Effect of intravenous fluid supplementation on serum bilirubin level during conventional phototherapy of term infants with severe hyperbilirubinemia

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الخلاصة

بيان فعالية إعطاء السائل الوريدي في تقليل نسبه البليروبين الكلي في مصل الدم في الأطفال حديثي الولادة كاملي النمو والمصابين بداء اليرقان الولادي الغير انحلالي .

أجريت هذه الدراسة في مستشفى كربلاء التعليمي للأطفال من الاول من كانون الثاني ٢٠١٠ الى الأول من كانون الثاني٢٠١١ على ٦٤ طفل حديثي الولادة كاملي النمو عراقي الأصل والمصابين بداء اليرقان الولا دي الغير انحلالي ادخلوا إلى وحدة العناية بالأطفال حديثي الولادة وجرى تعينهم عشوائيا إلى مجموعتان.

المجموعة الأولى :لم يتم إعطاؤهم أي سوائل اضافيه وعددهم ٣٢ طفل حديث الولادة.

المجموعة الثانية: تم إعطاؤهم سوائل وريديه بالاظافه إلى الرضاعة وعددهم ٣٢ طفل حديث الولادة. وجرى متابعة نسبة البليروبين الكلي في مصل الدم كل ١٢ ساعة خلال فترة علاجهم بالعلاج الضوئي العادي .

لم يكن للمحلول الوريدي المعطى خلال عملية العلاج الضوئي العادي دور فعال في تقليل نسبه البليروبين الكلي في مصل الدم.

Abstract

Background: Adequate hydration (hence good urine output) improve the efficacy of phototherapy. The aim of this study was to evaluate the effect of intravenous fluid supplementation on decrease of serum bilirubin levels in jaundiced healthy term infants during conventional phototherapy.

Patients and Methods: this study conducted in Karbala teaching hospital for children during the period from January 2, 2010 through December 31, 2010. Sixty four healthy breast-fed neonates with non-hemolytic hyperbilirubinemia (total serum bilirubin > 18 mg/dL [308 µmol/L] to < 22 mg/dL [375 µmol/L]) were assigned randomly to receive either breast milk or bottle formula exclusively (non-supplemented group; n=32) or intravenous fluid in addition to breast milk or formula (supplemented group; n=32) during conventional phototherapy.

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Results: 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. Similarly, the duration of phototherapy required in both supplemented and non supplemented groups was 48hr.
Conclusion: These data show that administration of extra intravenous fluid in jaundiced healthy, term, breastfed neonates have no beneficial effect on the rate of serum bilirubin reduction during conventional phototherapy.

Introduction

Intravenous fluid (IV) supplementation added to oral feedings may be beneficial in dehydrated neonates or neonates with bilirubin levels nearing those requiring exchange transfusion, although not necessary for all affected infants [1,2,3].
Some complications are associated with phototherapy include loose stools, overheating, dehydration (increased insensible water loss, diarrhea), hyperthermia and others [4,5,6]. Maintaining adequate hydration and urine output during phototherapy is important since urinary excretion of lumirubin is the principal mechanism by which phototherapy reduces total bilirubin. During phototherapy, infants should continue oral feedings by breast or bottle. For high total bilirubin levels that approach the exchange transfusion level, phototherapy should be continuous until the total bilirubin has declined to about 20 mg/dL (342 micromol/L). Thereafter phototherapy can be interrupted for feeding [7].
American Academy of Pediatrics, Subcommittee on hyperbilirubinemia instructions that intravenous hydration may be necessary to correct hypovolemia in infants with significant volume depletion whose oral intake is inadequate; otherwise, intravenous fluid is not recommended [7], and breastfed infants whose intake is inadequate, with excessive weight loss (>12 percent of birth weight), or who have evidence of hypovolemia, should receive supplementation with expressed breast milk or formula [7].

The temporary interruption of breastfeeding with the substitution of formula may enhance the efficacy of phototherapy by decreasing the enterohepatic circulation of bilirubin [8].

