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Effectiveness of Three Modalities of Phototherapy in the Treatment of Neonatal Jaundice

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ABSTRACT

Background: Jaundice is a yellowish discoloration of the skin and the mucosa due to accumulation of excess of bilirubin in the tissue and plasma in neonates. (more than 7mg/dl). 30-50 % of term newborn and more of preterm newborns. The aim of this study is to compare the efficacy of single, double or triple phototherapy in treating neonatal indirect hyperbilirubinemia. The study showed that the duration of hospital stay is less in double 18 cases (2- 3days) and triple (17 cases 2-3 days) phototherapy compared to single phototherapy (4-7 days 29 cases).

Patients and methods: A hospital based Cohort study done on neonate aged less than fourteen days with indirect hyperbilirubinemia attending the Pediatric Department at Salahaden General Hospital during the period from (2nd of January 2021) to (30th of August 2021) selected randomly. Each neonate included in the study were assessed by a prepared questionnaire that include name ,age , sex .. The decision for admission of patient to the neonatal intensive care unit done by experienced pediatrician depending on the maturity ,weight , risk factor and investigation.

Results: The study showed that the duration of hospital stay is less in double 18 cases (2- 3days) and triple (17 cases 2-3 days) phototherapy compared to single phototherapy (4-7 days 29 cases).

Conclusion: The study showed that the duration of hospital stay is less in double 18 cases (2-3days) and triple (17 cases 2-3 days) phototherapy compared to single phototherapy (4-7 days 29 cases).

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INTRODUCTION

Jaundice is a yellow discoloration of the skin and the mucosa due to accumulation of excess of bilirubin in the tissue and plasma in neonates. (more than 7mg/dl). The condition affects over half of babies in the first week of life, Of babies that are born early about 80% are affected. Globally over 100,000 late-preterm and term babies die each year as a result of jaundice. Neonatal hyperbilirubinemia results from a predisposition to the production of bilirubin in newborn infants and their limited ability to excrete it[2]. Infants, especially preterm infants, have higher rates of bilirubin production than adults, because they have red cells with a higher turnover and a shorter lifespan ,In newborn infants, unconjugated bilirubin is not readily excreted, and the ability to conjugate bilirubin is limited .Together, these limitations lead to physiologic jaundice that is, high serum bilirubin concentrations in the first days of life in full-term infants (and up to the first week in preterm infants and in some full-term Asian infants), followed by a decline during the next several weeks to the values commonly found in adults [13,14].

Prolonged unconjugated jaundice, persisting beyond the second week, is also seen in breastfed infants. The mechanism for this later 'breast milk jaundice syndrome' is still not completely understood. Non-physiological causes include blood group incompatibility (rhesus or ABO problems), other causesof haemolysis, sepsis, bruising, and metabolic disorders[13]. In the newborn baby, unconjugated bilirubin can penetrate the blood-brain barrier and is potentially neurotoxic. Acute bilirubin encephalopathy consistsof initial lethargy and hypotonia, followed by hypertonia (opisthotonus), irritability, apnoea, and seizures[3]. Phototherapy has remained the standard of care for the treatment of hyperbilirubinemia in infants for four decades, is often used to reduce level of unconjugated bilirubin that may result in acute or chronic encephalopathy[3]. The efficacy of phototherapy in the treatment of unconjugated hyperbilirubinaemia may be influenced by the wavelength of the light used, the intensity of the light source, the total dose of light received (time under phototherapy and amount of skin exposed), and/or the threshold at which phototherapy is commenced and its distance from the infant. Because bilirubin is a yellow pigment, it is likely to absorb blue light (with a wave- length of approximately 450 nm) Conventional phototherapy further classified into single , Double , triple conventional phototherapy.

MATERIALS AND METHODE

A hospital based Cohort study done on neonate aged less than fourteen days with indirect hyperbilirubinemia attending the Pediatric Department at Salahaden General Hospital during the period from (2nd of January 2021) to (30th of August 2021) selected randomly. Each neonate included in the study were assessed by a prepared questionnaire that include name ,age , sex .. The decision for admission of patient to the neonatal intensive care unit done by experienced pediatrician depending on the maturity ,weight , risk factor and investigation . Each patient included in the study were send to:

1. Total serum bilirubin , direct ,indirect . Measuring of bilirubin total direct and indirect was done by biochemistry machine.

