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THE RELATIONSHIP BETWEEN INTENSIVE PHOTOTHERAPY AND NEONATAL JUNDICE

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ABSTRACT

One of the most prevalent clinical conditions is hyperbilirubinemia, which is a common clinical problem encountered during the neonatal period, especially in the first week of life. To assess the efficacy of intensive phototherapy on treatment neonatal jaundice and it's relation with the frequency of the exchange transfusion and its complications. A cross sectional observation study conducted on neonate admitted to Al-Imamein Al-Kadhimein Medical City, during the period from the 1st of January 2017to 31th of December 2017,117 was with neonatal jaundice, and second group during period 1st of January 2013to 31th of December 2013, with 162 having neonatal jaundice . The information taking from the case sheets. A 2 groups of neonates having jaundice attending Al-Imamein Al-Kadhimein medical city, in 2013 was with male: female ratio =1.5:1, while in 2017 was with male: female ratio =1.7:1. There is significant reduction in breast feeding in 2013 was (55.6%), while in 2017 was (27.3%). There is significant reduction in exchange transfusion in 2013 was 62(%), while in 2017 was (%). There is significant reduction in day of hospitalisation by using intensive phototherapy (mean day of hospitalisation =2.31), while by using exchange transfusion (mean day of hospitalisation = 7.1). Regarding to complications there is no significant complications with intensive phototherapy (skin rash, diarrhoea, dehydration) was (50%, 4%, 7%) respectively. The use of intensive phototherapy in treatment of neonatal jaundice is very effective in lowering TSB and in reduction of the frequency of exchange transfusion, with low days of hospital stay and low risk of complications.

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INTRODUCTION

One of the most prevalent clinical conditions is hyperbilirubinemia (Olusanya, 2015), which is a common clinical problem encountered during the neonatal period, especially in the first week of life (Bhutani, 2013). Nearly 8% to 11% of neonates develop hyperbilirubinemia. When the total serum bilirubin (TSB) rises above the 95th percentile for age (high-risk zone) during the first week of life, it will be considered as hyperbilirubinemia (Burke, 2019 and Young Infants Clinical Signs Study Group, 2008). Between 60%–80% of healthy infants are expected to present with idiopathic neonatal jaundice (Chou, 2003). Neonatal jaundice is the discoloration of skin and sclera colour to yellowish in a newborn by bilirubin (Ogunfowora, 2006). Bilirubin is not merely a nuisance molecule that has dire consequences, but bilirubin such as uric acid is an important antioxidant circulating in biologic system of neonate (Nag, 2009; Yousefi, 2011 and Barikbin, 2011). However, high bilirubin levels can be toxic for central nervous system development and may cause behavioural and neurological impairment (Neurotoxicity or Kernicterus) even in term newborns (Paludetto, 2002 and Boo, 2007). Neonatal jaundice may be on account of different parameters such as birth weight, gestational age, premature rupture of membranes, maternal infectious diseases or other illness during pregnancy, having different sources of origin, hence having different types (Mesic, 2014). The main causes of increased bilirubin mostly are: race, genetic polymorphisms; inherited and acquired defects e.g. spherocytosis, Gilbert's syndrome, Najjar 1 and 2 Molecular genetics studies have shown the correlations between neonatal hyperbilirubinemia and different genetic variations which can change in enzyme activity, For example variations in the uridine 5′-diphosphate glucuronosyltransferase 1A1 (UGT1A1) gene may cause decreased enzyme activity in neonates and adults which leads

