Learnovate-International
An International Open-Access Journal Published By Lapain Press Publications [LPP]
Content Available at www.lapinjournals.com E-ISSN: 3049-1592
Research Article Open Access

EPIDEMIOLOGY, RISK FACTORS, AND CLINICAL OUTCOMES OF NEONATAL JAUNDICE: A PROSPECTIVE OBSERVATIONAL STUDY

Bujagouni Swapna[1]*, Thagaram Chandu[2], Nagilla Saidulu[2], Tokala Haritha Reddy[2], Acchugatla Shivarani[2], Surabhi Harsha[2], Hajira Begum[2]

[*1]Affiliation: Assistant Professor, Department of Pharmacy Practice, Smt. Sarojini Ramulamma College of Pharmacy, (Palamuru University), Seshadri Nagar, Mahabubnagar District, Telangana State, India.

[2]Affiliation: Pharm. D V year, Smt. Sarojini Ramulamma College of Pharmacy, (Palamuru University), Seshadri Nagar, Mahabubnagar District, Telangana State, India.

Article History: Received: 00 June 2025, Revised: 00 June 2025, Accepted: 26 Aug 2025

***Corresponding author**
Bujagouni Swapna

DOI: https://doi.org/10.70604/learnint.v2i3.85

Abstract

Neonatal jaundice is a highly common condition affecting over 80% of full-term and preterm infants, usually appearing within 2–4 days of birth due to increased total serum bilirubin (TSB) caused by heightened red blood cell breakdown and immature liver clearance. While most cases resolve spontaneously within 1–2 weeks, severe unconjugated hyperbilirubinaemia can lead to bilirubin encephalopathy, seizures, developmental delays, or even death, making early detection and treatment essential. This prospective six-month study was carried out in the Department of Paediatrics at SVS Medical College and Hospital, Mahabubnagar, involving 80 neonates to assess diagnosis, treatment approaches, and outcomes. Data collected included demographic details, bilirubin levels, type and severity of jaundice, and therapeutic responses. Results indicated a slight male predominance (53%) with the highest incidence in infants aged 1–10 days, while preterm infants were most affected (38%), highlighting their increased vulnerability due to immature liver function. The distribution of causes showed physiological jaundice and breast milk jaundice (25% each), pathological jaundice (20%), Rh incompatibility (17%), and ABO incompatibility (13%). Clinical presentation ranged from facial to generalised involvement, reflecting severity. Phototherapy was the main treatment (49%), followed by observation (31%), intravenous immunoglobulin (IVIG) (15%), and exchange transfusion (5%), emphasising its crucial role in preventing kernicterus. In conclusion, the study underscores that neonatal jaundice, although common, necessitates vigilant monitoring, early screening, and prompt intervention to minimise morbidity, especially in high-risk preterm infants.

Keywords: Neonatal jaundice, hyperbilirubinemia, bilirubin encephalopathy, phototherapy, exchange transfusion, preterm infants, neonatal outcomes

INTRODUCTION

Neonatal jaundice, defined as a clinical manifestation of elevated total serum bilirubin (TSB), is one of the most common conditions encountered during the first two weeks of life and remains a leading cause of neonatal hospital readmissions worldwide [1]. It affects approximately 60% of term and 80% of preterm infants, typically presenting within the first week after birth [2]. The condition arises from either unconjugated hyperbilirubinaemia (UHB) or conjugated hyperbilirubinaemia (CHB). UHB, which is more common, may be physiological or pathological. Physiological jaundice results from increased bilirubin production and immature hepatic clearance, whereas pathological UHB occurs when TSB rises above age-specific thresholds or increases by≥5 mg/dL/day [3, 3,4]. Causes of pathological UHB include immune-mediated haemolysis, such as ABO or Rh incompatibility [5, 6], red blood cell enzyme deficiencies, like glucose-6-phosphate dehydrogenase deficiency or pyruvate kinase deficiency [7, 8], and structural defects, such as hereditary spherocytosis or elliptocytosis [9, 10]. Other contributing factors include polycythaemia, intrauterine growth restriction, and delayed cord clamping, which increase bilirubin load. Decreased bilirubin clearance due to UGT enzyme deficiencies is observed in inherited disorders such as Gilbert syndrome and Crigler–Najjar syndrome [11]. CHB,

