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RESEARCH ARTICLE

A CROSS-SECTIONAL STUDY TO ASSESS THE PREVALENCE OF JAUNDICE AND KERNICTERUS IN NEONATES BORN IN A TERTIARY CARE HOSPITAL

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Key Words: (PT)-preterm, (AGA)-appropriate for gestational age, (SGA)-small for gestational age, (NW)-Normal weight of baby-(2.5kg-3.99kg), (LBW)- low birth weight (1.5kg-2.499kg), (VLBW)-very low birth weight (1kg-1.499kg), (TSB)- Total Serum Bilirubin & (NNH)- Neonatal Hyperbilirubinemia.

ABSTRACT

In this study, the aim was to assess the prevalence of jaundice and kernicterus in a group of neonates born alive in a tertiary care hospital in Delhi, India. In our cross-sectional study of 661 neonates (601 term neonates & 60 preterm neonates), the results showed that almost all neonates had transient unconjugated hyperbilirubinemia in the neonatal period, with more than ninety percent affected during their first week of life. The prevalence of physiologic jaundice in neonates was 86.99% (81.24% in term neonates & 5.75% in preterm neonates) and the prevalence of pathologic indirect hyperbilirubinemia in neonates was 13.01% (9.68% in term neonates & 3.33% in preterm neonates). Among these 13.01% neonates with pathologic jaundice, about 3.93% neonates had TSB between 12mg/dL to 14.99mg/dL, 7.87% neonates had TSB between 15mg/dL to 19.99mg/dL and 1.21% neonates had TSB between 20mg/dL to 26mg/dL. In our study, preterm gestation showed a strong association with pathologic indirect hyperbilirubinemia. In our study, no neonate discharged from Rockland Hospital was reported to have kernicterus or cerebral palsy on follow up. Besides, the neonatal mortality rate was zero, in our study.

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INTRODUCTION

The word 'jaundice' comes from the French word 'jaune', meaning 'yellow' and 'jaunisse' meaning "yellow disease".[12] The medical term for jaundice is icterus. The word 'icterus' comes from the Greek word 'ikteros'.[8] The origin of the word icterus is quite bizarre, coming from an ancient belief that jaundice could be cured from looking at the yellow bird icteria.[12] The term icterus is sometimes incorrectly used to refer to jaundice specifically of sclera.[8] [12] Neonatal jaundice is a yellowish discolouration of mucous membranes and skin in a neonate (infant under 28 days of age), due to high bilirubin levels.[19] Other symptoms may include excess sleepiness or poor feeding.[19] Complications may include seizures, cerebral palsy, or kernicterus.[19] Bilirubin was discovered by Rudolf Virchow in 1847.[16] The serum bilirubin level required to cause jaundice varies with skin tone and body region, but jaundice usually becomes visible on the sclera at a level of 2 to 3 mg/dL and on the face at about 4 to 5 mg/dL.[19]

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With increasing bilirubin levels, jaundice seems to advance in a head-to-foot direction, appearing at the umbilicus at about 15 mg/dL and at the feet at about 20 mg/dL. [19] Under normal circumstance, the level of indirect bilirubin in umbilical cord serum is 1-3mg/dL and rises at a rate of <5mg/dL/24hr; thus, jaundice becomes visible on the 2nd or 3rd day, usually peaking between the 2nd and 4th days at 5-6mg/dL and decreasing to less than 2mg/dL between the 5th and 7th days after birth. Jaundice associated with these changes is designated *physiologic jaundice* (non-pathologic unconjugated hyperbilirubinemia) and is believed to be the result of increased bilirubin production from breakdown of fetal red blood cell breakdown combined with transient limitation in conjugation of bilirubin by the immature neonatal liver. In premature infants, the rise in serum bilirubin tends to be the same or somewhat slower but of longer duration than in term infants. Peak levels of 8-12mg/dL are not usually reached until the 4th-7th day, and jaundice is infrequently observed after the 10th day, corresponding to the maturation of mechanisms for bilirubin metabolism and excretion.[14] [15] [19] In general, factors suggesting a *pathologic jaundice* a search to determine the cause of jaundice should be made if it appears in the 1st 24 hours after birth, serum bilirubin is rising at a rate faster than 5mg/dL/24hr, total serum bilirubin is >12mg/dL in a term

