Original Research Article

Effect of intravenous fluid supplementation on drop in serum bilirubin levels in term babies with severe hyperbilirubinemia

Priyanka Tank¹, Rakesh Tank²*, Abhishek Singh³

¹Department of Pediatrics, SHKM Government Medical College, Nuh, Haryana, India
²Department of Internal Medicine, SHKM Government Medical College, Nuh, Haryana, India
³Department of Community Medicine, SHKM Government Medical College, Nuh, Haryana, India

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*Correspondence:
Dr. Rakesh Tank.
E-mail: rakeshtank24@yahoo.com

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ABSTRACT

Background: Varied results emerging out of various studies have created a controversy about effect of intravenous fluid supplementation on drop in Serum Bilirubin levels in term babies with severe hyperbilirubinemia. Paucity of literature also warrants this study. The objective of this study is to evaluate the probable effect, if any, of intravenous fluid supplementation in decreasing the serum bilirubin level in healthy term babies with hyperbilirubinemia from Northern India.

Methods: In this prospective study healthy term neonates (37-41 weeks gestation) with serum bilirubin (>18 mg/dl and <25 mg/dl) for treatment with phototherapy were randomly allocated to two groups, study group received intravenous fluid for total 16 hours along with breast feed and control group given only breast feeds.

Results: Baseline variables like sex distribution, age at admission, gestation, birth weight, admission weight, number of babies, appropriate for gestational age, mode of delivery, oxytocin use, incidence of breast feeding and serum bilirubin level at the time of inclusion in study, were comparable in both control and study group. Drop of total serum Bilirubin (TSB) at 4 hours, 8 hours, 24 hours, 36 hours and 48 hours of study were also significantly higher in study group as compared to control group. Although the drop in TSB level at 60 hours between two groups was not significantly different.

Conclusions: Based on our findings it can be concluded that additional intravenous fluid supplementation significantly reduced the serum bilirubin in study group as compared to control group.

Keywords: Fluid supplementation, Hyperbilirubinemia, Total serum bilirubin

INTRODUCTION

Jaundice or Hyperbilirubinemia is commonly encountered in our setup. Bilirubin is potential toxic to central nervous system and can cause serious permanent side effect called kernicterus, in which brain stem nuclei and basal ganglia are damaged, resulting in cerebral palsy.¹ Phototherapy is a safe way which has remained the standard treatment in neonatal hyperbilirubinemia. During phototherapy, bilirubin is converted to less toxic water-soluble photoisomers.²,³ Because the photoproducts responsible for the decline in serum bilirubin are excreted in both urine and bile, maintaining adequate hydration and good urine output should help improving the efficacy of phototherapy. Phototherapy also increases the amount of body water loss, via insensible trans epidermal and stool water loss.²,⁵

Various studies have been done in past to see the effect of oral water, dextrose or artificial feed supplementation in.
Mean±

At

count,

neonate

admission.

(n=30)

symptoms

included

dehydration

(severity

and

hyperbilirubinemia).

Paucity

of

literature

also

warrants

this

study. Hence

this

study

was

planned

to

evaluate

the

probable

effect, if

any,

of

intravenous

fluid

supplementation

in

decreasing

the

Total

Serum

Bilirubin

(TSB)

level

in

healthy

term

babies

with

hyperbilirubinemia

from

Northern

India.

METHODS

This

cross-sectional

study

was

performed

at

the

Neonatal

ICU

at

Government

Multi

Speciality

Hospital,

Sector-16,

Chandigarh

for

a

period

of

10 months

in

year 2013. Term

neonates

with

severe

hyperbilirubinemia

seeking

care

at

Neonatal

ICU

at

Government

Multi

Speciality

Hospital,

Sector-16, Chandigarh during

the

study

period

formed

the

study

population. An

inclusion

criterion

was

term

neonates

(37-417/8 weeks

gestation)

presenting

with

severe

hyperbilirubinemia

(TSB >18

mg/dl

and

<25

mg/dl).

The

babies

with

obvious

clinical

signs

of

dehydration

at

enrollment

were

not

included

in

the

study.

Purposeful

sampling

technique

was

adopted.

This

study

included

60

term

newborns

having

no

other

problem

such

as

congenital

abnormalities,

sepsis, dehydration

symptoms

and

were

placed

into

2
groups

viz.

case

group

(n=30)

and

control

group

(n=30)

using

simple

random

sampling.

The

first

serum

bilirubin

level

was

taken

upon

admission.

Other

blood

tests

including

mother

and

neonatal

blood

group

and

Rh

factor,

complete

blood

count,

reticulocyte

count,

Coombs test,

G6PD,

and

peripheral

blood

smear

were

also

simultaneously

taken.

At

bed

side

clinician

assessed

the

hydration

status

of

newborn

independently. Clinical parameters

heart rate,

respiratory

rate,

capillary

filling

time,

anterior

fontanelle,

skin

turgor,

oral

mucosa

and

eye

ball

status

were

recorded.

