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The effect of covering head on the hypocalcemia caused by phototherapy in the icteric preterm infants in the Vali-e-Asr hospital in 2015; A Randomized Controlled Trial

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ABSTRACT

There are several methods to reduce serum bilirubin in neonatal jaundice that the most common of them is phototherapy and this method will cause some side effects which one of them is hypocalcemia that is occurred due to the decreased serum concentration of melatonin. This study was conducted aims to evaluate the effect of covering head on hypocalcemia caused by the phototherapy in the icteric infants in the Vali-e-Asr Hospital in 2015. in this clinical trial study, 60 preterm infants with icterus characteristics were hospitalized in NICU ward of Vali-e-Asr Hospital in Birjand at 2014 that had the inclusion criteria and were selected by available sampling and divided into two test group (30 individuals) and control group (30 individuals). Infants of the control group with the routine method and infants of the test group with the use of a hat covering occiput were treated under phototherapy. Serum bilirubin and calcium were checked upon admission, 48 hours after starting phototherapy and 24 hours after discontinuation of phototherapy. Data were analyzed using the statistical software of SPSS 15 and statistical t-test at the significance level of 0.05. results showed that the average age at birth, age at phototherapy, average of bilirubin level and calcium level before intervention in the infants of both test and control groups did not have a significant difference (P>0.05). But 48 hours after starting phototherapy, the average of serum calcium in the infants of test group compared to the control group and 24 hours after discontinuation of phototherapy in the infants of control group was significantly higher (P<0.05). In other words, incidence of hypocalcemia in infants with phototherapy with hat was significantly lower than infants with routine phototherapy. In this study (53 percent) of infants of the control group received 58.9 mg intravenous calcium. Only 6% of the infants in the intervention group received 10 mg intravenous calcium. covering the head of infants under phototherapy is an effective, safe and low cost method to prevent hypocalcemia.

Keywords: phototherapy, hypocalcemia, infants, icteric, hat.

INTRODUCTION

Neonatal jaundice is the most common disease in the neonatal period [1] that 60% of term and 80% of preterm infants are affected to it in the first week of life [2]. About 8-11% of cases, bilirubin level rises above 95% and evaluation and treatment are required that in the absence of proper treatment of jaundice may lead to serious complications such as Kernicterus that is followed by life-long disabilities [3. 4]. Proper deal in diagnosis, treatment and follow-up of jaundice has been always one of the important challenges in neonatology. Jaundice prevention, early diagnosis and proper treatment and prevention of its complications can reduce the problems of neonatal jaundice. Diagnosis and treatment of neonatal jaundice have a great jaundice in preventing encephalopathy [5].

Several ways have been evaluated in the treatment of neonatal jaundice that the most effective and most common of them is phototherapy [6]. This is while the phototherapy may be associated with some complications. Skin rash,

diarrhea, increased body temperature, DNA damage, chill, trauma to the eye, nasal obstruction due to eye bandage and bronze baby syndrome can be named as some common complications of phototherapy [7, 8]. In the recent years and in different studies, phototherapy is mentioned as a risk factor for hypocalcemia [9, 10].

The results of Hakanson et al study on the animals showed that phototherapy may lead to a decrease in melatonin and subsequently, secretion of Glucocorticoids is reduced and increasing calcium absorption from the bones will lead to hypocalcemia [11]. Kumar showed that more than 80% of the preterm infants and 66.66% of the term neonates are affected by hypocalcemia following phototherapy [12].

To prevent hypocalcemia within phototherapy, there are two suggestions: 1- oral calcium supplementation during phototherapy, 2- covering head during phototherapy in order to prevent reaching light to the pineal gland and prevention of melatonin reduction which eventually leads to the prevention of hypocalcemia [13]. Therefore, this study was conducted aimed to evaluate the effect of covering head on the hypocalcemia caused by phototherapy in icteric infants in Vali-e-Asr Hospital in 2015.