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to the unconjugated bilirubin accumulation, Also the variation in the organic anion transporter 2 (OATP2) genes may result in severe hyperbilirubinemia in neonates (D'Silva, 2014 and Huang, 2004). Variations of 388 G>A (Asp130Asn, rs2306283), 521 T>C (Val174Ala, rs4149056), 463 C>A (Pro155Thr, rs11045819) of the solute carrier organic anion transporter family member 1B1 (SLCO1B1) gene which encodes the hepatic solute carrier organic anion transporter 1B1, a putative bilirubin transporter, may dispose subjects to newborns hyperbilirubinemia by the limitation of hepatic bilirubin uptake (Watchko, 2010; Xu, 2007 and Tirona, 2001). Furthermore, in a genome wide association study, two polymorphisms of SLCO1B3 gene (rs17680137 C>G and rs2117032 C>T) were observed to have a strong association with serum bilirubin levels and to contribute to idiopathic mild unconjugated hyperbilirubinemia in healthy adults [18, 19]. Phototherapy is the most frequently used treatment for neonatal hyperbilirubinemia (Maisels, 2008). In normal circumstances, the liver conjugates the bilirubin so that it can be excreted in bile. In the neonate with hyperbilirubinemia, the conjugating function of the liver is decreased due to hepatic immaturity. Phototherapy converts bilirubin into water soluble photoproducts that can bypass the liver conjugating system and be excreted without further metabolism (Ennever, 1990). The efficacy of phototherapy is dependent upon wavelength, irradiance, exposed body surface area, distance of phototherapy, and duration of exposure. Phototherapy is provided by use of high levels of irradiance in the 430- to 490-nm band (usually 30μW/cm2 per nm or higher) delivered to as much of the infant's surface area as possible, The commonly used light sources for providing phototherapy are special blue fluorescent tubes, compact fluorescent tubes and halogen spotlights. However, efficacy and ability of these light sources to provide phototherapy may be limited because of the inability to keep them close to the infant; Fiberoptic blankets attached to a light source can eliminate the heat transmission, but are not as effective as conventional units due to exposure of a limited surface area (Mills, 2001). These light sources also share the disadvantage of emitting unstable, broad wavelength light output and, thereby, cause adverse effects like glare, giddiness and headache to health care personnel (Tan, 1989). In recent years, a new type of light source, light-emitting diodes (LEDs), has been incorporated into phototherapy units. LEDs are power efficient, portable devices with low heat production so that they can be placed very close to the skin of the infants without any apparent untoward effects; they are also durable light sources with an average lifespan of 20,000 hours (Seidman, 2003). Blue LEDs have a narrow spectral band of high intensity monochromatic light that overlaps the absorption spectrum of bilirubin; these unique characteristics of LEDs make them an attractive light source for an optimal phototherapy unit (Vreman, 1998; Fasol, 1997).

Aim of the study: To assess the efficacy of intensive phototherapy on treatment neonatal jaundice and it's relation with the frequency of the exchange transfusion and its complications.

Patient and method: This was a cross sectional observation study conducted on neonate admitted to Al-Imamein Al-Kadhimein Medical City, during the period from 1st of January 2013to 31th of December 2013, with 162 having neonatal jaundice, and second group during the period from 1st of January 2017 to 31th of December 2017, with 117 having neonatal jaundice. The information taking from the case sheets of patient including :(gender, age, term /preterm, birthweight, blood group of the mother,blood group of the baby, type of treatment : phototherapy / intensive phototherapy, exchange transfusion and it's complication, feeding : (breast / artificial feeding / mixed feeding).

Exclusion criteria: patient with sepsis, intracranial haemorrhage, hypoglycaemia, obvious congenital anomaly.

Statistics: done by using SPSS version 25, p_value taken (if p_value less than 0.05 {It considered as significant}, p_value less than 0.005 {It considered as highly significant}).

RESULTS

Regarding to the frequency of jaundice in 2 groups, neonates attending Al-Imamein Al-Kadhimein medical city, in 2013 was 1811 neonate admitted to the hospital 162(8.9%)of them having jaundice while in 2017 was 1605 neonates attending hospital 117(7.2%) of them having neonatal jaundice. Regarding sex in 2013 the number of male and female {99(61.1%), 63(38.9%)} respectively, with male: female ratio =1.5:1, while in 2017 was {75 (64.1%), 42(35.9%)} respectively, with male: female ratio =1.7:1. Regarding RH (-) of mother and neonate in 2013 was {41(25.4%), 17(10.3%)} respectively, while in 2017 was {37(31.6%), 18(15.4%)} respectively.

Regarding prematurity in 2013 was 61(37.6%), while in 2017 was 31(26.5%). Regarding to the Feeding types (Breast, Artificial, mixed) in 2013 was {90(55.6%), 62(38.3%), 10(6.1%)} respectively, while in 2017 was {32(27.3%), 40(34.2%), 45(38.5%)} respectively. According to total serum bilirubin we divided it into 3 groups (less than 14, 14_18, more than 18) mg/dl, in 2013 was {22(13.6%), 38(23.5%), 102(62.9%) mg/dl} respectively, while in 2017 {27(23.1%), 23(19.6%), 67(57.3%) mg/dl} respectively. According to the Weight we divided it to 3 groups (less than 1.5kg, 1.5_2.5kg, more than 2.5kg), in 2013 was {9(5.6%), 73(45%), 80(49.4%)} respectively, while in 2017 was {4(3.4%), 45(38.5%), 68(58.1%)} respectively. as shown in table (1).

