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RESEARCH ARTICLE

Comparison of Effect of Using Double Phototherapy and Single Phototherapy in Treatment of Non-Hemolytic Icterus in Newborns

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Abstract

Icterus is one of the common problems in newborn which may cause nervous damage, mental retardation and even death in case of failure in immediate treatment. Phototherapy is one of the common treatments for reducing bilirubin in newborns. This article compares the effect of using double phototherapy and single phototherapy for treatment of non-hemolytic icterus in newborns.This clinical trial study was conducted on 80 non-hemolytic icteric newborns hospitalized in neonatal ward of Tehran Javaheri Hospital in 2010-11. They were randomly divided into two 40-member groups: one group was treated by single and another by doublephototherapy. The phototherapy duration and level of serum bilirubin before and during phototherapy and 48 hours after discharge were analyzed. Data were analyzed by independent T-test and Chi-square test.There was no significant statistical difference between two groups in terms of average age, gender, birth weight and the level of serum bilirubin before phototherapy. The average reduction of serum bilirubin after 24 and 48 hours was 2.8±1.4 mg/dl and 5.79±1.98 mg/dl in the single phototherapy group, and 3.3±1.7 mg/dl and 6.11±2.21 mg/dl in double phototherapy group and this difference was not statistically significant. Average duration of phototherapy was 52.5±13.6 hours in single and 48.03±12.2 hours in double phototherapy, but this difference was not statistically significant.

Although the reduction rate of serum bilirubin in double phototherapy was more than single phototherapy 24 and 48 hours after beginning and the duration of phototherapy was less but this difference was not significant statistically. In non-hemolytic icterus which is not severe, using double phototherapy does not have more effect than single while it doubles the costs and energy consumption.

Introduction

Icterus is one of the common problems in newborns which appears in 60% of term and 80% of preterm newborns during the first week after birth (1). Neonatal jaundice is resulted from the sediment of non-conjugated bilirubin pigment in skin and mucosal membranes. It usually has a benign process, without any complications (2). Severe neonatal jaundice will be seriously neurotoxic if not treated in time, causing kernicterus, mental retardation and death (3). Bilirubin toxicity is usually irreversible. 5-10% of icteric newborns need therapeutic intervention (4).

Phototherapy, exchange transfusion and medication therapy are some treatments for icterus. Phototherapy is one of the common treatments for icterus in newborns, known as a safe noninvasive treatment method for icterus since 1958 (3). Blue light and white light with wavelength of 420-470 nm are used in phototherapy which is effective on reduction of serum bilirubin. Under light, bilirubin changes to soluble isomers in water and is easily excreted through urine and bile without need of conjugation. Common side effects of phototherapy are: increased insensible loss of water, loose stools, red skin rash, retinal injury and bronze discoloration of the skin (2). The effect of phototherapy depends on the intensity and wavelength of light and the surface of newborn's body exposed to the light (5,6). The more phototherapy lamps that are used, the faster serum bilirubin decreases (2). If bilirubin is close to the threshold of exchange transfusion, strong phototherapy will be indicated by increasing the surface of newborn's body exposed to the light and increasing the intensity of phototherapy by using lateral lamps and fiber optic blanket placed under newborn, which reduces serum bilirubin faster (2). In many neonatal wards, two phototherapy devices are used together, instead of one, for faster reduction of bilirubin; therefore, the number of phototherapy lamps increases and energy consumption doubles, but both devices radiate to the newborn from one surface. The aim of this study is to compare the effect of using single phototherapy with double phototherapy in treatment of non-hemolytic icterus in neonates.

Materials and Methods:

This clinical trial study was conducted on 80 newborns with non-hemolytic icterus in Tehran Javaheri Hospital in 2010-11. The inclusion criteria were term newborns without any underlying disease, weight more than 2500 g, age of 3-10 days, non-hemolytic icterus, serum bilirubin less than 20 mg/dl and not having any other problems except icterus through examination. Sampling method was taken from available cases. This research was performed with regards to the principles of Helsinki Declaration and consent was obtained from parents. Newborns were randomly divided into two 40-member groups. One group was treated by single and another group by double phototherapy. Each device, with trademark of Tucson, had 4 Philips lamps with blue light with wavelength of 420-470 nm, and lifetime less than 1000 hours placed near the newborn with an interval of 25 cm. In case of using two devices, one device was placed exactly above newborn's head and the other one beside the first one in an oblique form. Newborns were breast-fed. The variables included age, weight and gender of newborn, serum bilirubin levels at the time of admission and during phototherapy and duration and side effects of phototherapy. They were naked and their eyes and genitalia were covered during phototherapy. Newborns were replaced every 2 hours. 48 hours after phototherapy,serum bilirubin levelwas measured again. Data were analyzed by SPSS 15 and independent T-test and Chi Square. Significance of statistical relationships was less than 0.05.