Study

group

patients

received

calculated

intravenous

fluid

N/5

saline

with

5%
dextrose

for

16

hours

along

with

breast-feeding.

Control

(group

was

not

provided

any

extra

fluid. They

were

continued

to

receive

breast

feed

as

they

were

receiving

earlier

prior

to

randomization

procedure.

Both

groups

received

CFL
double

surface

blue

light

phototherapy.

Infants

were

fully

exposed

to
double

surface

phototherapy

except

eyes

and

genitalia.

Phototherapy

was

discontinued

when

2

serum

bilirubin

values

12

hours

apart

were

<14

mg/dl.

Outcome

indicators

of

this

study

were

drop

in

serum

bilirubin

level

at

4, 8, 12

and

24

hours

of

study.

Following

formula

was

used

to

calculate

drop

of

TSB:

\[
\text{Drop of TSB (mg/dl) = TSB at specific time - TSB at inclusion.}
\]

Informed

consent

was

obtained

from

parents. Permission

of

Institutional

ethics

committee

(IEC)

was

sought

before

the

commencement

of

the

study.

Data

analysis

was

done

using

Statistical

Package

for

Social

Sciences

(SPSS),

version

20.

The

results

were

expressed

using

appropriate

statistical

methods.

A

two-tailed

p

<0.05

was

considered

statistically

significant.

RESULTS

Data

of

60

subjects

was

included

in

the

final

analysis.

Baseline

variables

like

sex

distribution,

age

at

admission,

gestation,

birth

weight,

admission

weight,

number

of

babies,

appropriate

for

gestational

age,

mode

of

delivery,

oxytocin

use,

incidence

of

breast

feeding

and

serum

bilirubin

level

at

the

time

of

inclusion

in

study,

were

comparable

in

both

control

and

study

group

(Table 1).

<table>
<thead>
<tr>
<th>Baseline variables</th>
<th>Study group (n=30)</th>
<th>Control group (n=30)</th>
<th>P value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at admission (hours)*</td>
<td>109.8±44.84</td>
<td>107.8±36.76</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>Gestation (weeks)*</td>
<td>37.9±0.75</td>
<td>37.08±0.82</td>
<td></td>
</tr>
<tr>
<td>Birth weight (gm)*</td>
<td>2910.36±434.25</td>
<td>2795.27±414.83</td>
<td></td>
</tr>
<tr>
<td>Admission weight (gm)*</td>
<td>2750.64±388.45</td>
<td>2658.19±411.02</td>
<td></td>
</tr>
<tr>
<td>AGA No. (%)</td>
<td>27 (90%)</td>
<td>25 (83.33%)</td>
<td></td>
</tr>
<tr>
<td>NVD No. (%)</td>
<td>19 (63.33%)</td>
<td>16 (53.33%)</td>
<td></td>
</tr>
<tr>
<td>Oxytocin Use No. (%)</td>
<td>14 (46.67%)</td>
<td>13 (43.33%)</td>
<td></td>
</tr>
<tr>
<td>Exclusive breast-feeding No. (%)</td>
<td>28 (93.33%)</td>
<td>25 (83.33%)</td>
<td></td>
</tr>
<tr>
<td>TSB Value (mg/dl)*</td>
<td>20.18±1.64</td>
<td>19.25±1.70</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>18-24.8</td>
<td>18-24.3</td>
<td></td>
</tr>
</tbody>
</table>

Mean±sd*; non-significant**; AGA- appropriate for gestational age; TSB- total serum bilirubin.

Drop of Total Serum Bilirubin (TSB) at 4 hours, 8 hours, 24 hours, 36 hours and 48 hours of study were also significantly higher in study group as compared to control group. Although the drop in TSB level at 60 hrs between two groups was not significantly different (Table 2, Figure 1).

**Table 2: Drop of total serum bilirubin between study and control groups.**

<table>
<thead>
<tr>
<th>Hours of study</th>
<th>Study group (Mean±SD) mg/dl</th>
<th>Control group (Mean±SD) mg/dl</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 hours</td>
<td>2.71±1.28</td>
<td>1.25±1.23</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>8 hours</td>
<td>4.48±1.55</td>
<td>2.10±1.18</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>12 hours</td>
<td>6.05±1.90</td>
<td>2.77±1.30</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>24 hours</td>
<td>7.72±2.16</td>
<td>3.94±1.60</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>36 hours</td>
<td>8.05±1.63</td>
<td>4.12±1.63</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>48 hours</td>
<td>8.79±2.18</td>
<td>5.95±1.59</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>60 hours</td>
<td>9.09±5.11</td>
<td>6.78±1.57</td>
<td>0.084</td>
</tr>
</tbody>
</table>

**Figure 1: Graphical representation of drop of TSB between study and control groups.**

**DISCUSSION**

In order to address the controversy about effect of intravenous fluid supplementation on drop in serum bilirubin levels in term babies with severe hyperbilirubinemia we evaluated the probable effect, if any, of intravenous fluid supplementation in decreasing the serum bilirubin level in healthy term babies with hyperbilirubinemia from Northern India. Sixty healthy term neonates (37-41 weeks gestation) with serum bilirubin (>18 mg/dl and <25 mg/dl) for treatment with phototherapy were allocated to two groups, study group received intravenous fluid for total 16 hours along with breast feed and control group given only breast feeds.

