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# A comparative study to determine continuous versus intermittent phototherapy for reducing neonatal hyperbilirubemia at Saveetha Hospitals, Thandalam

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**Abstract**
**Background:** The aim of the study was to compare and determine Continuous versus intermittent phototherapy in reducing neonatal hyperbilirubinemia.
**Methods:** 60 neonates were randomly divided into two groups Group A and Group B. Group A Consist of 30 neonates. Group B consisting 30 neonates. Group A receives continuous phototherapy with on and off for two and half hour. Group B receives intermittent phototherapy for on and off one hour**.**
**Results:** In pretest maximum of them were of falling on moderate (46.67%), In posttest maximum of them were with mild level of bilirubin in group A. In pretest maximum of were with moderate (43.33%), in posttest also they were with moderate (43.33%) in group B. The table clearly states that, a group A who continuous phototherapy had significant reduction at level of pain $p<0.001$ and group B, who had intermittent phototherapy has no effect in posttest.
**Conclusion:** The study findings revealed that continuous phototherapy group I is more effective than the Intermittent phototherapy group II. Hence its continuous phototherapy reduce the bilirubin level among babies with hyperbilirubinemia.

**Keywords:** Hyperbilirubemia, versus, phototherapy

## Introduction

The most popular kind of therapy for the treatment and prevention of neonatal unconjugated hyperbilirubinemia is phototherapy [1]. Given the extensive history of its usage in the United States and Europe and the absence of any long-term side effects associated with short term phototherapy to date, phototherapy appears to be safe [2]. The gold standard of care for treating newborn jaundice is phototherapy (PT) [3]. Because of their immature livers and higher red blood cell turnover, infants are more prone to jaundice caused by elevated indirect bilirubin levels. It can occur in up to 80% of premature babies, with so-called physiological jaundice predominating. Due to the immaturity of the blood-brain barrier, bilirubin may penetrate neurological tissues at lower serum levels in premature newborns, increasing the risk [4].

Nearly all icteric neonates can benefit from phototherapy, which lowers their total serum bilirubin levels. Three distinct ways of phototherapy can lower the total serum bilirubin levels in newborns (photoisomerization, structural isomerization, and photooxidation). During phototherapy, more than 80% of bilirubin is eliminated by the photoisomerization pathway [5]. Negative long-term effects of brief phototherapy The following side effects of phototherapy have been reported thus far: skin rash, increased insensible losses, retinal damage, overheating, and changes to increased intestinal flow [6].

When bilirubin builds up in the skin and mucous membranes, it causes jaundice, which is a yellow coloring of the skin and sclera. It is the most prevalent clinical issue among newborns that needs medical treatment. 60% of term and 80% of preterm newborns are affected. In our region, 39.7 infants per 1000 live births experience neonatal jaundice. Unconjugated bilirubin is a by product of the breakdown of heme proteins, and elevated quantities may be neurotoxic [7].

Nearly 65% of full-term and preterm infants exhibit clinical jaundice, and about 97% of them exhibit biochemical hyperbilirubinemia (serum bilirubin > 1 mg/dl). In the early neonatal period, it is the most frequent reason for readmission. According to the American Academy of Pediatrics, newborns who are released from the hospital within 48 hours should go back within 48 to 72 hours incase there is any serious jaundice or other issues [8].

In India, the prevalence of jaundice ranges from 54.6% to 77%. The most prevalent illness in the first week of life is jaundice, which affects 60% of term and 80% of preterm babies. When newborns receive phototherapy, their skin is exposed to specific light wavelengths (blue and white), which cause bilirubin to change into a water-soluble isomer. This bilirubin isomer excretes with ease. Compact fluorescent bulbs or light emitting diodes can be used for phototherapy [9].