Table 1. The relationship between patients in 2017 group with different variables

variable	Full term	Preterm
RH(-)	13 (15.1%)	5 (16.1%)
RH(+)	73 (84.9%)	26 (83.9%)
Weight		
A)<1.5 kg	0 (0%)	4 (12.9%)
B)1.5_2.5 kg	24 (27.9%)	21 (67.7%)
C)>2.5kg	62 (72.1%)	6 (19.4%)
Mode of therapy		
1)Phototherapy	26(30.2%)	6(19.4%)
2)Intensive phototherapy	39(45.4%)	15(48.4%)
3)Exchange	21(24.4%)	10(32.2%)

Regarding to the use of intensive phototherapy the patients divided into two groups and compared in different variable as shown in table (2), and regarding to the use of intensive phototherapy the study show that there is significant association between artificial feeding (p_value=0.03) and level of bilirubin (TSB level) above 18 mg/dl (p_value=0.04) as shown in Table (2). The use of intensive phototherapy lead to significant reduction in number of exchange transfusion and day of hospitalisation without significant complications as shown in Table (3).

Table 2. Distribution of patient in the study according to mode of therapy

variable	No. And percentage before use intensive phototherapy	No. And percentage after use intensive phototherapy	p-value*
Neonatal jaundice	162 (8.9%)	117 (7.2%)	0.06
Male	99 (61.1%)	75 (64.1%)	0.01
Female	63 (38.8%)	42 (35.9%)	0.02
Breast feeding	90 (55.6%)	32 (27.3%)	0.20
artificial feeding	62 (38.3%)	40 (34.2%)	0.03
Mixed feeding	10 (6.1%)	45 (38.5%)	0.39
TSB (mg/dl)	22 (13.6%)	27(23.1%)	
A) Less than 14			0.16
B) 14-18	38 (23.4%)	22(18.8%)	0.06
C) Above18	102 (63%)	67(57.3%)	0.04
Exchange transfusion	62 (38.3%)	31 (26.5%)	0.19

*P-value if less than 0.05 considered as significant or less than 0.005 considered as highly significant

Table 3. Show the relationship between different modes of therapy

Variable	Traditional phototherapy	Intensive phototherapy	Exchange transfusions	P_value*
1.Mean stay in hospital	3.44	2.31	7.10	0.09
2.Complication				
A)skin rash	16(10%)	59(50%)		0.3
B)diarrhoea	11(7%)	5(4%)		0.2
C)dehydration	49(30%)	8(7%)		0.3
D) Death during exchangetransfusion=2 (1.7%)				

*P-value if less than 0.05 considered as significant or less than 0.005 considered as highly significant

DISCUSSION

The frequency of neonatal jaundice in 2013 was (8.9%) and in 2017 was (7.2%) who were enrolled in this study, this is agreed with the study of Burke BL (Burke, 2009) which reported that Nearly 8% to 11% of neonates develop hyperbilirubinemia. High frequency of neonatal jaundice is observed in males rather than females, in 2013 was (61.1%_ 38.9%) respectively, and in 2017 was (64.1%_ 35.9%) respectively, this agree with Geiger AM (Geiger, 2001). Concerning the need of exchange transfusion, in 2013 was (38.3%), and in 2017 was much lower than in 2013 (26.5%) our result met with De CARVALHO M. (De CARVALHO, 2011)) and RAGHUBIR K.V. (RAGHUBIR, 1996). There is significant reduction in days of hospitalisation in intensive phototherapy (mean hospitalisation day intensive phototherapy was 2.3) in comparison with exchange transfusion (mean hospitalisation day for exchange transfusion was 7.1) which agree with SARICI S.U. (SARICI S.U, 20000), KARADAGA A (KARADAGA, 2009) AMATO M (AMATO, 1984). The Current study show that complications after use intensive phototherapy include (skin rash, dehydration, diarrhoea) was (50%, 7% ,4%) respectively, while when use traditional phototherapy, was (10%, 30%, 7%) that' agree with Surmeli-Onay O (Surmeli-Onay, 2013) and Maayan-Metzger A (Maayan-Metzger, 2001), but disagree with Jaehrig K (Jaehrig, 1987) and De Curtis M (De Curtis, 1987), possibly due to long period under traditional phototherapy which increase sensible water loss.

Conclusion

The use of intensive phototherapy in treatment of neonatal jaundice is very effective in lowering TSB and in reduction of the frequency of exchange transfusion, with low days of hospital stay and low risk of complications.

Recommendation

A Long-term follow-up trials can be performed to evaluate the long-term side effects in newborn infants with indirect hyperbilirubinaemia who are treated with this mode of therapy (intensive phototherapy), and we advise ministry of health to increase number of intensive phototherapy devices in paediatric hospitals, also there is significant reduction in breast feeding during period of study which need a notification to ministry of health to provide different programs to enhance breast feeding and it's benefit for baby and mother among lactating mothers in Iraq.

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