infant (especially in the absence of risk factors) or 10-14mg/dL in a preterm infant, jaundice persists after 10-14 days after birth, or serum direct bilirubin fraction is >2mg/dL at any time. Other factors suggesting a *pathologic jaundice* (unconjugated or conjugated hyperbilirubinemia) are family history of hemolytic disease, pallor, hepatomegaly, splenomegaly, vomiting, lethargy, poor feeding, excessive weight loss, apnea, bradycardia, hypothermia, light coloured stools, dark urine positive for bilirubin, bleeding disorder, failure of phototherapy to lower the bilirubin level and signs of kernicterus.[15] [19]

Persistent pathologic indirect hyperbilirubinemia - that is, jaundice persisting beyond the first 14 days- is also seen in neonates, more commonly in breastfed babies. [14] In young babies, unconjugated bilirubin (which is not carried by albumin) can penetrate the membrane that lies between the brain and the blood (the blood–brain barrier) because the blood–brain barrier has yet to develop fully, whereas more developed individuals with increased bilirubin in the blood are protected. Unconjugated bilirubin is potentially toxic to neural tissue (brain and spinal cord). The term kernicterus is used to denote the clinical features of acute or chronic bilirubin encephalopathy, as well as the yellow staining in the brain associated with the former. Kernicterus is also known to occur at lower levels of bilirubin in term babies who have risk factors, and in preterm babies. [14][15] Kernicterus has been rising in recent years due to less time spent outdoors. [15] Jaundice and kernicterus are crucial global health issues, which must be addressed to reduce neonatal and child mortality globally and reach the sustainable development goals.

AIMS AND OBJECTIVES

In this study, the aim was to assess the prevalence of jaundice and kernicterus in a group of neonates born alive in a tertiary care hospital in Delhi, India.

MATERIALS AND METHODS

Study Setting and Period of Study: The study was conducted in the Department of Paediatrics, Rockland Hospital in Delhi, India during the period of 01 January 2012 to 07 August 2014.

Study Design: The study was a Cross-sectional Study, conducted at the Department of Paediatrics, Rockland Hospital in Delhi.

Sample Size: For the present study, 661 neonates (645 singleton neonates & 16 twin neonates) were recorded and studied in Paediatrics Department in Rockland Hospital. These neonates were born alive to 653 mothers in Obstetrics & Gynaecology Department in Rockland Hospital, during the period 01.01.2012 till 07.08.2014.

Sampling Design: The study was done as Random Sampling of the neonates noticed to have deep yellow discolouration of whole body that were born in Rockland Hospital, Delhi. In this study, all the venous blood samples of neonates for Total Serum Bilirubin (TSB) and Direct Serum Bilirubin were collected during first 9 days of life, and in one case of persistent pathologic hyperbilirubinemia, the sample was again collected on Day 21 of life.

Study Variables: Gender of neonate, total serum bilirubin level, indirect serum bilirubin level and direct serum bilirubin level of neonate, physiologic jaundice or pathologic jaundice, maturity of neonate (term or preterm), morbidity (kernicterus or cerebral palsy) and mortality rate in a group of neonates born in Rockland Hospital, Delhi.

Inclusion Criteria/ Selection Criteria

Participants in the study eligible for inclusion were neonates of either gender, born alive in Rockland Hospital during the period 01.01.2012 till 07.08.2014. Neonates were included after obtaining proper informed written consent from their parent/guardian.