Normal bilirubin production in newborns is 6–8 mg/kg, which is twice as much as in adults. However, because the conjugate enzyme is insufficient, the level of unconjugated bilirubin rises over time before steadily falling. High amounts of bilirubin can lead to neurotoxicity, which can result in kernicterus, cognitive decline, muscle tone issues, deafness, and occasionally even death [10]. While intensive (double) phototherapy causes blood bilirubin levels to drop more quickly than conventional (single) phototherapy, more severe rebound effects could happen [11].

One of the biggest issues in the neonatal period around the world, particularly in Asia and underdeveloped a nations, is excessive bilirubin levels. According to a study by Maisles, 8% to 4.2% of newborns have hyperbilirubinemia within the first week of life. Yahya and colleagues did another study in

a hospital in Indonesia and discovered a prevalence of neonatal hyperbilirubinemia of about 4.08%, making cases of excess bilirubin levels in newborns a common occurrence and one of the issues with babies in hospitals. Acute bilirubin encephalopathy, which is brought on by high bilirubin levels in extreme stages, results in deafness and a failure to establish permanent nerves [12].

Newborns show clinical signs which tend to start on the head and face and then spread down the trunk and limbs as a result of high serum levels of bilirubin.

Jaundice in newborns is a result of increased release of haemoglobin from breakdown of red cells due to high haemoglobin at birth, as well as due to reduced lifespan of newborn red blood cells (70–80 days) compared to that of adults (90–120 days), and reduced hepatic metabolism of bilirubin due to immature hepatocytes.

Most of this newborn hyperbilirubinemia is a natural transition which resolves by the first week of life with maturing of the liver [13].

## Methodology

### Study approach and design

Quantitative approach with Experimental pre- test posttest design was used to compare the level of bilirubin in continuous and Intermittent phototherapy for determining the reduction of hyperbilirubinemia in neonatal jaundice.

### Study duration

The study was conducted for the Duration of 2 months in the Neonatal Intensive Care Unit of saveetha hospitals.

### Ethical approval

After obtaining the ethical clearance from the institutional ethical committee of saveetha Institute of medical and technical sciences and a formal Permission from the Department of obstetrics and gynaecology the study was conducted.

### Study participants

A total of 60 Neonates who meets the inclusion criteria were recruited as study participants. The inclusion criteria includes neonates with bilirubin level above 5mg/ dl, Babies weighing from 1.5 kg to 3kg, Neonates at saveetha hospitals. The exclusion criteria includes neonates on the ventilator, endotracheal incubation and with any congenital malformation.

### Sampling technique

Probability (simple random sampling technique) was used.

### Methods

60 neonates were randomly divided into two groups Group A and Group B. Group A Consist of 30 neonates. Group B consisting 30 neonates. Group A receives continuous phototherapy with on and off for two and half hour. Group B receives intermittent phototherapy for on and off one hour**.**

## Results and discussion

**Section A:** description of the demographic variables of the demographic population.

**Table 1:** Frequency and percentage distribution of demographic variables of the both the groups.

N = 60(3+30)

| Demographic Variables | A Group | | B Group | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Age in days | | | | |
| 1-10 days | 8 | 26.7 | 6 | 20.0 |
| 11-20 days | 10 | 33.3 | 9 | 30.0 |
| 21-28 days | 12 | 40.0 | 15 | 50.0 |
| Gender | | | | |
| Male | 25 | 83.3 | 24 | 80.0 |
| Female | 5 | 16.7 | 6 | 20.0 |
| Religion | | | | |
| Hindu | 17 | 56.7 | 11 | 36.7 |
| Christian | 4 | 13.3 | 8 | 26.6 |
| Muslim | 9 | 30.0 | 11 | 36.7 |
| Place of residence | | | | |
| Urban | 16 | 53.3 | 18 | 60.0 |
| Rural | 14 | 46.7 | 12 | 40.0 |
| Educational status of father | | | | |
| No formal education | 13 | 43.3 | 13 | 43.3 |
| Primary education | 4 | 13.3 | 5 | 16.7 |
| High school education | 5 | 16.7 | 3 | 10.0 |
| Graduates | 8 | 26.7 | 9 | 30.0 |
| Educational status of father | | | | |
| No formal education | 12 | 40.0 | 11 | 36.7 |
| Primary education | 13 | 43.3 | 16 | 53.3 |
| High school education | 2 | 6.7 | 2 | 6.7 |
| Graduates | 3 | 10.0 | 2 | 6.7 |
| Occupation of father | | | | |
| Sedentary worker | 13 | 43.3 | 16 | 53.3 |
| Moderate worker | 8 | 26.7 | 8 | 26.7 |
| Heavy work | 9 | 30.0 | 6 | 20.0 |
| Occupation of mother | | | | |
| Sedentary worker | 12 | 40.0 | 11 | 36.7 |

