of 0.034) between duration of phototherapy ≤72 hours and significant rebound hyperbilirubinemia in the neonates.

In this study, total 78 (50%) had a decrease of serum bilirubin when measured 24±6 hrs after cessation of

primary phototherapy & for 6 (3.8%) neonates serum bilirubin remain same as of phototherapy cessation time value which subsequently normalized. For 54 (34.6%) neonates, there was increase of serum bilirubin level that doesn't reach significant level requiring reinstitution of phototherapy. Total 18 (11.5%) neonates in this study population showed significant rise of post phototherapy serum bilirubin level requiring reinstitution of phototherapy.

Among these neonates (with insignificant rebound) 79.6% shows increase in serum bilirubin <1mg/dl. 11 (7.05%) neonates shows 2-2.9mg/dl increase in serum bilirubin level, 6(3.8%) shows 1-1.9mg/dl & only 1(0.6%) in them shows rise in serum bilirubin >3mg/dl. All the 18 babies (100%) having "SBR" retreated with phototherapy for variable period of time. No baby required any other therapy. Total 54 neonates with "insignificant bilirubin rebound" & "6 neonates in whom serum bilirubin level remained unchanged" after 24±6 hrs of cessation of primary phototherapy were observed clinically.

Out of all neonates with significant rebound hyperbilirubinemia, only 5.6% of neonates recovered with phototherapy of ≤ 24hours duration. 50% neonates recovered within 24-48hours of phototherapy & 44.4% required phototherapy for ≥48 hours. This result bears significant statistical correlation (p value 0.002). The mean duration of hospital stay is 5.32 ± 1.85 days and it was observed that majority of babies (56.4%) with significant postphototherapy rebound hyperbilirubinem -ia had stayed for 5-8 days in the hospital before discharge.

Discussion

Rebound hyperbilirubinemia is increase in serum bilirubin following cessation of therapy in neonates undergoing phototherapy. Significant bilirubin rebound (SBR) is defined as increase in bilirubin to a level that requires reinstitution of phototherapy.[9]

The highest incidence of jaundice was observed between 2nd- 4th day of postnatal life which account for 85.2% of all cases of neonatal hyperbilirubinemia. In 66.7% babies with "SBR", onset of jaundice was within 1st 3days of life. Only 33.3 cases with SBR had onset of initial jaundice after 3rd day of postnatal life. When the neonates were grouped according to the age at onsets of jaundice and "SBR" status & studied accordingly, a statistically significant association rebound hyperbilirubinemia (p=0.002).

A slight male preponderance is observed in the present study. Babies with Significant Serum Bilirubin Rebound, 61.1% were males and 38.9% were females. After termination of phototherapy, among the significant bilirubin rebound group, 77.8% delivered by NVD delivery as a risk factor for "SBR", against other modes of delivery, no statistically significant association could be elicited (p=0.666) .Similar observations were made by Bansal et al66 (2009) who studied 232 neonates for post photography bilirubin rebound and found mode of delivery is not a risk factor for "SBR" & it is comparable among the neonates with or without "SBR."

In this series of total 156 neonates, among the weight group "<2000gms", who were initially treated with primary phototherapy, 11 out 81i.e, 13.5% showed significant bilirubin rebound. By clubbing the neonates as "<2000gms" & "<2000gms" group and categorizing the babies as with or without significant rebound hyperbilirubinemia, the p value was found to be 0.047 which again statistically significant. So birth weight <2000gms found to be a significant risk factor for "SBR". Similar results were found by Bansal A et al[9] (2009) who studied 232 neonates for post-phototherapy bilirubin rebound and found that risk of "SBR" is 10.8% with 95% CI among neonates with birth weight <2000gm. This is also similar to the result of a study done by Kaplan M et al[10] (2006) who found birth weight <2000gm as a risk factor for "SBR". Yetman RJ.et al[5](1998) reviewed retrospectively the medical record of 264 consecutive newborn receiving phototherapy for hyperbilirubinemia and found that TSB at rebound were significant lower that at discontinuation of phototherapy for infants weighing> 1800g, which is similar to this study showing importance of low birth weight as a risk factor for post phototherapy rise of serum bilirubin. Similar studies done by Valinjkar SK et al[11] (2017) and Elhawary IM et al[15] (2018) also suggested that low birth weight is an associated risk factor with significant rebound hyperbilirubinemia.

When statistical analysis done according to gestational age below or above 35 wks, significant association (p value 0.004) was obtained between less than 35 wks gestational age group and higher incidence of "SBR". Similar observation was made by Bansal A et al [9] in 2009, Chang PW et al[14]in 2017 and Valinjkar SK et al[11] in 2017. They found that rebound of bilirubin levels was of significant importance in preterm neonates with gestational age less than 35 weeks. Kaplan M et al[10] in 2006 and Jodeiry B et al[13] in 2013 also in their prospective studies found that incidence of significant rebound hyperbilirubinemia was higher in premature babies.

