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Effect of Fluid Supplementation in Severe Neonatal Hyperbilirubinemia

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Abstract: ***Objective: To evaluate the role of intravenous extra fluid supplementation in accelerating the reduction of serum bilirubin level in neonates and to Find out whether fluid supplementation decrease the total duration of photo therapy and need of exchange transfusion. Methods: Study was conducted at Neonatal ICU at civil, hospital, Ahmedabad over period of 6 months. Eighty four healthy breast-fed neonates with indirect non-hemolytic hyperbilirubinemiawere assigned randomly to receive either breast milk exclusively (case group; n=42) or intravenous fluid in addition to breast milk (control group; n=42). The rate of decrement of serum bilirubin, total duration of phototherapy and exchange transfusion rate were compared. Results: The rate of serum bilirubin decrement per hour in the first 6 hours is 0.58 in group I versus 0.37 in group II (P=<0.0001, z score). It was 0.48 in group I and 0.35 (p<0.0001, z score) for first 12 hours of admission. No. of neonates underwent exchange transfusion were 6 in group I and 13 in group II (p=0.03, fischer exact test). The duration of phototherapy was also shorter in group I (48 ± 16)as compared to group II (62 ± 24) (p=0.002, t-test). Conclusion: Fluid supplementation in severe non hemolytic hyperbilirubinemia can accelerate decrement of serum bilirubin. It also decreases the need of total duration of phototherapy and exchange transfusion.***

Keywords: hyperbilirubinemia, fluid supplementation, phototherapy, exchange transfusion.

1. Introduction

Jaundice/Hyperbilirubinemia is common neonatal problem. 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. In extreme jaundice, rapid reduction of serum bilirubin level is of utmost importance. Two commonly used mode of therapy are phototherapy and exchange transfusion.

Phototherapy has some side effectssuch as diarrhea, skin rash, dehydration, overheating, mother-baby bonding, and feeding disruption.[6,7] On the other hand, exchange transfusion complications include infections, emboli, and anemia, apnea, and hypocalcemia transfusion reactions. [8-10]

2. Literature Survey

Keeping in mind these potential risks encourage us to find some ways consisting of extra fluid supplementation to reduce resorting to these measures. A study has shown that the administration of extra fluid to icteric baby can reduce the jaundice more rapidly.[11] However, other studies have revealed no relationship between extra fluid administration and bilirubin decrement.[13,14] Therefore, with regard to the opposite results of such few studies, we conducted this study to identify the probable role (if any) of the administration of additional intravenous (IV) fluid in promoting the reduction of hyperbilirubinemia in neonates who received phototherapy.

3. Materials and Methods

This is a randomized-controlled study that was performed at the Neonatal ICU at Civil Hospital, Ahmedabad, India. Informed consent was obtained from parents. This study includes 84 Term newborn that has no other problem such as congenital abnormalities, sepsis, dehydration symptoms and randomly placed into 2 groups viz. case group (n=42) and control group (n=42). By using a random number table, simple randomization was performed. We included neonates 2 to 10 days old who had indirect non-hemolytic jaundice with serum bilirubin was ≥18 mg/dl. The first serum bilirubin level was taken upon admission. Other blood tests including mother and neonate blood group and Rh factor, complete blood count, reticulocyte count, Coomb's test, G6PD, and peripheral blood smear were also simultaneously taken.

Since they were well hydrated, no serum urea and electrolytes were obtained. Those with hemolysis were excluded. Further serum bilirubin level evaluation was performed after 6, 12 and 24 hours of admission. Other blood samples including serum bilirubin levels, and measures such as, discontinuation of phototherapy and exchange transfusion, and discharge was in accordance to the routine protocol of the Neonatal ICU. When bilirubin decreased to 14 mg/dl, phototherapy was discontinued. In the absence of rising bilirubin, patients were discharged. In the case group (group I) that includes 42 patients, breast milk and extra IV fluid including normal saline at the rate of 20 ml/kg over 2-3 hour was administered through the peripheral vein after admission to the hospital. The control group (group II) consists of 42 patients that were fed only with breast milk. The serum bilirubin levels were evaluated upon admission, at 6 and at 12 hours of admission. Standard protocol of

management of hyperbilirubinemia was applied. Both groups received the same type of LED phototherapy radiating from a 25 cm distance.

We excluded those patients with any of following: jaundice in first day after birth, any manifestations of kernicterus, any form of hemolysis, dehydration, any congenital malformation, antibiotics taken, direct bilirubin above 15% of the total bilirubin, exchange transfusion if it was performed soon after admission. This study was approved by the Committee of Ethics of B. J. Medical college, Gujarat University.Data was analyzed using t test, Chi-square, fischer-exact testand z score. A p-value <0.05 was considered significant.