Intrauterine deaths were excluded from the study. There were 7 neonates born in Rockland Hospital, Delhi and on Day 1 of life, these neonates were referred to the higher center. These 7 neonates were as follows:

- PT (28-29weeks) / Female / SGA / VLBW
- PT (29-30weeks) /Male/ SGA /LBW
- PT (31-32 weeks)/Male/SGA/Extreme LBW (920grams)
- PT (32 weeks) / Female / SGA / LBW
- Term / Male / AGA
- Term / Female / AGA
- Term / Female / AGA

The further outcome of these 7 neonates (4 preterm & 3 term) is not known. These 7 neonates were excluded from the study.

Study Characteristics: In this study, 661 neonates born alive in Rockland Hospital during the period 01.01.2012 till 07.08.2014, were recorded and studied. The demographic information, history, physical examination & investigations in the patient's questionnaire were recorded. Neonates that satisfied the inclusion criteria were selected and the neonates who did not meet the inclusion criteria were excluded.

Data Collection Methods and Tools: Neonates' history & investigations information was collected in questionnaires and the data was collected and reported, and then statistical analysis of data was performed using SPSS software. Calculations of P values were done using QuickCalcs-Graphpad Software.

Statistical Methods and Statistical Interpretation: Chi-square test or Fisher's exact test was used to calculate the Two-tailed P values in our study. When presenting P values, it was helpful to use the asterisk rating system as well as quoting the P value:

P < 0.05* , it is **statistically significant**,
P < 0.01 ** , it is **very statistically significant**,
P <0.001*** , it is **extremely statistically significant**.

RESULTS & OBSERVATIONS

For the present cross-sectional study, 661 neonates (645 singleton neonates & 16 twin neonates) were recorded and

studied in Paediatrics Department in Rockland Hospital. These neonates were born alive to 653 mothers (42.88% primigravida & 57.12% multigravida) by LSCS in 70.75% cases & by vaginal delivery in 29.25% cases, in Obstetrics & Gynaecology Department in Rockland Hospital, during the period 01.01.2012 till 07.08.2014. [(4)]

Hence, more than 70% neonates were observed in hospital for more than 72 hours before discharge, and the remaining healthy neonates with no risk factors were discharged after 24 hours of observation in Rockland Hospital, Delhi. In our study, all the 661 neonates after discharge were followed up for progress of jaundice in Paediatrics Out-Patient Department at Rockland Hospital, Delhi.

The various 645 singleton neonates (356 males & 289 females) were as follows:

- Term, LGA & Macrosomia-9 males & 3 females
- Term, AGA & NW - 299 males & 248 females
- Term, SGA & LBW - 12 males & 19 females
- PT, AGA & NW - 16 males & 07 females
- PT, AGA & LBW - 14 males & 10 females
- PT, SGA & LBW - 06 males & 01 female
- PT, SGA & VLBW - 00 male & 01 female

The various 16 twins (9 males & 7 females) were as follows:

- Term, AGA & NW - 1 male & 2 females
- Term, SGA & LBW - 4 males & 4 females
- PT, AGA & NW - 2 males only
- PT, AGA & LBW - 1 male & 1 female
- PT, SGA & LBW - 1 male only

Table 1: Table showing that the venous blood samples of 86 neonates with pathologic hyperbilirubinemia for Serum Bilirubin were collected during first 9 days of life, and in one case of persistent pathologic hyperbilirubinemia, the sample was again collected on Day 21 of life.

Age of baby	Neonates with pathologic jaundice	% Neonates with pathologic jaundice
Day 1	01	0.15%
Day 2	05	0.76%
Day 3	20	**3.03%**
Day 4	12	1.81%
Day 5	17	2.57%
Day 6	15	2.27%
Day 7	09	1.36%
Day 8	05	0.76%
Day 9	02	0.30%
Day 21	01 Repeat neonate	--
Total	86 neonates	13.01%

In this study, it is evident that almost all neonates with physiologic jaundice and about 90.70% (78) neonates with pathologic jaundice were diagnosed from Day 2 till Day 7 of life. Besides, one neonate was diagnosed with pathologic jaundice on Day 1 of life.