| | | | | |
|---|---|---|---|---|
| Moderate worker | 8 | 26.7 | 8 | 26.7 |
| Heavy worker | 10 | 33.3 | 11 | 36.7 |
| Type of family | | | | |
| Nuclear family | 16 | 53.3 | 18 | 60.0 |
| Joint family | 14 | 46.7 | 12 | 40.0 |
| Family income per month | | | | |
| Below 4000-6000 | 12 | 40.0 | 10 | 33.3 |
| Rs 6000-10000 | 11 | 36.7 | 9 | 30.0 |
| Above 10000 | 7 | 23.3 | 11 | 36.7 |

The result shows that most of A group, maximum of them were in the age group of 21-28 days, maximum of them were males, 56.7 were hindu, 53.3% were residing in urban set up, maximum of the father had no formal education and maximum of the mother had primary education, above 43.3 % of the parents were sedentary workers, 53.3% were of nuclear family with monthly income below 4000-6000

The result also shows that most of the in the B group,, maximum of them were in the age group of 21-28 days, maximum of them were males, 36.7 were hindu and muslims, 60.0% were residing in urban set up, maximum of the father had no formal education and maximum of the mother had primary education, maximum of the fathers were sedentary workers and maximum of the mothers were sedentary and heavy workers, 53.3% were of nuclear family with monthly income 10,000.


**Fig 1**

## Section B: Assessment of level of bilirubin in pretest and posttest in both groups

**Table 1:** Frequency and percentage distribution of level of bilirubin in both the groups

| Group | Level of bilirubin | Mild | | Moderate | | Severe | |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | No. | % |
| A Group | Pretest | 8 | 26.67 | 13 | 43.33 | 9 | 30.0 |
| | Post Test | 14 | 46.67 | 12 | 40.0 | 4 | 13.33 |
| B Group | Pretest | 1 | 3.33 | 13 | 43.33 | 9 | 30.0 |
| | Post Test | 1 | 3.33 | 13 | 43.33 | 9 | 30.0 |

The table shows that in pretest maximum of them were of falling on moderate (46.67%), in post test maximum of them were with mild level of bilirubin in group A.

The table also shows that, pretest maximum of were with moderate (43.33%), in posttest also they were with moderate (43.33%) in group B.