although less common, is always pathological and can result from infections, biliary atresia, or metabolic/genetic conditions [12]. If untreated, severe hyperbilirubinaemia may cause bilirubin-induced neurologic dysfunction (BIND), acute bilirubin encephalopathy, and kernicterus with long-term sequelae including cerebral palsy, hearing loss, and cognitive impairment [13]. Management depends on severity and aetiology: phototherapy remains the first-line treatment, converting bilirubin into excretable lumirubin [14], while exchange transfusion is reserved for severe cases that are unresponsive to phototherapy. Intravenous immunoglobulin (IVIG) is employed in immune-mediated haemolysis to reduce red cell destruction, though evidence for reducing exchange transfusion requirements is mixed [15]. Thus, neonatal jaundice, though often benign, requires vigilant monitoring, timely diagnosis, and appropriate treatment to prevent life-threatening complications and improve neonatal outcomes.

Materials and Methodology

Data Collection Procedure, Type, and Duration of Study

This study aims to investigate the diagnosis, treatment, and clinical outcomes of neonatal jaundice. Data will be collected from a sample of 80 newborns diagnosed with neonatal jaundice. The research uses a prospective observational design and will be conducted at the Department of Paediatrics, SVS Medical College and Hospital, Mahbubnagar. The study period is six months. Data collection will involve standardised forms and laboratory records, with subsequent analysis using suitable statistical methods. Parameters include patient demographic details, clinical signs (jaundice, lethargy, feeding difficulties), laboratory investigations (serum bilirubin levels, blood type, and related parameters), treatment options (phototherapy, exchange transfusion, intravenous immunoglobulin), and treatment outcomes. The primary goal is to offer valuable insights into diagnosing, managing, and understanding the outcomes of neonatal jaundice, thus aiding in enhancing neonatal care [16-19].

Study Setting and Source of Data

The study will be conducted in the Department of Paediatrics, SVS Medical College and Hospital, Mahbubnagar. Data sources will include patient case sheets, findings from physical examinations, bilirubin measurements, treatment records, and follow-up assessments.

Sample Size and Its Determination

The study will include 80 newborns diagnosed with neonatal jaundice. This sample size was determined to provide sufficient statistical power for evaluating treatment patterns and outcomes within the study duration [20,21].

Sample Selection Criteria

Inclusion Criteria

- Newborns diagnosed with neonatal jaundice.
- Preterm, term, and post-term infants.
- Parents willing to provide informed consent for participation.

Exclusion Criteria

- Neonates with signs of severe illness such as sepsis.
- Jaundice manifests within the first 24 hours of life.
- Newborns with birth asphyxia.
- Parents unwilling to provide consent.

Methodology

Neonatal jaundice is a prevalent clinical condition characterized by elevated bilirubin levels. The study will focus on the diagnosis, therapeutic interventions such as phototherapy and exchange transfusion, and the evaluation of outcomes. Data will be systematically entered into Microsoft Excel spreadsheets, and subsequent analyses will be performed using descriptive and inferential statistical methods. Descriptive statistics will summarize demographic and clinical variables, while inferential statistics such as the chi-square test and analysis of variance (ANOVA) will be used to evaluate associations and differences between groups. Prevalence and incidence rates will be calculated, and statistical significance will be determined at $p<0.05$ (95% CI). Following informed consent, eligible neonates will be enrolled, and data will be collected using a structured proforma including demographic details, bilirubin levels, treatment modalities, and follow-up findings[22,23].

Materials, Investigations, and Instruments

The study will utilize case record forms for systematic data collection. Clinical investigations will include physical examinations and serum bilirubin measurements, supplemented by transcutaneous bilirubin estimations when appropriate. Laboratory-based bilirubin testing and routine haematological investigations will be performed using standard hospital equipment. Treatment interventions, such as phototherapy and exchange transfusion, will be administered based on clinical requirements, and responses will be carefully monitored and documented [24-26].

Anticipated Risks and Mitigation

The study involves non-invasive or standard therapeutic procedures routinely used in the management of neonatal jaundice. No additional risks, lethal or sublethal, are anticipated for the study participants. All necessary precautions will be taken to ensure the safety and well-being of the neonates [27].