Hence neonates should be routinely followed for progress of jaundice in the first week of life. The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant.

Total Serum Bilirubin was calculated by adding Serum Indirect Bilirubin and Serum Direct Bilirubin. Normal values of Bilirubin are as follows:

- Total Serum Bilirubin = 0.3 to 1.0 mg/dL
- Serum Direct Bilirubin = 0.1 to 0.3 mg/dL
- Serum Indirect Bilirubin = 0.2 to 0.7 mg/dL

Hyperbilirubinemia is a higher-than-normal level of bilirubin in the blood. In our study, the results showed that the Total Serum Bilirubin was more than 2 mg/dL and the Serum Direct Bilirubin level was less than 2 mg/dL, in all the 661 neonates. Thus, in our study of 661 neonates, the results showed that almost all neonates had transient unconjugated hyperbilirubinemia in the neonatal period. In our study, about 575 neonates had physiologic jaundice (non-pathologic unconjugated hyperbilirubinemia) and about 86 neonates had pathologic indirect hyperbilirubinemia.

The various TSB levels of the 86 neonates with pathologic indirect hyperbilirubinemia were as follows:

12 mg/dL-12.99mg/dL- 10 neonates were as follows:
- Term/Male/AGA/NNH -5 neonates
- Term/Female/LBW/NNH -1 neonate
- PT/Twin/Male/LBW/NNH -1 neonate
- PT/Male/LBW/NNH -2 neonates
- PT/Female/LBW/NNH -1 neonate

13 mg/dL-13.99mg/dL- 8 neonates were as follows:
- Term/Male/AGA/NNH -2 neonates
- Term/Female/AGA /NNH -4 neonates
- PT/Male/LBW/NNH -1 neonate
- PT/Female/VLBW/NNH -1 neonate

14 mg/dL-14.99mg/dL- 8 neonates were as follows:
- Term/Male/AGA/NNH -3 neonates
- Term/Female/AGA/NNH -3 neonates
- PT/Male/NW/NNH -2 neonates

15 mg/dL-15.99mg/dL- 13 neonates were as follows:
- Term/Male/AGA /NNH -5 neonates
- Term/Female/AGA/NNH -4 neonates
- PT/Male/NW/NNH -1 neonate
- PT/Male/LBW/NNH -1 neonate
- PT/Female/NW/NNH -1 neonate
- PT/Female/LBW/NNH -1 neonate

16 mg/dL-16.99mg/dL- 15 neonates were as follows:
- Term/Male/AGA/NNH -10 neonates
- Term/Female/AGA/NNH -2 neonates
- Term/Female/LBW/NNH -1 neonate
- PT/Male/LBW/NNH -1 neonate
- PT/Female/LBW /NNH -1 neonate

17 mg/dL-17.99mg/dL- 10 neonates were as follows:
- Term/Male/LGA/Macrosomia/NNH -1 neonate
- Term/Male/AGA/NNH -3 neonates
- Term/Female/AGA /NNH -3 neonates
- PT/Male/NW /NNH -1 neonate
- PT/Male/LBW /NNH -2 neonates

18 mg/dL-18.99mg/dL- 12 neonates were as follows:
- Term/Male/AGA/NNH -5 neonates
- Term/Female/AGA/NNH -5 neonates
- Term/Female/LBW/NNH -1 neonate

- PT/Male/NW/NNH -1 neonate

19 mg/dL-19.99mg/dL- 2 neonates were as follows:

- Term/Male/AGA/NNH -1 neonate
- PT/Female/NW/NNH -1 neonate

20 mg/dL-20.99mg/dL- 1 neonate was as follows:

- Term/Female/AGA/NNH -1 neonate

21 mg/dL-21.99mg/dL- 1 neonate was as follows:

- Term/Female/AGA/NNH -1 neonate

22 mg/dL-22.99mg/dL- 1 neonate was as follows:

- Term/Female/AGA /NNH -1 neonate

23 mg/dL-23.99mg/dL- 2 neonates were as follows:

- Term/Male/AGA/NNH -1 neonate
- PT(34weeks+)/Male/LBW/NNH -1 neonate

24 mg/dL-24.99mg/dL- 2 neonates were as follows:

- PT(36weeks+) /Male / AGA / NNH -1 neonate
- PT(35weeks+) / Male / AGA/NNH -1 neonate (Day5-TSB-24.2 mg/dL, discharged after 3 days of phototherapy) & later again admitted for Persistent NNH (**Day21**-TSB-24.66 mg/dL, discharged after 3 days of phototherapy)

25 mg/dL-25.99mg/dL - 1 neonate was as follows:

- Term/Female/AGA/NNH -1 neonate

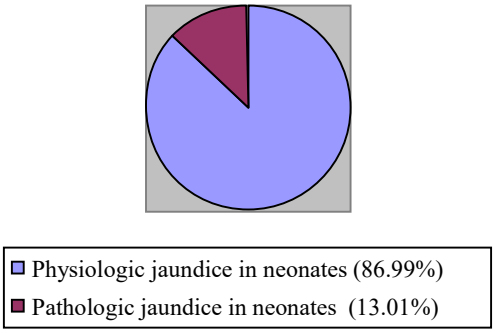

Figure 1: Pie diagram showing prevalence of jaundice in a group of 661 neonates born in Rockland Hospital, Delhi.

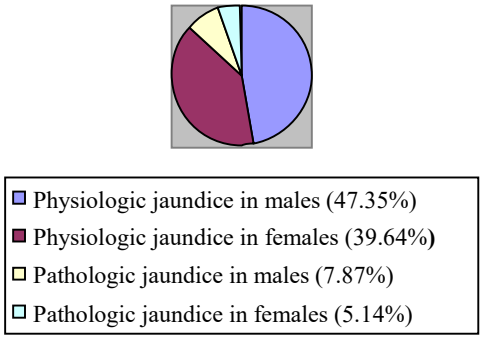

Figure 2: Pie diagram showing a comparison of prevalence of jaundice in males & females in a group of 661 neonates born in Rockland Hospital, Delhi.

In the present study, it is evident that the physiologic jaundice was seen in 86.99% (575) neonates {47.35% (313) males & 39.64% (262) females} and pathologic indirect hyperbilirubinemia was seen in 13.01% (86) neonates {7.87% (52) males & 5.14% (34) females}. The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant. Among these 13.01% (86) neonates with pathologic indirect hyperbilirubinemia, about 3.93% (26) neonates had TSB between 12mg/dL to 14.99mg/dL, 7.87% (52) neonates had TSB between 15mg/dL to 19.99mg/dL & 1.21% (8) neonates had TSB between 20mg/dL to 26mg/dL. In the present study, a late preterm neonate was again admitted on Day 21 of life, for persistent pathologic indirect hyperbilirubinemia. Besides, the association of pathologic jaundice with male gender was considered to be not statistically significant, in our study.

In the present study, it is evident that the physiologic jaundice was seen in 81.24% (537) term neonates (284 singleton males, 05 twin males, 6 twin females & 242 singleton females) & 5.75% (38) preterm neonates (21 singleton males, 13 singleton females, 1 twin female & 03 twin males). In the present study, it is also evident that the pathologic indirect hyperbilirubinemia was seen in 9.68% (64) term neonates (36 singleton males & 28 singleton females) & 3.33% (22) preterm neonates (15 singleton males, 6 singleton females & 01 twin male).