**Level of bilirubin in A group**

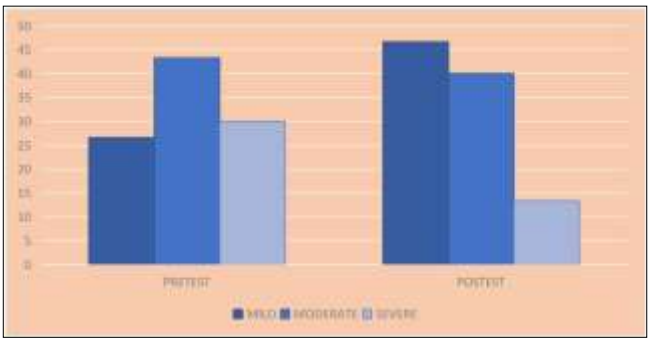


**Fig 2**

**Level of bilirubin in B group**

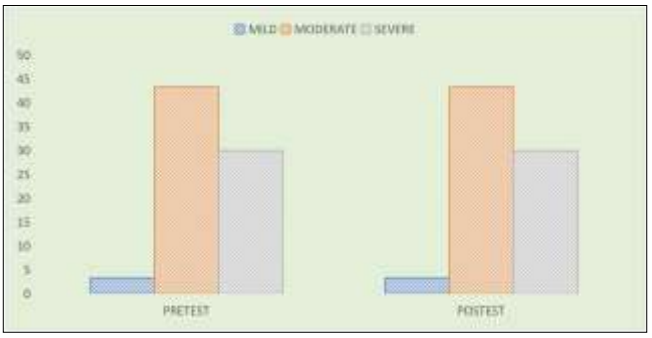


**Fig 3**

## Section C: Comparison of pretest and post test level of Bilirubin among both the groups

**Table 3:** Frequency and percentage distribution of both the groups

| A group | Mean | S.D | Paired 't' test Value |
|---|---|---|---|
| Pretest | 1.26 | 0.61 | t = 3.568 p = 0.0001 S*** |
| Post Test | 0.64 | 0.89 | |

***p<0.001, S – Significant

| B group | Mean | S.D | Paired 't' test Value |
|---|---|---|---|
| Pretest | 1.58 | 0.43 | t = 1.568 p = 0.063 N.S |
| Post Test | 1.36 | 0.38 | |

N.S – Not Significant

The result clearly states that, a group A who continuous phototherapy had significant reduction at level of bilirubin p<0.001 and group B, who had intermittent phototherapy has no effect in posttest.

**Section D:** Association of posttest level of bilirubin with selected demographic variables in both the groups.

**Table 1**

| Demographic Variables | Mild | | Moderate | | Severe | | Chi-Square Value |
|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | |
| Age in days | | | | | | | □2=3.658 d.f=6 p = 0.248 N.S |
| 1-10 days | 4 | 13.3 | 4 | 13.3 | 0 | 0 | |
| 11-20 days | 5 | 16.7 | 3 | 10.0 | 2 | 6.7 | |
| 21-28 days | 2 | 6.7 | 5 | 16.7 | 0 | 0 | |
| Gender | | | | | | | □2=0.568 d.f=1 p = 0.009 N.S |
| Male | 10 | 33.3 | 12 | 40.0 | 3 | 10.0 | |
| Female | 2 | 6.7 | 2 | 6.7 | 1 | 3.3 | |
| Religion | | | | | | | □2=3.575 d.f=4 p = 0.563 N.S |
| Hindu | 7 | 23.3 | 7 | 23.3 | 3 | 10.0 | |
| Christian | 2 | 6.7 | 1 | 3.3 | 1 | 3.3 | |
| Muslim | 3 | 10.0 | 6 | 20.0 | 0 | 0 | |
| Place of residence | | | | | | | □2=2.36 d.f=2 p = 0.003 S** |
| Urban | 10 | 33.3 | 12 | 40.0 | 3 | 10.0 | |
| Rural | 2 | 6.7 | 2 | 6.7 | 1 | 3.3 | |
| No formal education | 5 | 16.7 | 4 | 13.3 | 2 | 6.7 | |
| Primary education | 2 | 6.7 | 2 | 6.7 | 1 | 3.3 | |
| High school education | 3 | 10.0 | 2 | 6.7 | 1 | 3.3 | |
| Graduates | 2 | 6.7 | 6 | 20.0 | 0 | 0 | |
| Educational status of father | | | | | | | □2=1.807 |
| No formal education | 5 | 16.7 | 4 | 13.3 | 2 | 6.7 | d.f=4 p = 0.771 N.S |
| Primary education | 2 | 6.7 | 2 | 6.7 | 1 | 3.3 | |
| High school education | 3 | 10.0 | 2 | 6.7 | 1 | 3.3 | |
| Graduates | 2 | 6.7 | 6 | 20.0 | 0 | 0 | |
| Occupation of father | | | | | | | □2=15.5932 d.f=3 p= 0.003617 N.S |
| Sedentary worker | 10 | 33.3 | 9 | 30.0 | 2 | 6.7 | |
| Moderate worker | 2 | 6.7 | 5 | 16.7 | 2 | 6.7 | |
| Heavy work | - | - | - | - | - | - | |
| Occupation of mother | | | | | | | □2=0.253535 df=2 p = 0.8809 N.S |
| Sedentary worker | 2 | 6.7 | 2 | 6.7 | 1 | 3.3 | |
| Moderate worker | 3 | 10.0 | 2 | 6.7 | 1 | 3.3 | |
| Heavy worker | 2 | 6.7 | 6 | 20.0 | 10 | 33.3 | |
| Type of family | | | | | | | □2=29.7929 d.f=6 p= 0.4304 N.S |
| Nuclear family | 8 | 26.7 | 7 | 23.3 | 2 | 6.7 | |
| Joint family | 4 | 13.3 | 7 | 23.3 | 2 | 6.7 | |
| Family income per month | 3 | 5.0 | 1 | 1.7 | 2 | 3.3 | □2=18.5691 d.f=2 p= 0.9285 NS |
| Below 4000-6000 | 6 | 10 | 2 | 3.3 | 8 | 13.3 | |
| Rs 6000-10000 | 2 | 6.7 | 9 | 30.0 | 12 | 20 | |
| Above 10000 | | | | | | | |

