International Journal of Medical and Health Research
ISSN: 2454-9142
www.medicalsciencejournal.com
Volume 4; Issue 3; March 2018; Page No. 05-07

Investigating cutaneous examination in the diagnosis of infant hyperbilirubinemia

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Abstract
Introduction: Bilirubin is a tetrapyrrole pigment formed out of the combination of heme of the hemoglobin of blood cells. Billi Test is a simple method for cutaneous estimating total serum bilirubin levels in noninvasive, quick and painless to is used.
Method: The present descriptive analytical study was carried out on neonates with hyperbilirubinemia who were hospitalized in Neonatal and NICU Wards at Amir Almomenin (AS) Hospital in the first half of 2013.
Findings: Neonates diagnosed with hyperbilirubinemia admitted in pediatrics and NICU of Amiralmomenin Hospital of Zabol were studied in the present research; 64 neonates (53.3%) were boys and 56 neonates (46.7%) were girls. The average weight of newborns was 2.4±0.7 kg and the mean gestational age was 35.4±2.8 weeks. ($P>0.05$) The mean rate of cutaneous bilirubin turned out to be 14.4±2.8 mg/dl among infants diagnosed with hyperbilirubinemia examined in the present research.
Conclusion: According to the results of our study and other studies, it seems that the Bilicheck device has the necessary accuracy as a measuring and monitoring device for neonatal jaundice and can be an appropriate alternative for serum bilirubin measurement in neonates with jaundice.

Keywords: infant, hyperbilirubinemia

Introduction

Bilirubin is a tetrapyrrole pigment formed out of the combination of heme of the hemoglobin of blood cells. Approximately 4 milligrams of this substance, per each kilo of body weight, is produced daily, with a large portion (80-85 percent) of hemoglobin, and the remainder of the destruction of arthritic cells emerging sooner than they should in the bone marrow during ineffective erythropoiesis, and also the destruction of various hemoproteins, such as cytochrome p-450 and c cytochrome. The degeneration is performed in the monocular phagocytic cells of the spleen, liver and bone marrow. [1] The first step in converting both to bilirubin is to open the oxidation of the molecule in the carbon monoxide by the action of the heme oxygenase enzyme; this enzyme needs oxygen and NADPH for itself. The final product of this reaction is biliverdine, carbon monoxide and iron. The second reaction is catalyzed by a cytoplasmic enzyme called reductase biliverdine. In this reaction, the methylene blue linkage is recovered and bilirubin is produced. The bilirubin produced in the reticuloenthocytal cells is almost insoluble in water. Tinprotoporphyrin, a synthetic metalloparphyrin, is a potent competitive inhibitor of oxygenation. The beneficial effect of this compound can be on reducing the production of bilirubin and preventing its toxic effects among infants [2]. Mummies change water-soluble, non-toxic biliverdine into water-insoluble bilirubin; however, this is not the case in birds, reptiles and amphibians. This can be confirmed by the fact that biliverdine, unlike bilirubin, is unable to cross the pair. The chemical properties of bilirubin are composed of four peerlon loops connected by three carbon bridges. Non-conjugated bilirubin in physiologic PH is almost inaccurate in water because COOH and NH groups are involved in hydrogen bonds between strong molecules and thus not able to interact with the water. These transplants are broken down by conjugation of the COOH groups with glucuronic acid [3]. The reaction takes place in the liver cells, thereby greatly increasing the solubility of the bilirubin molecule in water and altering its biological properties. Non-conjugated bilirubin is released almost all over the membrane, such as the blood-brain barrier, the placenta, the intestinal epithelium, and the gallbladder, and only very small amounts are excreted into the bile. Therefore, liver conjugation to bilirubin allows the body to be excreted and prevent damage to the central nervous system. When unconjugated bilirubin is exposed to light, polar light isomers and lumirubin, which are the result of intra-molecular cyclization, are formed [4]. These compounds are eliminated by the liver without conjugation and therefore, it is very effective in lowering the concentration of bilirubin in hyperbilirubinemia of neonates and preventing its adverse effects [5]. Bilirubin transfer in the bilirubin produced in reticuloenthocytal cells is insoluble in water and it is immediately combined with plasma albumin after production from the cell into the blood. Bilirubin bound to albumin (non-conjugated bilirubin) is transported from the blood to the liver sinusoid, where bilirubin is removed from albumin and enters the liver. While kinetic data suggests that the prevailing trend in this release process has been facilitated and multiple bilirubin carriers have been identified, yet none of these molecules have been cloned yet. Intracellular bilirubin binds are distributed between the lipid medium of the membranes of the cell and the cytosolic aqueous medium through the plasma membrane and into the liver.

