

Neonatal Jaundice: Assessment and Phototherapy Nursing Care

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ABSTRACT

Neonatal jaundice is a common clinical condition affecting nearly 60% of term infants and 80% of preterm infants during the first week of life. It results from elevated serum bilirubin levels due to immature hepatic function, increased bilirubin production, or impaired excretion. Early recognition and timely intervention are essential to prevent complications such as acute bilirubin encephalopathy and kernicterus. This paper discusses the etiology, clinical assessment, risk identification, and diagnostic evaluation of neonatal jaundice. Further, it highlights the principles and nursing considerations in phototherapy—the standard treatment modality used to reduce bilirubin levels. Nursing responsibilities such as maintaining thermal stability, monitoring hydration, preventing phototherapy-related complications, maintaining eye protection, and ensuring parental education are emphasized. A table presenting bilirubin classification and a figure illustrating phototherapy setup are included to support clinical understanding.

KEYWORDS: *Neonatal jaundice, hyperbilirubinemia, phototherapy, bilirubin assessment, nursing care, newborn health.*

INTRODUCTION

Neonatal jaundice is one of the most frequently encountered clinical conditions in newborn care worldwide, affecting a majority of infants within the first week of life. It manifests as a yellowish discoloration of the skin, mucous membranes, and sclera due to the accumulation of bilirubin—a by-product of hemoglobin breakdown. In most infants, this condition is benign

and self-limiting; however, in a subset of newborns, bilirubin levels can rise rapidly to potentially dangerous concentrations. If untreated, severe hyperbilirubinemia may lead to acute bilirubin encephalopathy or chronic neurological damage known as kernicterus.

The neonatal period is uniquely susceptible to hyperbilirubinemia because of physiological immaturity. Liver conjugating enzymes are underdeveloped, red blood cell turnover is high, and enterohepatic circulation remains active. While these normal physiological mechanisms account for *physiologic jaundice*, several pathological factors may further increase bilirubin production or reduce elimination. Thus, the ability to differentiate physiologic jaundice from more serious conditions is a vital clinical skill in neonatal practice.

Globally, the burden of severe jaundice remains significant, especially in low- and middle-income countries where delayed diagnosis, limited access to phototherapy, inadequate breastfeeding support, and lack of parental awareness contribute to higher morbidity and mortality rates. Nurses, being primary caregivers in neonatal units, play a central role in assessment, monitoring, and implementing appropriate therapeutic interventions. Their competence in early risk identification and parental education is fundamental to preventing complications. This paper provides an in-depth discussion of the etiology, assessment, phototherapy management, and nursing considerations essential for high-quality neonatal care.

ETIOLOGY OF NEONATAL JAUNDICE

The etiology of neonatal jaundice can be multifactorial, involving physiological, pathological, and breastfeeding-related mechanisms. Understanding these causes is crucial for accurate diagnosis and appropriate treatment.

Physiological Causes

Physiologic jaundice is the most common type and usually appears between 24 to 72 hours of life. It occurs due to several normal developmental factors:

- **Increased hemolysis:** Newborns have higher red blood cell mass and shorter RBC lifespan compared to adults, leading to increased bilirubin production.
- **Immature liver metabolism:** The enzyme UDP-glucuronyl transferase, responsible for bilirubin conjugation, is not fully developed in neonates.

- **Increased enterohepatic circulation:** Limited intestinal motility and sterile gut conditions lead to reabsorption of unconjugated bilirubin back into the bloodstream.

Pathological Causes

Pathological jaundice typically appears within the first 24 hours or shows rapid progression.

Common causes include:

- **Hemolytic diseases:** ABO and Rh incompatibility remain major contributors. Hemolytic anemia increases bilirubin formation beyond the liver's capacity to conjugate.
- **G6PD deficiency:** A genetic condition that increases susceptibility to oxidative stress, resulting in hemolysis.
- **Infections:** Neonatal sepsis can lead to hepatic dysfunction and cholestasis, thereby impairing bilirubin clearance.
- **Endocrine and metabolic disorders:** Hypothyroidism and galactosemia can reduce bilirubin metabolism.
- **Birth trauma:** Cephalohematoma or bruising increases the breakdown of extravasated blood.

Breastfeeding-Related Jaundice

Breastfeeding impacts bilirubin levels through two mechanisms:

- **Breastfeeding jaundice (early-onset):** Appears in the first week, mainly due to insufficient breast milk intake, dehydration, and delayed meconium passage.
- **Breast milk jaundice (late-onset):** Appears after 5–7 days and may persist for several weeks. Certain substances in breast milk may inhibit bilirubin conjugation; however, infants typically remain healthy and feeding should continue.