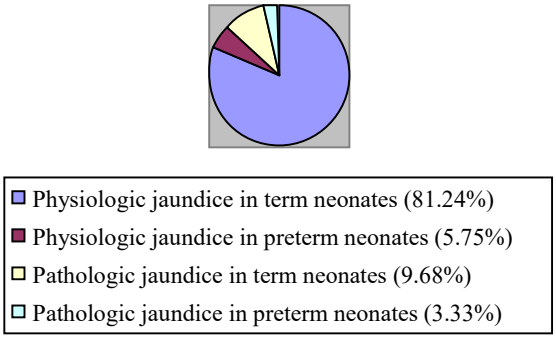

Figure 3: Pie diagram showing a comparison of prevalence of jaundice in term & preterm neonates in a group of 661 neonates born in Rockland Hospital, Delhi.

Neonates	Physiologic Jaundice	Pathologic Indirect Hyperbilirubinemia	Total
Term	537 (81.24%)	064 (09.68%)	601
Preterm	038 (05.75%)	022 (03.33%)	060
Total	575 (86.99%)	086 (13.01%)	661

Table 2: Table showing a comparison of prevalence of jaundice in term and preterm neonates in a group of 661 neonates born in Rockland Hospital, Delhi.

In the Table 2, the two-tailed P value was less than 0.0001***, in the Chi-square without Yates correction test and Fisher's exact test. The association between rows (Term & Preterm groups) and columns (Physiologic Jaundice & Pathologic Indirect Hyperbilirubinemia) was considered to be extremely statistically significant. Thus, in our study, preterm gestation showed a strong association with pathologic indirect hyperbilirubinemia.

In the present study, no neonate discharged from Rockland Hospital was reported to have kernicterus or cerebral palsy on follow up. Besides, the neonatal mortality rate (NMR) was zero during the period 01.01.2012 till 07.08.2014, in the Paediatrics Department in Rockland Hospital, Delhi, India. The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant.

DISCUSSION

For the present study, 661 neonates (645 singleton neonates & 16 twin neonates) were recorded and studied in Paediatrics Department in Rockland Hospital. These neonates were born alive to 653 mothers (42.88% primigravida and 57.12% multigravida) by LSCS in 70.75% cases and by vaginal delivery in 29.25% cases, in Obstetrics & Gynaecology Department in Rockland Hospital, during the period 01.01.2012 till 07.08.2014. [4] In our cross-sectional study of 661 neonates (601 term neonates & 60 preterm neonates), the results showed that almost all neonates had transient unconjugated hyperbilirubinemia in the neonatal period, with more than ninety percent affected during their first week of life. Hence neonates should be routinely followed for progress of jaundice in the first week of life. The prevalence of physiologic jaundice in neonates was 86.99% (81.24% in term neonates & 5.75% in preterm neonates) and the prevalence of pathologic indirect hyperbilirubinemia in neonates was 13.01% (9.68% in term neonates & 3.33% in preterm neonates). Among these 13.01% neonates with pathologic indirect hyperbilirubinemia, about 3.93% neonates had TSB between 12mg/dL to 14.99mg/dL, 7.87% neonates had TSB between 15mg/dL to 19.99mg/dL & 1.21% neonates had TSB between 20mg/dL to 26mg/dL. In our study, preterm gestation showed a strong association with pathologic indirect hyperbilirubinemia. In the present study, a late preterm neonate was again admitted on Day 21 of life, for persistent pathologic indirect hyperbilirubinemia. Besides, the association of pathologic jaundice with male gender was considered to be not statistically significant, in our study. In our study, no neonate discharged from Rockland Hospital was reported to have kernicterus or cerebral palsy on follow up. Besides, the neonatal mortality rate was zero, in our study.