4. Results

There were 23 males, and 19 females in group I. In group II, there were 22 males, and 20 females (p=0.82, Chi-square test). The mean age of patients in group I was 5.1 days, and 5.2 days in group II (p=0.29, t test). The mean weight on admission was 2.56 kg in group I (standard deviation=0.14 kg), and 2.55 (standard deviation=0.18 kg) in group II (p=0.77, t test). At admission, the mean bilirubin levels was 20.2mg/dl in group I and 21.00 mg/dl in group II (p=0.38, t test).At discharge, the mean serum bilirubin levels was 11.20 mg/dl in group and 11.70 mg/dl in group II (p=0.32, t test).

Table 1: Comparison of age, weight and serum bilirubin at admission

Variables	*Group I (case) (Mean value)*	*Group II (control) (Mean value)*	*p-value (t-test)*
Age (days)	5.1	5.2	0.29
Weight at admission (kg)	2.56	2.55	0.77
Serum bilirubin at admission	20.2	21.0	0.38
Serum bilirubin at discharge	11.2	11.7	0.32

Table 2: Comparison of sex distribution

Variable	*Group I*	*Group II*	*p-value (chi-square test)*
Male	23	22	0.82
Female	19	20	

Rate of decrement of bilirubin has a statistically significant decrement in group I in the first 12 hours (Table 2). There were no significant differences between the mean age of patients, mean birth weight and gender, and serum bilirubin levels at admission in both groups (Table 1,2). Maternal characteristics were not evaluated in this study. Also, the number of blood tests to evaluate serum bilirubin levels during the hospital stay had no significant differences in both groups.

Table 3: Comparison of rate of decrement of serum bilirubin/hour

Rate of decrement of serum bilirubin/hour	*Group I (Mean)*	*Group II (mean)*	*p-value**
First 6 hours	0.58	0.37	<0.0001
First 12 hours	0.48	0.35	<0.0001

* Z score was applied

There was significant difference in exchange transfusion rate in both groups (p=0.02, Fisher's exact test) (Table 4). We also found statistical significant in total duration of phototherapy (hours) required in both groups. It was 48 ± 16 hours in group I and 62 ± 24 hours (p=0.002, t-test) (Table 5).

Table 4: Comparison between rate of exchange transfusions

	Group I	Group II	*p*-value*
Exchange transfusion	4	13	0.03
No exchange transfusion	38	29	

*Fischer-exact test was applied

Table 5: Comparison of total duration of phototherapy (hours) required.

	Group I Mean value	Group II Mean value	P value (t-test)
Total duration of phototherapy (hours)	48	62	0.002

5. Discussion

Based on our findings, additional IV fluid administration during the first 2-3 hours can significantly decrease serum bilirubin levels in very icteric neonates. According to this study additional IV fluid can decrease the need of Exchange transfusion rate and duration of phototherapy. Our findings is similar to other studies (S kumar et al., reza saeidi et al.),[11, 12] with a different rate of fluid supplementation, in which extra IV fluids of half the maintenance were given for 8 hours and 24 hours respectively.In another report,[13] extra oral fluids versus extra oral and IV fluids are compared without any significant difference between groups in the reduction of serum bilirubin levels. However, there was no control groupin that study to compare the reduction in the bilirubin levels in the receiving fluid groups versus non-receiving group. ButThe combination of oral feeding and extra IV fluid therapy may result in the decrease in enterohepatic circulation, and then a lower rate of bilirubin reabsorption from the bowel. Also, it seems that additional fluids therapy can cause dilution of serum bilirubin, and also increases blood circulation in the kidneys, and rising urine output, and subsequently improves excretion of water soluble photo isomers in urine.[15] On the other hand, it was suggested that high serum bilirubin levels can cause sleepiness in icteric newborns.[16] Hence, inadequate oral feeding in such sleepy cases can, along with increased insensible water loss during phototherapy predispose to the worsening of hyper-bilirubinemia in newborns not receiving extra fluid. And also due to this sleepiness of very icteric babies, the intake of breast feeding of a newborn's auto regulatory mechanisms may be influenced. Also in our study, extra fluid administration was limited to the 2-3 hours of admission.

In conclusion, extra fluid treatment in the first 2-3 hours in neonates with severe hyperbilirubinemia can significantly reduce the serum bilirubin levels in term newborns with no hemolytic disorder. Further study in which taking extra oral fluid in one more group during hospitalization is suggested.

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