Data Analysis Procedure

All neonates presenting with jaundice will be screened, and those meeting the inclusion criteria with parental consent will be enrolled. A structured proforma will be used to record demographic, clinical, and laboratory data.

Parents will be counselled regarding treatment modalities, both before and after interventions. Following data collection, statistical analysis will be performed to evaluate the effectiveness of the treatment and patient outcomes. Results will be interpreted, and conclusions will be drawn to reflect the overall objectives of the study [28,29].

Statistical Methods

The collected data will be systematically entered into Excel spreadsheets. Frequency distribution tables will be generated, and descriptive statistics will be calculated. Associations between categorical variables will be tested using the chi-square test, while ANOVA will be applied to examine significance within and between groups. A significance level of $p<0.05$ will be considered statistically significant at a 95% confidence interval [30,31].

Statistical Package

Statistical analyses will be performed using the Statistical Package for the Social Sciences (SPSS) version 23 and GraphPad Prism version 9.

Collaboration

No external collaboration is involved in this study.

Ethical Clearance

The study protocol was reviewed and approved by the Institutional Ethics Committee of SVS Medical College and Hospital prior to initiation. Ethical clearance reference number: IEC/DHR-01/ (02/05)/2025/021/5.

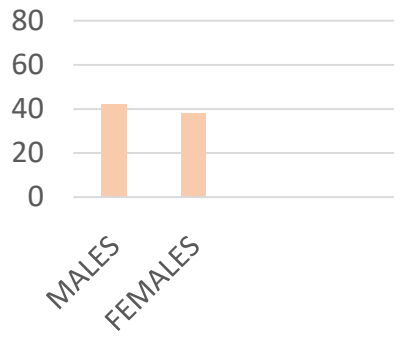
Results and Discussion

Distribution of Patients Based on Gender

In the present study of 80 neonates with jaundice, a slight male predominance was observed, with 42 males (53%) and 38 females (47%). This indicates a marginally higher occurrence of jaundice in male infants compared to females (Fig. 1). Similar gender-related trends have been reported in previous studies, suggesting that physiological factors, such as liver maturity and red blood cell turnover, may play a role in this disparity. However, further studies are required to establish a definitive correlation. The details are presented in Table 1, which shows the distribution of patients according to gender.

Table 1: Distribution of Patients Based on Gender

Gender	Number Of Patients	Percentage
Males	42	53%
Females	38	47%
Total	80	100%



Distribution Based on Gestational Age

When stratified by gestational age, the highest prevalence of jaundice was observed among preterm neonates, accounting for 30 cases (38%), compared with 29 term neonates (36%) and 21 post-term neonates (26%). This demonstrates that preterm infants are more vulnerable to hyperbilirubinemia, likely due to immature liver function, higher hemolysis rates, and reduced albumin levels that impair bilirubin metabolism. These results highlight the importance of early detection and management of jaundice in preterm infants. The gestational age-wise distribution is presented in Table 3.

Table 3: Distribution of Neonates Based on Gestational Age

Gestational Age	Number of Patients	Percentage (%)
Term	29	36%
Preterm	30	38%
Post-term	21	26%
Total	**80**	**100%**

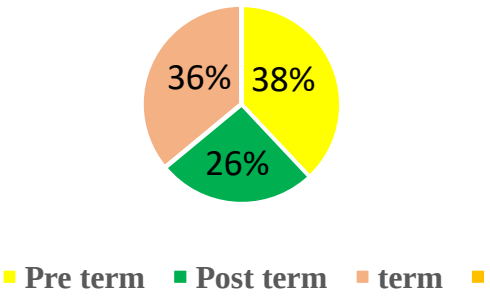


Fig.3: Pie chart shows distribution based on Gestational Age

Distribution Based on Type of Jaundice

The etiological classification of jaundice in the study cohort showed a diverse spectrum of causes. Physiological jaundice and breast milk jaundice were the most frequent, each occurring in 20 neonates (25%). Pathological

jaundice was noted in 16 neonates (20%), while Rh incompatibility accounted for 14 cases (17%) and ABO incompatibility for 10 cases (13%). This distribution highlights the multifactorial etiology of neonatal jaundice, with both physiological and pathological components contributing significantly to disease burden. The details are provided in Table 4, which presents the distribution of neonates according to the type of jaundice.