The aim of this work was to evaluate the effect of intravenous fluid supplementation during conventional phototherapy on decreasing serum bilirubin levels in neonates with high bilirubin levels who are healthy term and with nonhemolytic hyperbilirubinemia.

Patients and Methods

During the period from January 2, 2010 through December 31, 2010, Sixty four jaundiced neonates who were admitted to the neonatal ward of Karbala teaching hospital for children, delivered between 38 and 41 weeks gestation following an uneventful pregnancy and had a total serum bilirubin (TSB) between 18 and 22 mg/dl were studied.

The neonate with the following problems has been excluded from the study: major congenital malformation, hemolytic disease (Rh or ABO incompatibility and a positive coombs' test), Infection (congenital or acquired), G6PD deficiency, dehydration, conjugated hyperbilirubinemia > 15% of the total serum bilirubin levels, prolonged jaundice persisting beyond 14 days of life.

With verbal consent from their parents, neonates were assigned randomly to two groups, either the breast-fed or formula-fed with IV fluid (non-supplemented group; N=32), or breast-fed or formula fed in addition to IV fluid (supplemented group; N=32)

Neonates in the fluid-supplemented group receive a 25% of their maintenance fluid requirement. The daily maintenance fluid level considered 80 ml/ kg on day 2, 100 ml/kg on day3 and 150 ml/kg on day 4 and thereafter. The supplementary fluid was given as continuous intravenous 1/5 normal saline and 5% dextrose.

Phototherapy units contained 3 special blue lamps (Philips TL20/52, Philps lighting) and 2 white lamps adjusted to be 25 cm above the neonates skin. Total serum bilirubin levels were measured at the beginning, and then every12 hours. Phototherapy and bilirubin measurement were continued until the TSB declined to less than 14 mg/dl.

Laboratory investigations included: Complete blood count and blood film, blood group typing of neonates and their mothers, direct coombs tests, reticulocyte count, serum bilirubin level (total and direct), erythrocyte G6PD level, TSB was measured by Bilirubinometer and determination of direct bilirubin was made by the Colorimetric method.

We monitor the neonates during conventional phototherapy for risk of dehydration by clinical assessment, in addition to daily body weighing and daily specific gravity of the urine .

The study is a prospective, case control study. t –test was used in the statistical analysis. P value < 0.05 was considered as a level of significance.

Results

Table (1) shows the basic demographic data of the two groups (study group which supplemented with intravenous fluid and the control group in which no extra fluid added to the feeding) There were no significant differences between the two groups regarding gestational age, age on admission, weight on admission, and gender distribution, type of feeding and mode of delivery (p. value insignificant).

Table (1) show demographic data of neonate in supplemented and non-supplemented groups. Data are mean ±SD

Data		Supplemented Group N: 32	Non- supplemented Group N: 32	P value
Gestational age (wk)		39.03 ± 0.64	38.84 ± 0.72	0.26
Age at admission (days)		7.31 ± 1.69	6.96 ± 1.39	0.36
Weight on admission (kg)		3.10 ± 0.14	3.09 ± 0.99	0.95
Sex	Male	17	18	0.85
	Female	15	14	0.86
Feeding	Breast	23	25	0.62
	Bottle	9	7	0.78
Delivery	NVD	17	19	0.72
	C/S	15	13	0.75

Figure (1, 2) shows there is no significant difference in percentage of type of feeding and mode of delivery in both fluid supplemented and non-supplemented groups.