MATERIALS AND METHODS

In this clinical trial study, 60 preterm infants hospitalized in NICU ward of Vali-e-Asr Hospital in Birjand with diagnosis of jaundice in 2015 and had the inclusion criteria, were selected by available sampling and evaluated. Inclusion criteria included gestational age less than 37 weeks, birth weight less than 2500 g, being healthy in the physical examination, tendency of mothers to participate in the study. In case of having any of the following items, the neonates were excluded from the study: asphyxia, respiratory distress, sepsis, hemolytic anemia, congenital malformations, hypocalcemia before phototherapy, systemic infection and blood disorders and positive combs test, Apgar score below 7, infants with parenteral nutrition, infants who were under blood replacement and infants of diabetic mothers, thyroid disorder, anticonvulsants consumer and infants of mothers with high blood pressure.

After obtaining permission from the hospital authorities and visiting NICU ward, the infants who had the inclusion criteria were selected and after obtaining a written informed consent from their parents were participated in the study and age, sex, weight and bilirubin of them were recorded in data form. The infants were randomly divided into two groups of test (30 individuals) and control (30 individuals) and the infants of control group were treated by routine phototherapy and infants of the test group were treated by phototherapy using a hat that covers occiput of infant. In both intervention and control groups, genital areas and eyes were covered in order to prevent the possible damages to the genital glands and cornea of the eye. Serum bilirubin and calcium were checked upon admission, 48 hours after starting phototherapy and 24 hours after discontinuation of phototherapy. Calcium and bilirubin of the infants' blood samples were measured with Human 200 kit device and photometry method.

Blood samples were taken as clot and approximately 2 hours after the baby has been fed and it was avoided to pour it in the test tubes containing oxalate, citrate and EDTA due to the complex formation of these materials with calcium. Blood sampling was done in the morning and preferably by a research assistant.

The sample was also poured very slowly to the test tube to prevent damage of blood cell and a false increase in calcium level. The maximum storage time of blood was one hour and to avoid the false increase in the calcium level, it was sent to the laboratory promptly and analyzed by a technician in the laboratory.

According to Dr. Karimifar et al study, for more accurate research, the calcium level less than or equal to 7.5 mg/dl was defined as hypocalcemia (14).

All infants were treated by 8 single conventional phototherapy device (made in Toussaint), 40 watt with blue light and wavelength of 410-479 nm at a distance of 30-40 cm from the body surface.

Data were analyzed using the statistical software of SPSS 15 and independent statistical t-test at the significance level of 0.05.

RESULTS

30 patients of 60 evaluated preterm infants with diagnosis of icterus were in the test group (50%) and 30 of them were in the control group (50%). The average age of birth, age at phototherapy, weight and the average bilirubin level had no significant difference in test and control groups before intervention ($P>0.05$) (table 1).

Time of phototherapy for the infants of intervention and control groups were 3.1±0.40 and 3.7±2.03, respectively (P=0.12).

The result of independent t-test showed that the average of calcium level in the infants of both test and control groups did not have any significant difference (P=0.89), but it was significantly higher in the infants of test group compared to the control group 48 hours after starting phototherapy (P<0.001). The average of calcium level after 24 hours of discontinuation of phototherapy was higher in the control group compared to the test group (P=0.03) (table 2).

Also, the results showed that 16 infants of the control group (53.3%) and 2 infants of the test group (6%) needed to receive calcium 48 hours after starting phototherapy (P<0.05) and intravenous dose of calcium has been stopped 24 hours after discontinuation of phototherapy.

Table 1- comparison of age of birth, age at phototherapy, weight and average of bilirubin level before intervention in the infants of test and control groups

Variable	Intervention	Control	P value
	Mean±SD	Mean±SD	
age of birth (week)	30.86±3.14	30.83±2.93	0.97
age at phototherapy (day)	3.53±3.34	3.00±0.52	0.39
Weight (g)	1485.5±429.39	1525.0±444.66	0.73
average of bilirubin level	11.27±2.93	10.67±1.75	0.34

Table 2- comparison of the average of calcium level before intervention, 48 hours after starting phototherapy and 24 hours after discontinuation of phototherapy in the infants of both test and control groups

Variable	Intervention	Control	P value
	Mean±SD	Mean±SD	
before intervention	7.87±1.19	7.83±1.25	0.89
48 hours after starting phototherapy	8.95±1.12	7.04±1.29	<0.001
24 hours after discontinuation of phototherapy	8.94±0.99	9.62±1.29	0.03

DISCUSSION

Results of the present study showed that the average of calcium level was significantly higher in the infants of test group 48 hours after starting phototherapy compared to the control group [P<0.001]. in other words, the incidence of hypocalcemia in infants with phototherapy with hat was significantly lower than infants with routine phototherapy.