Method

The present descriptive analytical study was carried out on

neonates with hyperbilirubinemia who were hospitalized in Neonatal and NICU Wards at Amir Almomenin (AS) Hospital in the first half of 2013. The inclusion criterion was neonates with hyperbilirubinemia, and the exclusion criterion was blood transfusion. The required data were collected using a form and analyzed with SPSS Software. Data analysis was carried out through descriptive-analytical statistics using independent t-test and one-way ANOVA. The level of statistical significance was set at $p \leq 0.05$.

Finding

Neonates diagnosed with hyperbilirubinemia admitted in pediatrics and NICU of Amiralmomenin Hospital of Zabol were studied in the present research; 64 neonates (53.3%) were boys and 56 neonates (46.7%) were girls. The average weight of newborns was 2.4±0.7 kg and the mean gestational age was 35.4±2.8 weeks. (P>0.05)

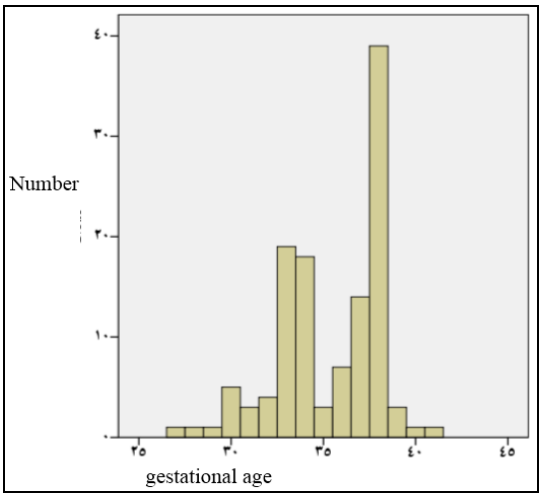

Fig 1: The frequency of gestational age of infants diagnosed with hyperbilirubinemia

The mean rate of cutaneous bilirubin turned out to be 14.4±2.8 mg/dl among infants diagnosed with hyperbilirubinemia examinedin the present research

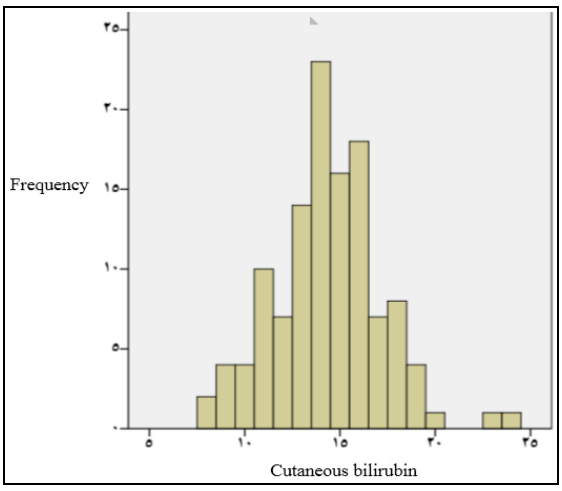

Fig 2: The frequency of gestational age of cutaneous bilirubin among infants diagnosed with hyperbilirubinemia

Discussion and Conclusion

Based on the results of Hemmati and Kiyani Rad study conducted in 2013, the correlation between the two methods was 0.96 and the gestational age, sex, and newborn weight did not affect the correlation. Bilickeck's sensitivity was 96.6%. The results showed that Bilicheck is a simple, non-invasive and reliable method for measuring bilirubin [6]. This study is also consistent with the present study and the sensitivity level; however, in contrast with their study, the gestational age, sex, and weight of the newborn affected the pregnancy rate, and the term neonates with normal weight and female gender had higher correlation in comparison with other neonates. In contrast to the previous study, Ebbesen's study showed a close correlation between the two methods in America. In this study, the cutaneous method is dependent on factors such as race, gestational age and birth weight, limiting its use in heterozygous populations [7], which is consistent with the present study in this regard. The results of Hegyi's study indicated that the size of the cutaneous site is not significantly different for preterm infants in any age group. In infants who did not undergo phototherapy, there was a high correlation between the two cutaneous and serum levels in both black and white breeds. This study also showed that phototherapy reduces the correlation coefficient and currently the use of this index in neonates is not recommended under phototherapy [8]. The results of Keshishjan *et al* study conducted in Russia indicated a linear relationship between the cutaneous and serum levels; the results showed that photometric measurements did not estimate serum bilirubin levels during phototherapy accurately, and this method is only suitable for monitoring the level of bilirubin and its changes in the skin and also for screening newborns [9]. Based on the results of Saeidi *et al* study conducted in 2010, serum bilirubin values in the laboratory had a high correlation with the results of TCB with a Bilicheck device. (766/0 = r) [10]

According to the results of our study and other studies, it seems that the Bilicheck device has the necessary accuracy as a measuring and monitoring device for neonatal jaundice and can be an appropriate alternative for serum bilirubin measurement in neonates with jaundice.

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