



Original Article

Role Of Intravenous Fluid Therapy in the Management of Non-Hemolytic Neonatal Hyperbilirubinemia; A Randomized Controlled Trial

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ABSTRACT

Introduction: Neonatal jaundice (NJ) is common among the newborns which is often physiological however, in some cases it may become pathological. Timely detection and treatment for underlying cause may prevent severe consequences like bilirubin encephalopathy. Further, dehydration due to evaporative losses and poor intake of breast feed may worsen the condition and likely to require exchange transfusion which is associated with severe complications. This study was planned to evaluate the effect of fluid therapy in the management of NJ.

Methods: This randomized controlled trial was carried out in the department of pediatrics, Government Medical College, from April 2022 to April 2023. A total of 617 neonates diagnosed with NJ and exposed to intensive phototherapy were divided into two groups as Group 1 (received intravenous fluid (IV) with breast feeding) and group 2 (only breast feeding). The neonates were observed for the rate of fall of total serum bilirubin (TSB), duration of phototherapy and need of exchange transfusion level of rebound bilirubin.

Results: The age and birth weight were statistically similar in both the groups, but significant difference was noted with respect to gender, type of feeding and mode of delivery. The TSB levels decreased significantly in the intervention group compared to the control group at six, 12 and 24 hours after the treatment. The need of exchange transfusion was less in case group.

Conclusion: The IV fluid supplementations appear to accelerate the decrement of TSB levels and reduce requirement of exchange transfusion.

Keywords: Dehydration Fluid therapy, Neonatal jaundice, Phototherapy.

INTRODUCTION

Neonatal Hyperbilirubinaemia, defined as a total serum bilirubin level above five mg per dL (86 μ mol per L), is a frequently encountered problem.¹⁻³ It is one of the most common clinical sign in neonatal medicine. Some two-thirds of healthy term infants and almost all premature infants develop clinical jaundice in the first week of life.^{4,5} Bilirubin is the final product of heme degradation. At physiologic pH, bilirubin is insoluble in plasma and requires protein binding with albumin. After conjugation in the liver, it is excreted in bile. Newborns produce bilirubin at a rate of approximately 6 to 8 mg per kg per day.⁶ This is more than twice the production rate in adults, primarily because of relative polycythemia and increased red blood cell turnover in neonates. Bilirubin production typically declines to the adult level within 10 to 14 days after birth.¹

Common risk factors for Hyperbilirubinaemia include fetal-maternal blood group incompatibility, prematurity, and a previously affected sibling.^{1,6} Cephalohematomas, bruising, and trauma from instrumented delivery may increase the risk for serum bilirubin elevation. Delayed meconium passage also increases the risk. Infants with risk factors should be monitored closely during the first days to weeks of life.⁶

The usual treatments for this neonatal disease are phototherapy and exchange transfusion (ET). Phototherapy reduces serum bilirubin levels through luminous oxidation, while ET is used primarily to maintain bilirubin levels below toxicity levels, eliminate antibodies, and correct hemolytic anemia.⁸

Significant elevated levels of bilirubin leads to bilirubin encephalopathy followed by kernicterus with permanent neurodevelopmental sequelae. According to AAP recommendations,⁹ intravenous fluids can be given for infants receiving intensive phototherapy if oral intake is inadequate or questionable. AAP also recommends use of formula along with breast feeding in order to increase the calorie intake and decrease the enterohepatic circulation. This study designed to evaluate the role of IV fluid supplementation in the management of NH.

METHODS

This hospital based randomized controlled trial was done from April 2022 to 2023. A total of 3630 neonates were admitted in the special newborn care unit (SNCU) of Maternity & child Care Hospital (MCCH) associated Government Medical College, (GMC) Anantnag, Jammu and Kashmir, India were studied. Out of which 617 were diagnosed with NH and enrolled in the study after fulfilling the inclusion criterion. Prior to the commencement, ethical clearance was obtained from Institutional ethical committee. The parents of neonates with NH were explained about the nature of the study and a written informed consent was obtained.

Neonates enrolled in the study were divided into two groups based on computerized generated randomization number. Group I included 306 neonates who were treated with IV fluid Isolyte P 50mL/kg through peripheral line in addition of breast feeding. Neonates in group 2 received only breast feeding. Intensive phototherapy was given to both groups by LED Phototherapy machines. During the exposure to light, eyes were shielded to prevent retinal damage. The position was changed frequently so that maximum skin was exposed to light. Neonates were monitored for change in TSB at admission, six hours, 12 and 24 hours, duration of phototherapy and requirement of exchange transfusion. Neonates were kept under the light round the clock and taken out only for feeding or changing wet napkins. Hydration status was monitored by body weight, vital signs, urine output. when bilirubin levels were decreased below phototherapy range according to AAP charts, phototherapy was discontinued and bilirubin levels were done for rebound hyperbilirubinemia after 24 hours. All these details were noted in the predesigned and pretested proforma.

The data obtained was coded and entered into Microsoft Excel Worksheet and analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. The categorical data was expressed as rate, ratio, proportion and continuous data was expressed as mean $\pm$ standard deviation (SD). Comparison of categorical data was done by Chi-square test. The comparison of continuous data was done by paired sample t test. A probability value (p value) of less than or equal to 0.050 at 95% confidence interval was considered as statistically significant.