2. Blood group , RH for mother and baby.
3. Each patient included in the study were examined for presence of jaundice .

Patient who fulfill the inclusion criteria were admitted to the neonatal intensive care unit and put under phototherapy .the patient who included in the study divided into three groups selected randomly by simple random study put on single , double or triple phototherapy. patient included in the study were send for TSB at admission and after 8 hrs , 16 hrs , and 24 hrs .

RESULTS

A total of 100 neonates were included in the study, with a slight predominance of females (54%) compared to males (46%). Regarding total serum bilirubin (TSB) levels at the time of admission, the majority of cases (93%) had TSB levels between >15–20 mg/dL. Only 5% had TSB levels <15 mg/dL, while 2% had levels >20 mg/dL. There was no statistically significant difference in TSB level distribution between males and females (p = 0.93) (Table 1).

The distribution of study cases according to the type of treatment showed an almost equal allocation among single (33%), double (33%), and triple (34%) phototherapy modalities. No significant association was found between gender and type of treatment received (p = 0.98) (Table 2). Regarding the duration of phototherapy, most cases (59%) required treatment for 4–7 days, followed by 28% treated for 1–3 days. A statistically significant association was observed between the type of phototherapy and duration of treatment (p = 0.032). Single phototherapy was most commonly associated with longer treatment durations (4–7 days), whereas triple phototherapy was more frequently used for shorter durations (1–3 days). Double phototherapy showed an intermediate pattern. These findings indicate that more intensive phototherapy was associated with a shorter duration of treatment (Table 3).

DISCUSSION

The efficacy of phototherapy is dependent on the color (wavelength), intensity (irradiance) of the light emitted during phototherapy, the exposed body surface area and the infant's distance from the light (8,10) , blue lamps are most effective in reducing hyperbilirubinemia (8,11-12). The nearer the lights source to the infant, the greater the irradiance (8) . In general the demonstrated significant differences between the compared studied groups in favor of double and triple phototherapy type are collectively attributed to these factors. These factors were responsible for the significantly higher percentages of bilirubin decline /hour found in studied double and triple phototherapy group compared to single phototherapy group within 6, 12, 24 hours after commencing phototherapy. Those differences reflected the significant effectiveness of the double and triple phototherapy type in TSB reduction regardless the cause of neonatal hyperbilirubinemia (8). Duration of phototherapy was shorter in the double and triple phototherapy type group compared to single phototherapy group in this study likewise in other studies (13, 16, - 18).

CONCLUSION

The study showed that the duration of hospital stay is less in double 18 cases (2-

3days) and triple (17 cases 2-3 days) phototherapy compared to single phototherapy (4-7 days 29 cases).

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TABLES

Table 1: Distribution of study cases according to the TSB level at time ofadmission.

TSB level	Male	female	total
<15 mg\dl	3 (6.5%)	2 (3.7%)	5 (5%)
>15-20mg\dl	42 (91.3%)	51 (94.5%)	93 (93%)
>20mg\dl	1 (2.2%)	1 (1.8%)	2 (2%)
total	46 (46%)	54 (54%)	100 (100%)

Table 2: Distribution of study cases according to the type of treatment.

Type of treatment	male	female	total
Single	13 (39.4%)	20 (60.6%)	33 (33%)
double	16 (48.5%)	17 (51.5%)	33 (33%)

Triple	17 (50%)	17 (50%)	34 (34%)

Table 3: Distribution of study cases according to the mean duration ofphototherapy.

Type of treatment	Mean duration			
	<1day	1-3days	4-7days	>7days
single	1 (16.6%)	3 (10.7%)	29 (49.3%)	4 (57.1%)
double	1 (16.6%)	8 (28.6%)	18 (30.5%)	2 (28.6%)
triple	4(66.8%)	17(60.7%)	6 (10.2%)	1 (14.3%)
total	6 (6%)	28 (28%)	59 (59%)	7(7%)