In the study of Nezami Qeshmi et al [2012] in the field of evaluating the incidence of hypocalcemia in the infants under phototherapy and in the study of Human et al [2007] in the field of serum and urinary calcium excretion in Non-physiological neonatal phototherapy, found that the average of calcium level there is no significant difference between the calcium levels before and 48 hours after phototherapy in this research [P=0.578] that is not consistent with our study. Maybe this difference is due to the fact that in our study, the infants were under phototherapy with 8 lamps but with 4 lamps in Nezami Qeshmi study.

In Kargar et al study [2012] regarding the effect of using a hat on the level of serum and magnesium in icteric term neonates during phototherapy found that serum calcium level of the infants of control group has decreased compared to before phototherapy and a significant difference is occurred between two groups of with and without hat [P=0.001] [11].

Ehsanipour et al [2009] in a study in the field of evaluating the frequency of decreased concentration of serum calcium caused by phototherapy on the icteric infants, found that serum calcium level reduced significantly in 48 hours after phototherapy compared to before that [P=0.001] and 82% of infants were affected by hypocalcemia 48 hours after phototherapy [15]. In this regard, Eqbalian et al study in Hamedan on 63 term infants weighing over 2500 g confirmed the hypocalcemia caused by phototherapy and since an infant was affected sleep apnea due to hypocalcemia, calcium prophylaxis administration was recommended in these cases [16].

Oppe et al [2004] indicated that using a hat to cover the occiput area can prevent the complications of hypocalcemia as well as its long-term effects such as mental retardation, academic failure and also physical disability [17].

The results of Kargar et al study [2012] in the field of evaluating the effect of using a hat on the serum level of calcium and magnesium in the icteric term infants during phototherapy that was conducted on 72 full term infants

weighing 2500 g, showed that hypocalcemia in infants with routine phototherapy [38.88%] was significantly higher compared to the infants with phototherapy with a hat [13.88%] [P<0.001] [11].

The results of Ehsanipor et al study [2009] in regard to evaluating the effect of a hat on the hypocalcemia caused by phototherapy in the icteric infants which was conducted on 120 full term infants weighing more than 2500 g, showed that the incidence of hypocalcemia in the infants with routine phototherapy [77.77%] was significantly higher than the infants with phototherapy with a hat [22.2%] [P<0.001] [13].

The pathogenesis of hypocalcemia caused by phototherapy can be known as reduced melatonin following the suppression of pineal gland and following that, suppression of corticosterone synthesis and increased calcium absorption [11, 14]. According to the results of above mentioned studies, we can prevent the decrease in melatonin and following that hypocalcemia by covering the occiput area.

According to the results of the present study after discontinuation of phototherapy, serum level of calcium was returned to normal in the infants of control group. Intravenous dose of calcium was stopped and the average of calcium level in the infants of control group was higher compared to the test group.

In a research which was conducted by Karamifar et al in Shiraz, 22% of preterm infants and 8.7% of term infants became hypocalcaemic during phototherapy and calcium level of all these infants became normal after discontinuation of phototherapy [14].

These findings show that although with the reduction of calcium level in infants, treatment by calcium must be made if necessary, but according to the most dangerous side effects of treatment such as bradycardia and dysrhythmia and that its injection will be followed by some complications such as necrosis and calcification of the injection site [18]. By wearing a hat, controversial change of calcium level in infants with a particular sensitivity can be naturally prevented. Moreover, it indicates that changes in calcium level during phototherapy had been due to the light of phototherapy devicesthat after neonatal jaundice became normal and did not need to receive phototherapy, this change will be resolved, too.

CONCLUSION

The results of the present study showed that covering the pineal gland is effective in prevention of hypocalcemia caused by phototherapy and since by stopping phototherapy, calcium was returned to the normal range, there is no need to administer calcium in these cases and this complication can be prevented only by covering the occiput area of the head using a hat.

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