RESULTS

A total of 3630 admissions were done during the study period, out of which 617 were diagnosed as NH and enrolled in the study (Figure 1). The comparison of baseline characteristics of the study population is as depicted in table 1. It was observed that, the mean age at admission and birth were statistically similar but, statistically significant difference was noted with respect to gender, type of feeding, and mode of delivery. There was no statistically significant difference in TSB levels between two groups at the beginning of treatment. The TSB levels decreased significantly in the intervention group compared to the control group at six, 12 and 24 hours interval after the treatment (Table 2). With regard to duration of phototherapy, the duration of phototherapy was significantly less in group 1 as compared to group 2 (Table 3). The requirement of exchange transfusion was statistically similar in both the groups (Table 4). The mean sodium serum levels were normal at six and 12 hours of fluid therapy. After 24 hours of fluid supplementation, two neonates developed hyponatremia (>135 meq/L).

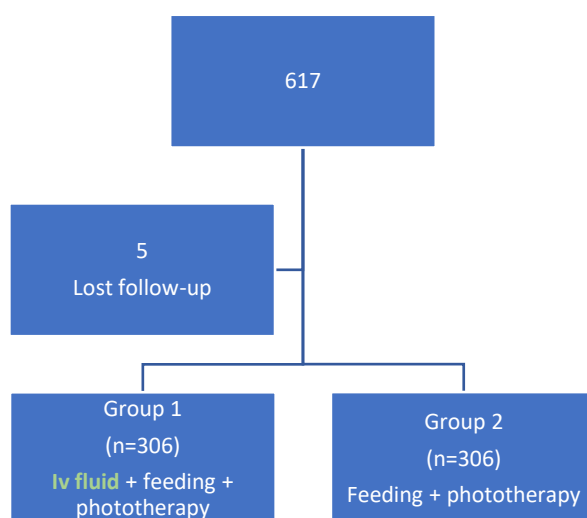


Figure I. Selection and enrollment of neonates

Table 1. Comparison of baseline data

Characteristics		Group 1 (n=306)	Group 2 (n=306)	p value
Age at admission (days)		4.17±1.52	4.21±1.48	0.67
Weight in kg.		3.13±1.70	3.13±1.70	1.00
Gender	Male	157 (51.3%)	118 (38.6%)	0.002
	Female	149 (48.7%)	188 (61.4%)	
Type of Feeding	Breast milk	214 (69.9%)	207 (67.6%)	0.01
	Bottle	73 (23.9%)	60 (19.6%)	
	Mixed	19 (6.2%)	39 (12.7%)	
Type of delivery	Vaginal delivery	109 (35.6%)	82 (26.8%)	0.018
	Caesarean section	197 (64.4%)	224 (3.2%)	

Table 2. Change in TSB at different intervals

Intervals	Group 1 (n=306)	Group 2 (n=306)	p value
At 6 hours	15.7±1.43	16.35±1.28	0.008
At 12 hours	11.90±1.79	14.33±1.28	<0.001
At 24 hours	10.03±1.77	11.80±1.14	<0.001

Table 3. Comparison of duration of phototherapy

Interval	Group 1 (n=306)	Group 2 (n=306)	p value
<12 hours	208 (68.0%)	32 (10.5%)	<0.001
12-24 hours	98 (32.0%)	235 (76.8%)	
24-48 hours	0 (0.0%)	39 (12.7%)	

Table 4. Comparison of need of exchange transfusion

Exchange Transfusion	Group 1 (n=306)	Group 2 (n=306)	p value
Yes	0 (0)	4 (1.3%)	0.361
No	299 (97.7%)	302 (98.7%)	

DISCUSSION

In this study, it was observed that additional IV fluid administration during initial six hours can significantly decrease TSB levels. Similar results were observed by Bandyopadhyay A. et al.¹⁰ (2017) though they use different IV Fluids. Additional IV fluids therapy causes dilution of TSB, increases blood flow to kidneys which improves excretion of water-soluble photo isomers in urine. Further inadequate oral feeding in sleepy neonates due to significant hyperbilirubinemia along with increased insensible water loss during phototherapy can predispose the worsening of hyperbilirubinemia in newborn, not receiving extrafluids. In the present study intervention group required lesser duration of phototherapy.

A study by Sasikumar BR et al.¹¹ (2017) and Patel M. et al.¹² (2014) concluded that IV fluids can significantly decrease the phototherapy duration. In our study only two neonates required exchange transfusion in group 2 while, none of the neonates required in group 1 however, this difference was statistically not significant. Mehta S et al.¹³ (2005) concluded that maintenance fluid over eight hours can significantly reduce the exchange transfusion rates.

In the present study there was no significant hypo or hypernatraemia associated with IV fluid supplementation for both the groups over first 12 hours. Although the present study showed benefits of IV fluid supplementation, these observations need to be interpreted cautiously due to potential limitations of this study that is, the single centre study and bias in results. That is, the study was not controlled for gender, type of feeding and mode of delivery which were an important limitation of the study.

CONCLUSION

Additional IV fluid supplementation during initial six hours can significantly decrease TSB levels and total phototherapy duration in severe non-hemolytic neonatal hyperbilirubinemia with significant decrease in requirement of exchange transfusion without fluid imbalance.

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