Table 4: Distribution of Neonates Based on Type of Jaundice

Type of Jaundice	Number of Patients	Percentage (%)
ABO Incompatibility	10	13%
Rh Incompatibility	14	17%
Pathological	16	20%
Physiological	20	25%
Breast Milk Jaundice	20	25%
Total	**80**	**100%**

Distribution Based on Affected Body Parts According to Kramer's Rule

The extent of jaundice was assessed using Kramer's rule, which correlates visible body region involvement with serum bilirubin levels. Jaundice limited to the face was observed in 17 neonates (21%), while involvement of the face and trunk was seen in 19 neonates (24%). An equal number of neonates (19; 24%) showed extension of jaundice to the thighs, while 9 neonates (11%) had further progression to the arms. The most severe involvement, covering the whole body including the palms and soles, was recorded in 16 neonates (20%). The corresponding bilirubin ranges associated with these sites of involvement are also detailed in Table 5. A visual representation is provided in Fig.4, which clearly demonstrates the distribution pattern according to Kramer's zones.

Table 5: Distribution of Neonates Based on Affected Body Parts According to Kramer's Rule

Affected Body Parts	Serum Bilirubin (mg/dL)	Number of Patients	Percentage (%)
Face	4–6	17	21%
Face + Trunk	8–10	19	24%
Face + Trunk + Thighs	12–14	19	24%
Face + Trunk + Thighs + Arms	15–18	9	11%
Whole Body (incl. Palms/Soles)	≥19	16	20%
Total	—	**80**	**100%**

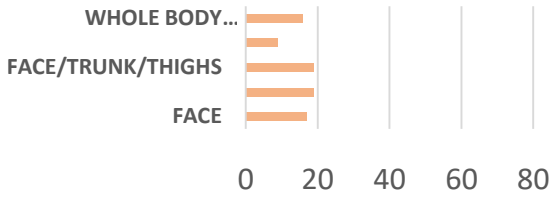


Fig.4: Bar Graph Shows Distribution Based on Affected Body Parts According to Kramer's Rule

Distribution Based on Treatment

The management of neonatal jaundice in the study population was carried out according to standard clinical protocols. Phototherapy was the most frequently used treatment modality, administered in 39 neonates (49%). Observation alone, without active intervention, was sufficient in 25 cases (31%), where bilirubin levels remained below treatment thresholds. Intravenous immunoglobulin (IVIG) was administered to 12 neonates (15%), predominantly in cases of isoimmune hemolytic disease, such as Rh or ABO incompatibility. Exchange transfusion, the most invasive intervention, was required in 4 neonates (5%) who had severe hyperbilirubinemia unresponsive to intensive phototherapy. These findings highlight phototherapy as the cornerstone of treatment, while underlining the importance of escalation in cases that are severe or refractory. The distribution of treatment modalities is summarised in Table 6.

Table 6: Distribution of Neonates Based on Treatment

Treatment Method	Number of Patients	Percentage (%)
Phototherapy	39	49%
Observation Only	25	31%
Exchange Transfusion	4	5%
Intravenous Immunoglobulins (IVIG)	12	15%
Total	**80**	**100%**

Conclusion

The present study, conducted on 80 neonates diagnosed with neonatal jaundice over a six-month period, provides valuable insights into its epidemiology, risk factors, clinical presentation, and management strategies. The findings revealed a slight male predominance, with 53% of cases occurring in males compared to 47% in females, and demonstrated that the onset of jaundice most commonly appeared within the first 1–5 days of life, reflecting the

pattern of physiological jaundice. Preterm infants emerged as the most vulnerable group, accounting for 38% of cases, underscoring the role of hepatic immaturity in increasing susceptibility. Both pathological and physiological jaundice were frequently observed, emphasizing the importance of careful clinical differentiation and individualized treatment planning. The clinical distribution of jaundice followed the classical cephalocaudal progression, with predominant involvement of the face, trunk, and thighs. Among therapeutic interventions, phototherapy was the most commonly employed, highlighting its central role in preventing complications such as kernicterus. Overall, the study reinforces the importance of early screening, timely initiation of treatment, and targeted management, particularly in high-risk preterm infants, to minimize morbidity and improve neonatal outcomes.