Results and discussion :

The average age of newborns was 4.97±2.1 days and their average weight was 3103.5±383.3 g. Two groups did not have any significant statistical differences in terms of average age, gender, birth weight and level of serum bilirubin at the time of admission (table 1). Average reduction of serum bilirubin after 24 hours was 2.8±1.4 mg/dl in group under single phototherapy, and 3.3±1.7 mg/dl in group under double phototherapy and this difference was not significant statistically (P= 0.14). The average reduction of bilirubin was 5.79±1.98 mg/dl in group under single phototherapy, and 6.11±2.21 mg/dl in group under double phototherapy, 48 hours after admission and this difference was not significant statistically (P= 0.49). The average duration of phototherapy was 52.5±13.6 hours in single phototherapy and 48.03±12.2 hours in double phototherapy. Although the duration in double phototherapy was less than single phototherapy but this difference was not significant statistically (P=0.13). No side effectwas observed caused by phototherapy in neither of the groups. The average increasing of serum bilirubin was 0.15±1.9 mg/dl in single phototherapy group, and 0.53±1.6 mg/dl in double phototherapy group 48 hours after discharge, and the difference was not significant statistically (P=0.41).

According to the results of this study, in case of using double phototherapy instead of single for the treatment of non-hemolytic icterus which is not severe, serum bilirubin level reduces faster and the duration of phototherapy becomes shorter, but the difference between two methods is not significant statistically. In Silva et al study in 2009, 37 newborns underwent single phototherapy and 40 underwent double phototherapy. In this study, the average reduction of bilirubin in double phototherapy was more than single 24 hours after admission but it was not significant statistically which is similar to the results of our study. This study has concluded that double phototherapy is not more effective than single phototherapy on term newborns with non-hemolytic hyperbilirubinemia(7). In Zamani et al study in Iran (October 2008-2010), there was a comparison of phototherapy with 4 lamps and 8 lamps and it was observed that the efficiency of 4-lamp phototherapy with a distance of 20 cm from the newborn is equal to efficiency of 8-lamp phototherapy with the distance of 40 cm. This study has

concluded that the rate of energy waste in 8-lamp phototherapy is two times more than 4-lamp, but due to the doubled distance of light source from the newborn and ineffective contact of the radiation of lateral lamps to newborn, the efficiency of both methods is equal (8). In Naderi et al study in Iran (2009), double phototherapy and triple phototherapy were compared, but there was no difference between two groups in terms of serum bilirubin reduction and hospitalization duration (9). In Boonyarittipong et al study in Thailand (2008), the strong single surface and double surface phototherapies were compared in non-hemolytic icterus in neonates, showing that the effect of double phototherapy in reduction of serum bilirubin was more than single phototherapy 24 and 48 hours after beginning the treatment(10). The Sarici et al study in Turkey (2000) reported that the effect of double phototherapy is better in serious hyperbilirubinemia (11). In this study, the blue light above the head of the newborn and fiber optic blanket under the newborn were used for double phototherapy, and newborns received light from both sides; as a result, the effect of double phototherapy was more. In Holtrop et al study, the double phototherapy was more effective on newborns with low birth weight than single (12). In this study, double phototherapy included one phototherapy device above the head and fiber optic blanket under newborn, and in fact, the skin contact surface to the phototherapy light was more.

Generally, this study indicated that there is no significant difference between double and single phototherapy in non-serious non-hemolytic icterus while double phototherapy consumes costs and energy two times more. By placement of one phototherapy device beside another one, the efficiency of phototherapy does not increase due to ineffective contact of radiation of the lamps of the lateral device. Using double phototherapy will be more effective than single phototherapy if the phototherapy is radiated to the newborn from two sides. Therefore, in serious hyperbilirubinemia close to exchange transfusion, it is recommended to use strong phototherapy radiating to newborn from different sides. Some limitations of this study were few number of samples and not considering severe hyperbilirubinemia. Conducting a study with considering hemolytic icterus and severe hyperbilirubinemia is recommended.

Table 1: Characteristics of Two Groups of Single and Double Phototherapy:

Phototherapy/ Specifications	Single Phototherapy	Double Phototherapy	Rate of P
Average Age (Days)	**5.18±2.3**	**4.75±1.7**	**NS**
Average Birth Weight (gr)	**3044.4±424**	**3143.1±341**	**NS**
Gender: Boy **Girl**	**52.5%** **47.5%**	**47.5%** **52.5%**	**NS**
Average Serum Bilirubin at the time of admission (mg/dl)	**15.17±2.3**	**15.67±2.6**	**NS**

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