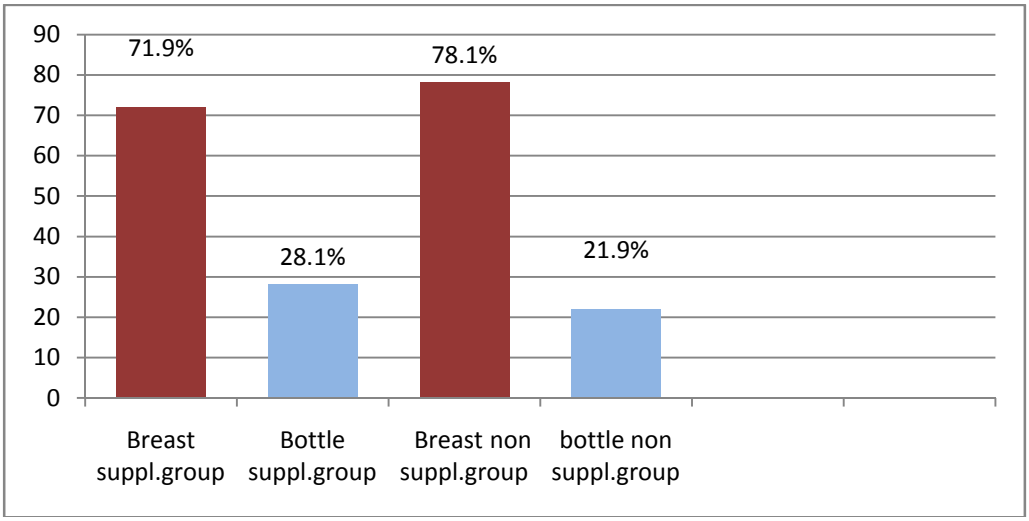

Figure (1) percentage of type of feeding in supplemented and non-supplemented group.

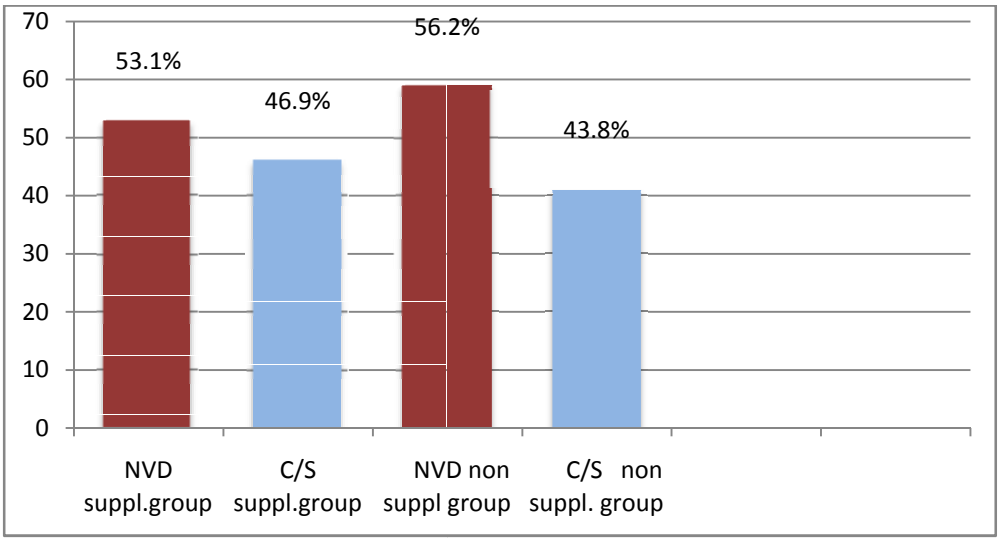

Figure (2) percentage of mode of delivery in supplemented and non-supplemented group.

Table (2) shows there were no statistically significant differences in the mean reticulocyte count, hematocrit and TSB levels at the time of enrollment between the two groups thus, supplemented and non-supplemented groups were comparable. The TSB levels on enrollment in supplemented and non supplemented groups ranged from 18 to 22 mg/dl and 18 to 21.2 mg/dl, respectively.The mean TSB levels in the two groups of neonates during phototherapy were not significantly different after 12h, 24hr, 36hr, and 48hr respectively.