CLINICAL ASSESSMENT OF NEONATAL JAUNDICE

Accurate and timely assessment is essential to detect infants at risk of severe hyperbilirubinemia. Assessment includes visual examination, laboratory testing, risk identification, and structured monitoring.

Visual Assessment

A clinical examination under natural light remains the first step in jaundice detection. The Kramer scale is commonly used to estimate bilirubin levels by observing cephalocaudal progression of yellow discoloration. However, visual assessment alone is unreliable, especially in dark-skinned infants, and must always be supplemented with objective measurements.

Objective Bilirubin Measurement

- **Total Serum Bilirubin (TSB):** Blood sampling provides the most accurate bilirubin level and is used to determine the need for phototherapy or exchange transfusion.
- **Transcutaneous Bilirubin (TcB):** A non-invasive technique widely used for screening. TcB measurements reduce blood sampling, especially in term infants, but abnormal results must be confirmed with TSB.

Risk Factor Evaluation

Nurses should assess for risk factors predisposing infants to severe hyperbilirubinemia:

- Prematurity (incomplete liver maturity)
- Hemolytic disease (positive Coombs test)
- Family history of neonatal jaundice
- Male infants (slightly higher risk)
- Significant bruising or cephalohematoma
- Poor feeding or weight loss >10%
- Asian ethnicity (higher predisposition in many populations)

Monitoring and Documentation

Continuous assessment every 8–12 hours is essential during the neonatal period. Documentation of bilirubin trends, feeding patterns, and clinical signs is critical for decision-making.

PHOTOTHERAPY IN NEONATAL JAUNDICE

Phototherapy is the cornerstone of hyperbilirubinemia management and is considered safe, effective, and widely accessible.

Mechanism of Action

Phototherapy utilizes blue-green light (wavelength 420–500 nm) to convert unconjugated bilirubin into structural and configurational isomers. These photoisomers are water-soluble and can be excreted in bile or urine without the need for hepatic conjugation. This bypasses immature liver pathways in newborns.

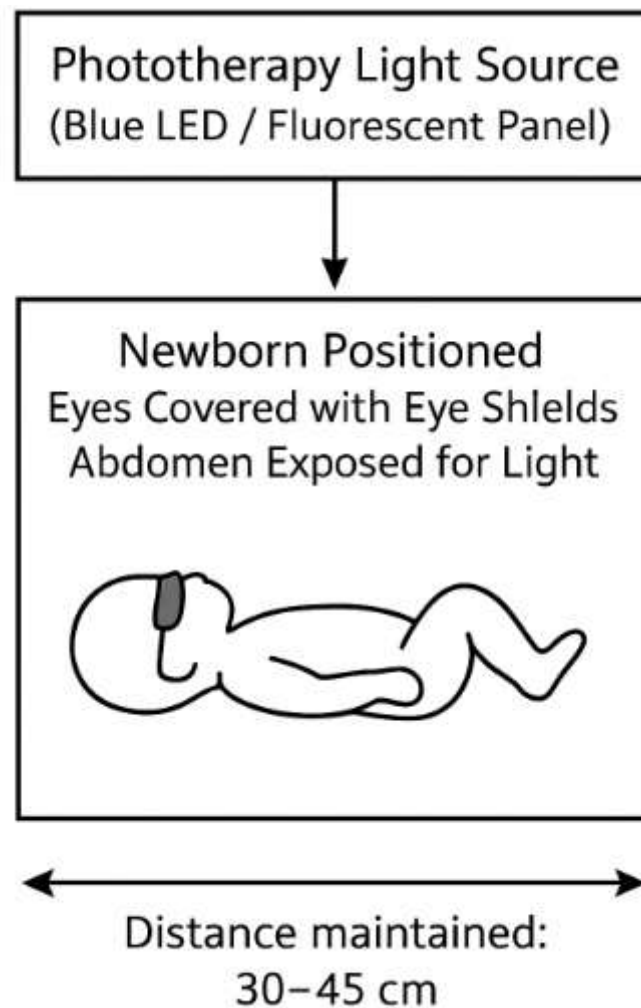


Figure 1: Schematic representation of a standard phototherapy setup used for treating neonatal jaundice, showing proper infant positioning, eye protection, and recommended light distance.