Limitations

This study was limited by its relatively short duration of six months and a small sample size of 80 neonates, which constrains the generalizability of its findings. Furthermore, long-term outcomes following treatment, particularly neurodevelopmental effects, were not assessed, which limits the ability to evaluate the full impact of neonatal jaundice and its management. These limitations suggest that while the study provides meaningful preliminary insights, larger and more comprehensive investigations are needed to draw broader conclusions.

Recommendations

Future research should be extended over a longer duration with inclusion of a larger number of cases across multiple centers to enhance the representativeness of findings and improve generalizability. Further studies should also focus on long-term outcomes, particularly the neurodevelopmental impact of neonatal jaundice and its treatment, in order to better understand quality of life implications. Additionally, more detailed evaluations of various therapeutic regimens, adverse drug reactions, and drug–drug interactions associated with different management approaches are warranted. Collaborative, multi-institutional studies are recommended to generate more robust evidence, facilitate standardized treatment protocols, and improve neonatal healthcare outcomes.

Funding

Nil

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Acknowledgment

The authors express their sincere gratitude to the Dr. K. Shailaja, MBBS, DNB Paediatrics, Professor and HOD, Department of Paediatrics at SVS Medical College and Hospital, Mahabubnagar, for providing facilities and clinical support during the study. We also thank the patients who consented to participate in this research.

Author Contributions

Bujagouni Swapna conceptualised and designed the study, supervised data collection, and finalised the manuscript draft. Thagaram Chandu contributed to methodology design, data acquisition, and statistical analysis. NagillaSaidulu and Tokala Haritha Reddy were involved in clinical data collection, literature review, and preparation of results. AcchugatlaShivarani and Surabhi Harsha assisted in drafting the introduction, background, and discussion sections. Hajira Begum contributed to editing, proofreading, and formatting of the manuscript.

Ethical Statement

The study protocol was reviewed and approved by the Institutional Ethics Committee of SVS Medical College and Hospital, Mahbubnagar (Reference No: IEC/DHR-01/(02/05)/2025/021/5).

References

1. Maisels MJ, McDonagh AF. Phototherapy for neonatal jaundice. N Engl J Med. 2008;358(9):920-8.
2. Bhutani VK, Wong RJ. Bilirubin neurotoxicity in preterm infants: risk and prevention. Clin Perinatol. 2016;43(2):341-55.
3. Watchko JF. Hyperbilirubinemia and bilirubin toxicity in the late preterm infant. Clin Perinatol. 2006;33(4):839-52.
4. American Academy of Pediatrics Subcommittee on Hyperbilirubinemia. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics. 2004;114(1):297-316.
5. Rennie JM, Burman-Roy S, Murphy MS. Neonatal jaundice: summary of NICE guidance. BMJ. 2010;340:c2409.
6. Christensen RD, Yaish HM. Hemolytic disorders causing severe neonatal hyperbilirubinemia. Clin Perinatol. 2016;43(2):341-54.
7. Valaes T. Severe neonatal jaundice associated with glucose-6-phosphate dehydrogenase deficiency: pathogenesis and global epidemiology. Acta Paediatr Suppl. 1994;394:58-76.
8. Kaplan M, Hammerman C. Bilirubin and the genome: the hereditary basis of unconjugated neonatal hyperbilirubinemia. Curr Pharm Des. 2009;15(25):3032-42.
9. Newman TB, Maisels MJ. Evaluation and treatment of jaundice in the term newborn: a kinder, gentler approach. Pediatrics. 1992;89(5 Pt 1):809-18.
10. Olusanya BO, Teeple S, Kassebaum NJ. The global burden of neonatal jaundice: a systematic review. BMC Pediatr. 2018;18(1):47.