In this study, when neonates were grouped according to their final diagnosis, it was observed that, 35.7% cases of haemolytic etiologies of neonatal jaundice (i.e. ABO incompatibility, Rh incompatibility, G-6-PD deficiency together) present with significant bilirubin rebound. 6.5% of all prematurity cases present with significant bilirubin rebound. Total 3.6% and 22.2% of breast feeding jaundice along with exaggerated physiological jaundice cases and cephalohematoma cases contribute to significant rebound hyperbilirubinemia respectively. When neonates with "SBR" having final diagnosis of hemolytic causes of jaundice were compared with other causes, it was observed that there was a significant difference in distribution of babies with "SBR" as compared to others for hemolytic etiologies (p value <0.001). This study result agrees with the prospective studies done by Kaplan M et al[10] in the year 2006 and Elhawary IM et al[15] in the year 2018 who found hemolytic etiology as a potential risk factor for "SBR".

In this study, among the neonates who developed "SBR", 14 (77.7%) had receive phototherapy for a duration <=72 hours. It was observed that there was a significant association (p value of 0.034) between duration of phototherapy <=72 hours and significant rebound hyperbilirubinemia in the neonates .This finding is in agreement with the following studies. Kaplan M et al[10] in the year 2006 and Jodeiry B et al[13] in the year 2013 through their prospective clinical surveys concluded that phototherapy duration less than 72 hours is a risk factor for rebound hyperbilirubinemia. Recently in year 2018, Elhawary IM et al[15] did a prospective observational study including 500 newborns and found that short duration of conventional phototherapy is a risk factor for bilirubin rebound.

In this study, total 78(50%) had a decrease of serum bilirubin when measured 24±6 hrs after cessation of primary phototherapy & for 6 (3.8%) neonates serum bilirubin remain same as of phototherapy cessation time value which subsequently normalized. For 54(34.6%) neonates, there was increase of serum bilirubin level that doesn't reach significant level requiring reinstitution of phototherapy. Total 18 (11.5%) neonates in this study population showed significant rise of post phototherapy serum bilirubin level requiring reinstitution of phototherapy .Among these neonates (with insignificant rebound) 79.6% shows increase in serum bilirubin <1mg/dl. 11(7.05%) neonates shows 2-2.9mg/dl increase in serum bilirubin level, 6(3.8%) shows 1-1.9mg/dl & only 1(0.6%) in them shows rise in serum bilirubin >3mg/dl. Similar observations were made by Bansal A et al[9] in 2009. They observed that, neonates with SBR, had mean increase of serum bilirubin level by 2.3mg/dl when measured 24±6 hrs after stopping phototherapy.

Neonates who had post phototherapy rise of serum bilirubin were treated as per standard guidelines mentioned before. All the 18 babies (100%) having "SBR" retreated with phototherapy for variable period of time. No baby required any other therapy (i.e. Exchange Transfusion) for treatment of rebound hyperbilirubinemia. Total 54 neonates with "insignificant bilirubin rebound" & "6 neonates in whom serum bilirubin level remained unchanged" after 24±6 hrs of cessation of primary phototherapy were observed clinically & biochemically and found to have decreasing serum bilirubin level on subsequent measurements. Therefore retreatment with phototherapy was found to be an effective therapy for neonates with significant post phototherapy rise of serum bilirubin.

This prospective observational study involved total 156 term & preterm neonates with jaundice who received phototherapy during the study period. They were subsequently estimated for rebound hyperbilirubinemia usually 24±6 hrs after cessation of phototherapy.

In this study out of total 156 neonates, for whom post-phototherapy serum bilirubin was measured, 18 (11.5%) developed "SBR" following termination of phototherapy. This finding is similar to Kaplan et al[10] (2006) who studied 226 neonates and found 30 (13.3%) of neonates had phototherapy rebound hyperbilirubinemia. Also this finding is similar to the study done by Valinjkar SK et al[11] in 2017 who found 11% incidence of rebound hyperbilirubinemia out of the 148 studied cases. Previous studies showing lower record of rebound hyperbilirubinemia were: Maisels M J *et al* [12](2002) did a retrospective study in newborn nursery of a large community hospital and found 13(8.2%) of 158 infants of rebound hyperbilirubinemia. Another retrospective study was conducted in tertiary care centre in north India by Bansal A et al [9] (2009) on bilirubin rebound in post-phototherapy neonates and found that significant bilirubin rebound is observed in 7.3% of neonates. A prospective study was conducted at Mofid Children's Hospital, a tertiary paediatric referral hospital by Jodeiry B et al[13] (2013) and they found 1.6% incidence of rebound. Chang PW et al[14] (2017) through a retrospective cohort study recorded 4.6% cases of rebound hyperbilirubinemia. On the other hand, in year 2018, Elhawary IM et al[15] did a prospective observational study including 500 newborns and found a total of 124(24.9%) newborns developed rebound hyperbilirubinemia after stopping phototherapy.