Table (2) laboratory data of neonate in supplemented and non supplemented groups. Data are mean ±SD

Data	Supplemented group N:32	Non- supplemented group N:32	P value
PCV (%)	48.31 ± 3.31	49.53 ± 4.25	0.20
Reticulocyte (%)	2.15 ± 0.67	2.21 ± 0.79	0.74
TSB (mg/dl) admission	18.93 ± 1.70	19.53 ± 1.09	0.97
12 hr	16.82 ± 1.13	17.32 ± 1.20	0.09
24hr	15.74 ± 0.73	16 ± 0.57	0.11
36hr	14.54 ± 0.51	14.74 ± 0.61	0.15
48hr	12.62 ± 0.75	13 ± 0.91	0.07

Duration of phototherapy in the fluid supplemented group and non-supplemented group was similar. There is no significant dehydration develops in the control group during phototherapy.

All the neonates in both groups discharge from phototherapy after 48 hr. No cases developed local or systemic infection, dehydration, or need for exchange blood transfusion. All neonates discharged with good general condition.

Discussion

This work demonstrates that the rate of the decrease in bilirubin concentration in fluid-supplemented healthy hyperbilirubenemic group was comparable with the non supplemented group. In addition, the duration of exposure to phototherapy was not significantly different in two groups.

In a controlled study on the effect of water supplementation in normal term breast-fed babies who have physiologic jaundice, where water supplementation was given to 120 babies, while 55 babies received no extra fluid. There was no significant difference between the two groups when peak serum bilirubin levels and incidence of phototherapy were compared [9].

In other controlled study that include fluid supplementation in non hemolytic hyperbilirubinemia in healthy term neonates, intravenous fluid of 1/5 normal saline and 5% dextrose was given to 30 neonates while other 30 neonates had no other additional fluid. There was no significant difference between the two groups in the rate of decreasing TSB or duration of phototherapy [10].

Although a review of the literature by AAP found no strong evidence that excess fluid administration affects the serum bilirubin concentration [11], there is a beneficial effect of additional fluid in reducing serum concentration of bilirubin [12]. Some studies have shown evidence of decreased response to phototherapy in breast-fed compared with formula-fed neonates [13,14]. In exclusively breast-fed neonates with severe jaundice who require conventional phototherapy, the addition of formula feeding might enhance the response to phototherapy [13]. They have speculated that even a mild relative dehydration might be a contributing factor in reducing response to phototherapy.

The AAP Work Group on Breast Feeding indicates that if supplementation is deemed necessary as in cases of ineffective breast-feeding or mild dehydration, human milk is preferred feeding supplement in all infants [15]. In this situation mother must be helped with breast-pumping to maintain a generous milk supply. Furthermore, it is reported that neonates fed on demand during

phototherapy, will increase their fluid intake by 20- 40% compared to control [16].

As far as oral supplementation is dependent on mother or nurse and it is not accurate enough to rely on, we selected intravenous supplementation instead. However, in our study we found there is no signs of dehydration develops in the control group during conventional phototherapy and also there is no decreasing in the daily weight or increase in the specific gravity of urine in this group, we can't measure or estimate the volume of breast milk taken by the breast-fed neonates, but since there was no significant difference in the rate of decrease of TSB, it seems that the exclusively breast-fed neonates compensated their fluid loss by increases in their breast milk intake during phototherapy.

There is a strong relationship between the frequency of breastfeeding and a decreased incidence of significant elevated bilirubin levels [17].

Thus, based on our results, all good feeding healthy term infants with significant hyperbilirubinemia requiring conventional phototherapy prefer not be given supplemental intravenous fluid. Furthermore administration of intravenous fluid may be accompanied by such problems as painful venipuncture, and potential risks of extravasation of fluid and infection. In addition, setting up an intravenous drip is cost effective.

A premature neonate may lose fluid more than a full term during conventional phototherapy and because some premature neonates are poor feeders, we recommend further study to evaluate the effectiveness of extra fluid in decreasing TSB in jaundiced premature neonate during phototherapy .

In addition, using intensive rather than conventional phototherapy nowadays and its effects on fluid state also need to be concerned.

Conclusion

There is no significant effect for intravenous fluid supplementation in decreasing TSB level in good feeding healthy full term neonates with severe non hemolytic hyperbilirubinemia during conventional phototherapy.

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