In the present study TSB levels were monitored at regular intervals at 4 hours, 8 hours, 12 hours, 24 hours, 36 hours and 48 hours. Drop of TSB and rate of drop of TSB were calculated at regular intervals in both groups. The drop of TSB and rate of drop of TSB were significantly more in study group as compared to control group. TSB levels were monitored till baby received phototherapy.

In a controlled study on the effect of water supplementation in normal term breast-fed babies who have physiologic jaundice, water supplementation was given to 120 babies, while 55 babies received no extra fluid.\(^6\) There was no significant difference between the two groups when peak serum bilirubin levels and incidence of photo-therapy were compared.

**Table 3: Studies on effect of intravenous fluid supplementation on drop in serum bilirubin levels.**

<table>
<thead>
<tr>
<th>Studies</th>
<th>Year</th>
<th>Outcome</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present study</td>
<td>2013</td>
<td>Rate of drop of TSB</td>
<td>Significant</td>
</tr>
<tr>
<td>Demisroy et al(^{12})</td>
<td>2011</td>
<td>Drop of TSB</td>
<td>Not significant</td>
</tr>
<tr>
<td>Sáiedi et al(^{14})</td>
<td>2009</td>
<td>Drop of serum bilirubin</td>
<td>Significant</td>
</tr>
<tr>
<td>Mehta et al(^{15})</td>
<td>2005</td>
<td>Drop in TSB</td>
<td>Significant</td>
</tr>
<tr>
<td>Irapour et al(^{11})</td>
<td>2004</td>
<td>Rate of decrease of TSB</td>
<td>Not significant</td>
</tr>
<tr>
<td>Boo NY et al(^{9})</td>
<td>2002</td>
<td>Rate of decrease of TSB</td>
<td>Not significant</td>
</tr>
<tr>
<td>K L Tan et al(^{1})</td>
<td>1998</td>
<td>Rate of decrease of TSB</td>
<td>Significant</td>
</tr>
<tr>
<td>Decarvalho et al(^{13})</td>
<td>1980</td>
<td>Decrease of TSB</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Another randomized controlled trial has shown the beneficial effect of additional fluid in reducing serum concentration of bilirubin, but the finding was not statistically significant.\(^8\) Authors compared the rates of decrease in serum bilirubin levels in well hydrated healthy and severely jaundiced term neonates during intensive phototherapy when given 10% extra oral, versus intravenous fluid supplementation. Although the mean rates of decrease in TSB were not significantly different between the extra oral and extra intravenous fluid supplementation groups but the rate of decrease in TSB were greater than that recommended by the AAP.\(^10\) The AAP proposed that an effective intensive phototherapy should reduce the serum bilirubin levels by 1-2 mg/dl within 4 hour of treatment (or at a rate of 0.25-0.48 mg/h), while in the study, the rate of decrease in serum bilirubin during the first 4 hour after admission was between 0.6 and 0.65 mg/h in oral and intravenous fluid supplemented groups, respectively. They concluded that these rates of decrease in TSB could be due to fluid supplementation.

A study from Iran assigned 60 healthy breast-fed neonates with non-hemolytic hyperbilirubinemia randomly to receive either breast milk exclusively (non-
supplemented group; n=30) or intravenous fluid in addition to breast milk (supplemented group; n=30) during conventional phototherapy.\textsuperscript{11} The mean total serum bilirubin (TSB) levels at the time of enrollment and within 84 hours after phototherapy were not statistically different between two groups.

Demisroy et al and Maisels MJ also showed no significant difference in decrease or rate of drop of serum bilirubin levels with extra fluid therapy.\textsuperscript{12,13}

A study by Saiedi et al showed that rate of serum bilirubin decrease per hour was significantly more (P = 0.02) in extra fluid group during 12-24 hours of study period.\textsuperscript{14} Similarly, in study by Mehta et al percentage drop in TSB upto 24 hours of study was significantly more in extra fluid group.\textsuperscript{15} Tan KL et al showed rate of decrease of serum bilirubin at 24 hours of study was significantly more in group which received both breast feeds and formula feeds as compared to groups which received either breast feeds or formula feeds.\textsuperscript{3} The overall rate of decrease of bilirubin concentration during phototherapy exposure was significantly less in-group, which received, only breast-feeds as compared to group, which received formula feeds, or both. Few studies on effect of intravenous fluid supplementation on drop in serum bilirubin levels are tabulated below (Table 3).

**CONCLUSION**

On the basis of empirical evidences of the current study it can be summarized that additional intravenous fluid supplementation, as per study design, has significantly reduced the serum bilirubin in study group as compared to control group. It may also decrease the need of total duration of phototherapy and exchange transfusion.

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**Conflict of interest: None declared**

**Ethical approval: The study was approved by the Institutional Ethics Committee**

**REFERENCES**