Types of Phototherapy Units

- **Conventional fluorescent lamps:** Older but effective systems widely used in many hospitals.

- **LED phototherapy units:** Preferred due to high irradiance, energy efficiency, lower heat emission, and longer lifespan.
- **Fiber-optic phototherapy:** Allows easy handling and can be used for breastfeeding infants; however, light intensity may be lower than overhead units.

Indications and Treatment Thresholds

Treatment is guided by nomograms based on infant's **gestational age, weight, and hours of life**. Preterm infants require earlier interventions due to increased vulnerability.

Monitoring During Phototherapy

Nurses must regularly assess temperature, hydration, skin condition, bilirubin levels, and effectiveness of therapy. Intensity (irradiance) should be measured using a photoradiometer.

NURSING CARE DURING PHOTOTHERAPY

Nursing care is pivotal in ensuring safe and effective phototherapy. The nurse must prevent complications, ensure accurate monitoring, and support family involvement.

Pre-therapy Responsibilities

- Verify physician orders and treatment thresholds.
- Assess baseline vital signs, bilirubin level, and skin integrity.
- Provide education to parents about procedure and benefits.
- Remove all clothing except diaper to maximize skin exposure.

Care During Therapy

- Maintain appropriate distance (usually 30–45 cm) between the infant and light source.
- Ensure eye shields are correctly positioned to prevent retinal damage.
- Change infant positioning every 2 hours to expose different skin areas.
- Monitor vital signs, temperature, hydration, and urine output frequently.
- Encourage breastfeeding to promote bilirubin excretion.
- Avoid lotions or creams which can absorb light and heat.
- Ensure adequate hydration, especially in exclusively breastfed infants.

Managing Complications

- **Hyperthermia or hypothermia:** Adjust warmer or light distance.
- **Skin rashes:** Keep infant dry; monitor for signs of sensitivity.
- **Diarrhea and dehydration:** Increase feeding frequency.
- **Bronze baby syndrome:** Occurs in cholestatic jaundice; notify physician immediately and reassess therapy.

Post-therapy Care

- Remove eye patches after phototherapy stops.
- Assess for rebound jaundice within 12–24 hours.
- Provide parents with discharge advice and follow-up schedule.

PARENT EDUCATION

Parent involvement is essential because jaundice often progresses after discharge.

Nurses should teach parents to:

- Identify early signs of jaundice such as yellowing of skin, poor feeding, lethargy.
- Monitor infant feeding frequency (8–12 feeds per day).
- Encourage effective breastfeeding and avoid unnecessary supplementation unless advised.
- Follow scheduled bilirubin checks.
- Maintain proper hydration and adequate sunlight exposure if recommended.
- Understand phototherapy procedures, duration, and safety measures.
- Seek urgent care if infant becomes excessively sleepy, refuses feeds, or shows worsening discoloration.

DISCUSSION

- Neonatal jaundice continues to pose a major clinical and public health challenge. While physiological jaundice is benign, the potential for rapid bilirubin increases and neurological damage underscores the need for timely identification. Advances in screening tools such as transcutaneous bilirubinometers, standardized treatment guidelines, and widespread availability of LED phototherapy have significantly reduced the incidence of kernicterus globally.

- However, disparities remain—particularly in resource-limited settings where access to diagnostic tools and phototherapy equipment is constrained. Lack of parental awareness, early discharge policies, cultural beliefs, and inadequate breastfeeding support further contribute to late presentations of severe jaundice.
- Nurses serve as crucial frontline providers in neonatal care. Their skills in bilirubin monitoring, recognizing high-risk infants, and preventing therapy complications directly influence outcomes. Additionally, comprehensive parent education ensures continuity of care after discharge and reduces the likelihood of delayed treatment.
- Strengthening neonatal nursing education, improving infrastructure for bilirubin screening, and ensuring universal access to safe phototherapy are essential strategies for reducing the global burden of hyperbilirubinemia-related complications.

CONCLUSION

Neonatal jaundice is a prevalent but manageable condition when identified early and treated appropriately. Phototherapy is highly effective in reducing bilirubin levels and preventing neurological complications. Nursing care remains central to ensuring safe phototherapy use, monitoring for complications, maintaining hydration and thermoregulation, and educating parents. A structured assessment approach, combined with vigilant monitoring and adherence to treatment guidelines, significantly improves newborn outcomes and prevents long-term developmental impairments.

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