Following references support our observations:

- Almost all hyperbilirubinemia in the immediate neonatal period is unconjugated. Physiologic hyperbilirubinemia occurs in almost all neonates. Shorter neonatal RBC life span increases bilirubin production; deficient conjugation due to the deficiency of UGT decreases clearance; and low bacterial levels in the intestine combined with increased hydrolysis of conjugated bilirubin increase enterohepatic circulation. Bilirubin levels can rise up to 18 mg/dL by 3 to 4 days of life (7 days in Asian infants) and fall thereafter. Physiologic jaundice generally lasts less than seven days. The condition affects over half of babies in the first week of life. Of babies that are born early about 80% are affected.[19]
- Transient neonatal jaundice is one of the most common conditions occurring in newborns (children under 28 days of age) with more than eighty percent affected during their first week of life.[16]
- Jaundice is observed during the 1st week after birth in approximately 60% of term infants and 80% of preterm infants.[14] [15]
- The prevalence of neonatal jaundice in healthy term babies at National District Hospital in Bloemfontein was 55.2%. Although 52% of sampled infants had jaundice on the Bilicheck® meter, only 17% appeared clinically jaundiced. The consequence of a missed diagnosis and delayed treatment may cause serious morbidity (kernicterus).[3]
- The incidence of neonatal hyperbilirubinemia in a retrospective study done in a tertiary care hospital was 13.47%. Preterm gestation showed a strong association with neonatal hyperbilirubinemia. [27]
- The neonatal morbidity was studied in 7015 neonates born at the All India Institute of Medical Sciences Hospital, New Delhi. Neonatal hyperbilirubinemia occurred in 5.9 per cent, most of whom were premature. [28]
- Hyperbilirubinemia is a common and, in most cases, benign problem in neonates. Overall, 6-7% of full term infants have indirect bilirubin levels >13mg/dL, and <3% have levels >15mg/dL. [15]
- The tragedy of occurrence of kernicterus is compounded by the fact that, if newborn jaundice and neonatal hyperbilirubinemia are detected early, kernicterus is completely preventable. All newborn infants are at risk for newborn jaundice, which when unmonitored or untreated can progress to excessive bilirubin levels.[26]
- In a retrospective study on 1020 patients admitted at a hospital during one year period 1st January 2012–31st December 2012, in 260 there was a diagnosis of indirect hyperbilirubinemia, associated pathology consisted of urinary tract infection in 15 cases, piodermatitis in 12, otitis media in 7, acute diarrhea in 14 cases and severe dehydration in 9 cases. Only one case complicated with kernicterus.[9]
- Neurotoxicity is the major consequence of neonatal hyperbilirubinemia. An acute encephalopathy can be followed by a variety of neurologic impairments, including cerebral palsy and sensorimotor deficits; cognition is usually spared. Kernicterus is the most severe form of neurotoxicity. Although it is now rare, kernicterus still occurs and can nearly always be prevented.[19]
- Common complications of preterm birth are high rates of respiratory distress syndrome, sepsis, periventricular leucomalacia, seizures, intraventricular hemorrhage, cerebral palsy, infections, pathologic jaundice, kernicterus, hypoxic ischemic encephalopathy, and visual and hearing problems. Complications of preterm birth were the leading cause of death in children younger than 5 years of age globally in 2016, accounting for approximately 16% of all deaths, and 35% of deaths among newborn babies. Preterm neonates who survive are at greater risk of a range of short-term and long-term morbidities. [30]
- Preterm birth is the most common cause of death among infants worldwide.[22] Complications from preterm births resulted in 0.81 million deaths in 2015 down from 1.57 million in 1990.[2][10] The chance of survival at 22 weeks is about 6%, while at 23 weeks it is 26%, 24 weeks 55% and 25 weeks about 72%.[6] The chances of survival without any long-term difficulties are lower.[14] Approximately 0.5% of births are extremely early periviable births, and these account for most of the deaths.[1]
- By pathologic criteria, kernicterus develops in 30% of infants (all gestational ages) with untreated hemolytic

disease and bilirubin levels >25-30 mg/dL. The incidence at autopsy in hyperbilirubinemic preterm infants is 2-16%. [15]

Following references don't support our observations:

- Bilirubin in LBW infants is significantly higher in males when compared with females.[29]
- Globally over 100,000 late-preterm and term babies die each year as a result of jaundice.[21]
- Neonatal mortality rate of India fell gradually from 85.2 deaths per thousand live births in 1969 to 22.7 deaths per thousand live births in 2018. [13]
- In the present study, the neonatal mortality rate (NMR) was zero. [4]

