Research Article

Effect of Intensive Phototherapy on Advanced Oxidation Protein Product Level in Neonates with Significant Hyperbilirubinemia

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Abstract:

Objectives: To measure the level of Advanced Oxidation Protein Products in neonates with significant hyperbilirubinemia & investigate the effect of intensive phototherapy on its level.
Methods: This was a prospective cross-sectional study that included sixty term and near-term neonates (>35 weeks), thirty neonates underwent intensive phototherapy because of significant hyperbilirubinemia (phototherapy group) and the other thirty were taken as a control group. **Results:** Total Serum Bilirubin, Direct Bilirubin and Advanced Oxidation Protein Products levels were significantly higher in the study group before phototherapy than in the control group. In neonates receiving intensive phototherapy; Total Serum Bilirubin, Direct Bilirubin and Advanced Oxidation Protein Products levels decreased significantly after intensive phototherapy. In correlation analysis there was significant positive correlation between the level of Advanced Oxidation Protein Products before phototherapy and the level of Total Serum Bilirubin and Direct Bilirubin before phototherapy and a significant positive correlation between the level of Advanced Oxidation Protein Products after phototherapy and the level of Total Serum Bilirubin after phototherapy.
Conclusion: The decrease in Advanced Oxidation Protein Products level after intensive phototherapy implies the protective effect of intensive phototherapy against oxidative stress.
Keywords: Advanced Oxidation Protein Products, significant hyperbilirubinemia, and intensive phototherapy.

Introduction

In Neonates, free radicals and their products, lipid and protein peroxides, have been thought to be responsible for the pathogenesis of many conditions such as retinopathy of prematurity, broncho-pulmonary dysplasia, intracranial hemorr-hage, sepsis, necrotizing enterocolitis and hypoxic ischemic encephalopathy[(1)].

Bilirubin, at physiologic concentrations, protects neonatal red blood cells against oxidative stress. However, increased bilirubin concentrations are associated with significant cytotoxicity and significant hyperbilirubinemia (SH) may cause an increase in free radicals & their products[(2)].

Phototherapy (PT) itself, which is the most commonly used treatment modality in SH, may also result in the release of reactive nitrogen, and oxygen species, and photolysis products are cytotoxic and associated with the production of free oxygen radicals [(3)].

Advanced oxidation Protein Products (AOPPs) are formed during oxidative stress, and they are defined as novel parameters of oxidative stress. There are limited numbers of studies about AOPPs during the neonatal period[(4)].

Aim of the work

Measurement of the level of Advanced Oxidation Protein Products (AOPPs) in neonates with significant hyperbiliru-binemia (SH) & investigate the effect of intensive phototherapy (PT) on its level.

Subjects and Methods

This is a prospective cross-sectional study that included sixty terms and near-term neonates (> 35 weeks), thirty neonates

underwent intensive phototherapy because of significant hyperbilirubinemia (SH) reaching the level of intensive phototherapy and the other thirty were taken as a control group.

Significant hyperbilirubinemia was defined as a post discharge bilirubin level that exceeded the hour-specific threshold value for phototherapy, according to the guide-lines presented by the AAP.

The study was conducted in Neonatal Intensive Care Unit, Children and maternity university hospital, Minia University during the period from June 2016 to Jan 2017. Informed consents were obtained from the patient's legal guardians before enrollment in the study.

Our neonates were divided to:

Group I: including 30 term and near-term neonates (>35 weeks) who underwent intensive phototherapy because of significant hyperbilirubinemia (SH).

Group II: including 30 newborns that came to the first control visit after hospital discharge.

Inclusion Criteria:

Term and near-term neonates.
From any mode of delivery.
Both genders.
Average birth weight (from 2300 to 4000 gm).

Exclusion Criteria:

Preterm babies (gestational age < 35 weeks) and post-term babies (gestational age >42 weeks).
Infants of diabetic mothers.
Neonatal asphyxia.
Neonatal sepsis.
Congenital malformations.

Results

Table (1): Comparison of some demographic data between the phototherapy and control groups.

	Phototherapy group (n=30)	Control group (n=30)	P value
(1)Sex Male (No %) Female (No %)	 16(53.3%) 14(46.7%)	 18(60%) 12(40%)	0.602
(1)Delivery SVD (No %) CS (No %)	 10(33.3%) 20(66.7%)	 9(30%) 21(70%)	0.781
(2)Gestational age (weeks) Range Mean ± SD	 (36-40) 38.8±1.18	 (36-42) 39±1.53	0.574
(2)Maternal age (years) Range Mean ± SD	 (20-32) 25.33±4.06	 (20-35) 26.8±4.18	0.174

*** Significant difference at p value < 0.05** **(1) Chi square test.**
***SVD=Spontaneous vaginal delivery.** **(2) Independent sample t test.**
***CS=Caesarean section.**

This table shows statistically insignificant difference between the studied groups regarding their demographic data.

Discussion

Neonatal jaundice is a common disorder worldwide and one of the important contributors to the high neonatal morbidity and mortality in Sub-Saharan Africa. Severe neonatal jaundice leads to brain damage or even death in otherwise healthy newborns[5].

Treatment of unconjugated hyperbilirubinemia primarily relies on the use of phototherapy; light changes the structure of bilirubin molecule into water-soluble isomers that can be excreted without the need for hepatic conjugation[6].

Although phototherapy is now widely used for the treatment of neonatal hyperbilirubinemia, there are concerns regarding the possibility of photodynamic tissue damage. The exposure of red cells to phototherapy light in the presence of a sensitizer (bilirubin) resulted in oxidative injury to the red cell membrane as manifested by a significant increase in the concentrations of products of lipid peroxidation in the membrane and hemolysis [8].

An imbalance between oxidant and antioxidant defense systems results in excessive reactive oxygen species generation and oxidative stress, which is associated with oxidative modification of proteins, lipids, and DNA, and leads to cell transformation or cell death by apoptotic or necrotic mechanisms [9].

Advanced Oxidation Protein Products (AOPPs) is a novel marker of oxidant-mediated protein damage. Recently, increased levels of AOPPs have been found in premature patients with free radical-related diseases, necrotizing enterocolitis (NEC), and hypoxia [10].

Recommendations

All neonates with significant hyperbilirubinemia should be treated with intensive phototherapy not only to rapidly decrease the TSB level to avoid complications of hyperbilirubinemia but also to avoid diseases linked to oxidative stress.

AOPPs should be measured to assess the efficacy of intensive phototherapy effect on oxidative stress.

More studies should be done to investigate phototherapy-induced oxidative stress in the human neonate especially the preterm and these studies should include a large number of cases as only scanty data is available in this field.

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