The Effect of Combination Phototherapy Compared with Dual Phototherapy Blankets on Phototherapy Duration and Total Serum Bilirubin Levels

Stephanie Wiegert, DNP, APRN, CPNP-PC & Huong Mai BSN, RN, CPN

Background/Significance

Neonatal hyperbilirubinemia is a common diagnosis affecting approximately 60% of newborns. When hospitalization is necessary, phototherapy is the mainstay of treatment to reduce total serum bilirubin (TSB) levels. At Ann & Robert H. Lurie Children’s Hospital of Chicago, dual blanket phototherapy has become more prevalent in the past 5 years.

- Reducing TSB levels quickly is essential to avoid the risk of health complications, including kernicterus.
- Emerging data links phototherapy exposure to seizures and damage to DNA.

Therefore, reducing phototherapy duration is critical.

Despite the quantity of comparative effects literature evaluating phototherapy methods, only one study evaluated the efficacy of dual phototherapy blankets, but did not use current phototherapy equipment.

Purpose

This study compared four phototherapy methods and evaluated phototherapy duration and decline in TSB.

Methods

- Retrospective chart review
- Inclusion Criteria:
  - >37 weeks gestational age
  - >3 and <10 days of age at admission
  - No underlying medical diagnosis
  - Admitted with hyperbilirubinemia from June 2012-September 2019

Data collected included phototherapy type and duration, TSB levels, and demographic information.

Results

<table>
<thead>
<tr>
<th>Phototherapy Duration (Median)</th>
<th>A Light and 1 Blanket (n=117)</th>
<th>B 2 Blankets (n=81)</th>
<th>C 2 Lights and 1 Blanket (n=13)</th>
<th>D Mixed Method, (n=64)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phototherapy Duration</td>
<td>14.30</td>
<td>15.27</td>
<td>15.63</td>
<td>13.86</td>
<td>0.2809</td>
</tr>
<tr>
<td>Total Percent Decline (mean SD)</td>
<td>-29.05 (11.52)</td>
<td>-21.84 (9.16)</td>
<td>-29.70 (9.43)</td>
<td>-27.46 (8.97)</td>
<td>N/A</td>
</tr>
<tr>
<td>Percent Decline/hr (mean SD)</td>
<td>-1.78 (0.82)</td>
<td>-1.20 (0.63)</td>
<td>-1.96 (0.84)</td>
<td>-1.80 (0.70)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Mixed method phototherapy is defined as multiple phototherapy combinations used during the same hospitalization.

Plot of predicted means from a linear mixed regression model with predictors of group, time, and group by time interaction

TSB Decline over Time

- As a significant time by group interaction was found (p <0.0001), the rate of decline in TSB significantly differed between groups.
- Groups A, C, and D had a higher percent TSB decline per hour than Group B.

Phototherapy Duration

- All Groups had a similar phototherapy duration without statistical significance (p= 0.289).

Demographic

- There was no significant difference among phototherapy duration or rate of decline when models were adjusted for demographic data.

Discussion

Phototherapy duration may have been impacted by the variable timing of lab draws.

Limitations:

- Variable timing of TSB lab draws and phototherapy orders
- Inconsistent or absent documentation

Conclusion

Dual LED blanket phototherapy is effective in reducing TSB levels but, if it is crucial for TSB to be quickly reduced, combination phototherapy should be used.

Future Research:

- This study is one of the first to evaluate the effectiveness of dual phototherapy blanket treatment.
- Additional research is needed to assist in determining effectiveness of dual phototherapy blanket treatment when compared with 1 phototherapy light and 1 phototherapy blanket.

References


Acknowledgments

The Lurie Children’s IRB granted a complete (full) waiver of the authorization requirement under 45 CFR 164.512(i). Thank you to the PRINCE Nurse Scientist Grant for providing funds for this study.
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Background: Neonatal hyperbilirubinemia is a common diagnosis affecting approximately 60% of newborns (March of Dimes, 2013). When hospitalization is necessary, phototherapy is the mainstay of treatment to reduce total serum bilirubin (TSB) levels. At Ann & Robert H. Lurie Children’s Hospital of Chicago, dual blanket phototherapy has become more prevalent in the past five years. This study compared four phototherapy methods and evaluated phototherapy duration and decline in TSB. Reducing TSB levels quickly is essential to avoid the risk of health complications, including kernicterus. Eliminating unnecessary phototherapy exposure is important as emerging data links phototherapy exposure to seizures and damage to DNA (Ramy, et al., 2016 & Newman, Wu, Kuzniewicz, Grimes, and McCulloch, 2018). Despite the quantity of comparative effect literature, only one study was identified that evaluated the efficacy of dual phototherapy blankets (Tan, 1997). This study did not evaluate the phototherapy equipment that is currently in use.

Methods: A retrospective chart review was conducted evaluating 255 infants admitted with hyperbilirubinemia from June 2012-September 2019. Infants were included if they were at least 37 weeks gestational age, were 3-10 days of age at the time of admission, and were otherwise healthy. Phototherapy type, phototherapy duration and rate of TSB decline was evaluated. Demographic information was collected and included ethnicity, age at the time of admission, and whether the infant was breast fed or formula fed. The Lurie Children’s IRB granted a complete (full) waiver for this study.

Results: Infants were divided into groups including one phototherapy light and one phototherapy blanket (n=117), two lights and one blanket (n=13), mixed method phototherapy (n=44), and two phototherapy blankets (n=81). Mixed method phototherapy is defined as multiple combinations of phototherapy received during the same hospitalization. A linear mixed regression model was used to predict the TSB decline over time. As a significant time by group interaction was found (p <0.0001), the rate of decline in TSB significantly differed between groups. The first three phototherapy groups had a steeper rate of TSB decline when compared with the two blanket phototherapy group. Phototherapy duration was similar among both groups, and results were not statistically significant (p=0.2809). There was no statistical difference in demographic data among phototherapy groups.

Discussion: While there was a statistically significant difference in rate of TSB decline among groups, there was a negligible difference in total phototherapy duration. Phototherapy duration was likely impacted by variability in the frequency of TSB lab draws. This variability could lead to increased phototherapy duration in some patients, especially if the timing of TSB levels were ordered less frequently.

Recommendations: Dual LED blanket phototherapy is effective in reducing TSB levels but, if it is crucial for TSB to be quickly reduced, combination phototherapy should be used. Additional research is needed to assist in determining effectiveness of dual phototherapy blanket treatment when compared with 1 phototherapy light and 1 phototherapy blanket.

References