SUMMARY

In this study, the aim was to assess the prevalence of jaundice and kernicterus in a group of neonates born alive in a tertiary care hospital in Delhi, India. For the present study, 661 neonates (645 singleton neonates & 16 twin neonates) were recorded and studied in Paediatrics Department in Rockland Hospital. These neonates were born alive to 653 mothers, in Obstetrics & Gynaecology Department in Rockland Hospital, during the period 01.01.2012 till 07.08.2014. The study was done as random sampling of the neonates noticed to have deep yellow discoloration of whole body that were born in Rockland Hospital, Delhi. In this study, all the venous blood samples of neonates for Total Serum Bilirubin (TSB) and Direct Serum Bilirubin were collected during first 9 days of life, and in one case of persistent pathologic hyperbilirubinemia, the sample was again collected on Day 21 of life. Participants that satisfied the inclusion criteria were selected and the participants who did not meet the inclusion criteria were excluded. Neonates' history & investigations information was collected in questionnaires and the data was collected and reported, and then statistical analysis of data was performed using SPSS software. Calculations of P values were done using QuickCalcs-Graphpad Software. Chi-square test or Fisher's exact test was used to calculate the Two-tailed P values in our study.

In our cross-sectional study of 661 neonates (601 term neonates & 60 preterm neonates), the results showed that almost all neonates had transient unconjugated hyperbilirubinemia in the neonatal period, with more than ninety percent affected during their first week of life. The prevalence of physiologic jaundice in neonates was 86.99% (81.24% in term neonates & 5.75% in preterm neonates) and the prevalence of pathologic indirect hyperbilirubinemia in neonates was 13.01% (9.68% in term neonates & 3.33% in preterm neonates). Among these 13.01% neonates with pathologic indirect hyperbilirubinemia, about 3.93% neonates had TSB between 12mg/dL to 14.99mg/dL, 7.87% neonates had TSB between 15mg/dL to 19.99mg/dL & 1.21% neonates had TSB between 20mg/dL to 26mg/dL. In our study, preterm gestation showed a strong association with pathologic indirect hyperbilirubinemia. In the present study, a late preterm neonate was again admitted on Day 21 of life, for persistent pathologic indirect hyperbilirubinemia. In our study, no neonate discharged from Rockland Hospital was reported to have kernicterus or cerebral palsy on follow up. Besides, the Neonatal Mortality Rate was zero, in our study. The two-tailed P value was less than 0.0001***, in the Chi-square test, in all the above results. By conventional criteria, this difference was considered to be extremely statistically significant.

CONCLUSION

From this cross-sectional study of 661 neonates (601 term neonates & 60 preterm neonates), it is concluded that almost all neonates had transient unconjugated hyperbilirubinemia in the neonatal period, with more than ninety percent affected during their first week of life. The prevalence of physiologic jaundice in neonates was 86.99% (81.24% in term neonates & 5.75% in preterm neonates) and the prevalence of pathologic indirect hyperbilirubinemia in neonates was 13.01% (9.68% in term neonates & 3.33% in preterm neonates). Among these 13.01% neonates with pathologic indirect hyperbilirubinemia, about 3.93% neonates had TSB between 12mg/dL to 14.99mg/dL, 7.87% neonates had TSB between 15mg/dL to 19.99mg/dL & 1.21% neonates had TSB between 20mg/dL to 26mg/dL. In our study, preterm gestation showed a strong association with pathologic indirect hyperbilirubinemia. In the present study, a late preterm neonate was again admitted on Day 21 of life, for persistent pathologic indirect hyperbilirubinemia. In our study, no neonate discharged from Rockland Hospital was reported to have kernicterus or cerebral palsy on follow up. Besides, the Neonatal Mortality Rate was zero, in our study. By conventional criteria, this difference was considered to be extremely statistically significant.

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