The variation in results may be due to different definitions of rebound bilirubin level, local differences (e.g. hospitals with and without midwifery wards), funding policies of medical insurance organizations, and socioeconomic factors - many mothers and their babies are discharged less than 48 hours or even less than 24 hours after birth.

Out of all neonates with significant rebound hyperbilirubinemia, only 5.6% of neonates recovered with phototherapy of <=24hours duration. 50% neonates recovered within 24-48hours of phototherapy & 44.4% required phototherapy for >=48 hours. This result bears significant statistical correlation (p value 0.002).The mean duration of hospital stay is 5.32 ± 1.85 days and it was observed that majority of babies (56.4%) with significant post-phototherapy rebound hyperbilirubinemia had stayed for 5-8 days in the hospital before discharge.

Limitations of the Study

The present study involved only 156 neonates (smaller sample size). Larger studies could have validated the findings of this study. As majority of neonates in this study were incidentally premature, all the outcomes could not be generalized to normal term neonate population.

Conclusions

In this study it is found that rise of serum bilirubin to a significant level after phototherapy cessation is present in 11.5% of cases. The etiological risk factors include gestational age <35 weeks, low birth weight (<2000gms), haemolytic causes, age at onset of jaundice, duration of primary phototherapy <72 hrs. Retreatment with phototherapy was found to be an effective therapy for neonates with significant post phototherapy rise of serum bilirubin.

References

1. Ambalavanan N, Carlo WA. Jaundice and hyperbilirubinemia in the Newborn In: Kliegman,

Stanton, St. Geme III JW, Schor NF editors. Nelson Text Book Of Paediatrics. 20th Ed.Philadelphia: Elsevier; 2015. P871-880.
2. Young Infants Clinical Signs Study Group. Clinical Signs that predict severe illness in children under age 2 months: a multicentre study.The Lancet. 2008 Jan 18; 371(9607):135-42.
3. Stet S, Chung M, Kulig J, O'Brien R, Sege R, Glicken S, et al. An evidence-based review of important issues concerning neonatal hyperbilirubinemia. Pediatrics.2004; 114.
4. National Neonatal Perinatal Database Network .Report 2002-2003. New Delhi: National Neonatology Forum of India; 2004.
5. Yetman RJ, Parks DK, Huseby V, Mistry K, GarciaJ. Rebound bilirubin levels in infants receivingphototherapy. J Pediatr 1998 Nov; 133(5): 705-7.
6. Al-Saedi SA. Rebound hyperbilirubinemia in term infants after phototherapy. Saudi Med J 2002 Nov; 23(11): 1394-7.
7. Erdeve O, Tiras U, Dallar Y. Rebound bilirubin measurement is not required for hyperbilirubinemia regardless of the background attributes of the newborns. J Trop Pediatr 2004 Oct; 50(5): 309.
8. American Academy of Pediatrics Subcommittee on Hyperbilirubinemia. Management of hyperbilirubin emia in the newborn infant 35 or more weeks of gestation. Pediatrics. 2004; 114:297-316.
9. Bansal A, Jain S, Parmar VR, Chawala D. Bilirubin rebound after intensivephototherapy for neonatal Jaundice. Indian Pediatrics.2010 July, 47(7):607-609.
10. Kaplan M, Kaplan E, Hammerman C, Algur N. Bromiker R,Schimmel MS et al .post phototherapy neonatal bilirubin rebound; a potential cause of significant hyperbilirubinemia.Arch Dis Child.2006;91:31-34.
11. Valinjkar SK, Sutay NR, Sharma B. Rebound hyperbilirubinemia in neonates after phototherapy and factors affecting it. JMSCR. 2017;5: 19003–14.
12. Maisels MJ, Kring E. Rebound in serum bilirubin level following intensive phototherapy. Arch Pediatr Adolesc Med 2002 Jul; 156: 669-672.
13. Jodeiry B, Fakhraee SH, Kazemian M, Afjeiee SA, Javaherizadeh H. Rebound hyperbilirubinaemia in neonates admitted to Mofid Children's Hospital, Tehran, Iran. SAJCH. 2013; 7:22–4.
14. Chang PW, Kuzniewicz MW, McCulloch CE, Newman TB. A Clinical Prediction Rule for Rebound Hyperbilirubinemia Following Inpatient Phototherapy.Pediatrics. 2017 Mar; 139(3).
15. Elhawary IM, Abdel Ghany EAG, Aboelhamed WA, Ibrahim SGE. Incidence and risk factors of post-phototherapy neonatal rebound hyperbilirubinemia. World J Pediatr. 2018 Feb 20