11. Kaplan M, Hammerman C. Glucose-6-phosphate dehydrogenase deficiency: a hidden risk for kernicterus. Semin Perinatol. 2004;28(5):356-64.
12. Slusher TM, Zamora TG, Appiah D, Stanke JU, Strand MA, Lee BW, et al. Burden of severe neonatal jaundice: a systematic review and meta-analysis. BMJ Paediatr Open. 2017;1(1):e000105.
13. Watchko JF, Tiribelli C. Bilirubin-induced neurologic damage—mechanisms and management approaches. N Engl J Med. 2013;369(21):2021-30.
14. Bhutani VK, Johnson LH. Kernicterus in late preterm infants cared for as term healthy infants. Semin Perinatol. 2006;30(2):89-97.
15. Papachristou GI, Muddana V, Yadav D, O'Connell M, Sanders MK, Slivka A, et al. Comparison of BISAP, Ranson's, APACHE-II, and CTSI scores in predicting complications and mortality. Am J Gastroenterol. 2010;105(2):435-41.
16. Pérez-Nombela S, Álvarez-Bueno C, Hidalgo-Robles Á, Ruiz-Becerro I, Fernández-Rego FJ. Neonatal hyperbilirubinemia and repercussions on neurodevelopment: a systematic review. Child Care Health Dev. 2022;48(6):935-45. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/cch.13183
17. Zahed Pasha Y, Alizadeh-Tabari S, Zahed Pasha E, Zamani M. Etiology and therapeutic management of neonatal jaundice in Iran: a systematic review and meta-analysis. World J Pediatr. 2020;16(6):586-95.
18. Kirk JM. Neonatal jaundice: a critical review of the role and practice of bilirubin analysis. Ann Clin Biochem. 2008;45(Pt 5):452-62.
19. Gottimukkala SB, Lobo L, Gautham KS, Bolisetty S, Fiander M, Schindler T. Neonatal jaundice. Lancet Child Adolesc Health. 2023;7(4):241-56. PMID: 36867730.
20. Abbey P, Kandasamy D, Naranje P. Neonatal jaundice. Indian J Pediatr. 2019;86(2):171-8. PMID: 30790186.
21. Shahbazi M, Khazaei S, Moslehi S, Shahbazi F. Effect of massage therapy for the treatment of neonatal jaundice: a systematic review and dose-response meta-analysis. Iran J Pediatr. 2022;32(2):e114641.
22. Zhang M, Tang J, He Y, Li W, Chen Z, Xiong T, et al. Systematic review of global clinical practice guidelines for neonatal hyperbilirubinemia. BMC Pediatr. 2021;21(1):56. PMID: 7817798.
23. Olusanya BO, Teeple S, Kassebaum NJ. Burden of severe neonatal jaundice: a systematic review and meta-analysis. BMC Pediatr. 2018;18(1):44. PMID: 5862199.
24. Westenberg LEH, Been JV, Willemsen SP, Vis JY, Tintu AN, Bramer WM, et al. Diagnostic accuracy of portable, handheld point-of-care tests vs laboratory-based bilirubin quantification in neonates: a systematic review and meta-analysis. JAMA Pediatr. 2023;177(4):366-75.
25. Iqbal J, Sharma S, Naaz B. Study of aetiological factors and clinical profiles of neonatal jaundice in the special newborn care unit of a tertiary care hospital in Jammu and Kashmir. Int J Res Med Sci. 2023;11(5):11738.
26. Olusanya BO, Kaplan M, Hansen TWR. Neonatal hyperbilirubinemia: a global perspective. Lancet Child Adolesc Health. 2018;2(8):610-20.
27. Chang YS, Hwang JH, Kwon HN, Choi CW, Ko SY, Park WS, et al. In vitro and in vivo efficacy of new blue light emitting diode phototherapy compared to conventional halogen quartz phototherapy for neonatal jaundice. J Korean Med Sci. 2005;20(1):61-8.
28. Seidman DS, Moise J, Ergaz Z, Laor A, Vreman HJ, Stevenson DK, et al. A prospective randomized controlled study of phototherapy using blue and blue-green light-emitting devices, and conventional halogen-quartz phototherapy. Acta Paediatr. 2003;92(3):327-31.
29. Kaplan M, Hammerman C. American Academy of Pediatrics guidelines for detecting neonatal hyperbilirubinaemia and preventing kernicterus. Arch Dis Child Fetal Neonatal Ed. 2005;90(6):F448-9. PMID: 16244203.
30. Tan KL. The nature of the dose-response relationship of phototherapy for neonatal hyperbilirubinemia. J Pediatr. 1977;90(3):448-52. PMID: 839123.
31. Maisels MJ. Why use homeopathic doses of phototherapy? Pediatrics. 1996;98(2 Pt 1):283-7. PMID: 8701749.