The result shows that the demographic variable such as place of residence shows significant association with A group.

Shereen Mari (2021) *et al*., conducted study on Comparative Analysis of Intermittent and Continuous Phototherapy in Patients with Neonatal Jaundice. This study aims to compare the outcome of intermittent phototherapy versus continuous phototherapy in treatment of neonatal jaundice. There were 222 neonate with jaundice, which were randomly allocated into two groups. One hundred and one neonates were in group "A" who received continuous phototherapy while 111 neonates were treated with intermittent phototherapy called group B. Phototherapy units were identical regarding their manufacture and radiance with 5 blue light tubes at a distance of 15-20 cm above neonate that produced the irradiance of 20µW/cm2/nm at 420-470 nm. Serum bilirubin levels were measured every 12 hourly after starting phototherapy up to 48 hours. SPSS was used for data analysis. The study despite shows that the average age of the neonates was 2.23±1.45 days. In this study, the reduction of bilirubin level in both groups after 12, 24, 36, 48 hours of phototherapy and at the time of discharge was not different between groups.

Moj Taheritafti (2019) *et al*., conducted study on Comparison of Intermittent and Continuous Phototherapy to Treat Non-hemolytic Moderate Hyperbilirubinemia in Term Infants. This study aims to study on Comparison of Intermittent and Continuous Phototherapy to Treat Non-hemolytic Moderate Hyperbilirubinemia in Term Infants. The current randomized controlled trial (RCT) aimed at investigating the efficacy of intermittent and continuous phototherapy to reduce bilirubin in neonatal jaundice and neonatal circadian rhythm. The current double blinded RCT was conducted on 60 icteric term neonates from November 2016 to June 2017. A total of 60 icteric term neonates were randomly divided into two groups. In the continuous group, the phototherapy device was turned on for 24 hours and in

the intermittent phototherapy group, the phototherapy device was turned on for 18 hours (off for eight hours). This study despite shows that 2.3±0.60 and 2.46±0.93 days in the continuous and intermittent groups, respectively (P=0.516). The duration of phototherapy was 45.26±16.39 and 46±11.82 hours in the continuous and intermittent groups, respectively, and they had no significant differences (P=0.843). The rate of serum bilirubin cessation in the two groups was similar after 36 hours. Although the melatonin level was higher in the intermittent group than in the continuous group, the difference was not statistically significant (P=0.455)

**Conclusion**

The study findings revealed that continuous phototherapy group I is more effective than the intermittent phototherapy group II. Hence its continuous phototherapy reduce the bilirubin level among babies with hyperbilirubinemia.

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