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ORIGINAL ARTICLE

Effect of phototherapy on B and T lymphocytes in Egyptian infants suffering from neonatal jaundice☆

I.K. Eyada[a], A.L. El Saie[a], G.A. Ibrahem[b], N.M. Riad[c,*]

[a] *Pediatrics and Neonatology Department, Faculty of Medicine, Cairo University, Egypt*
[b] *Pediatric and Neonatology Department, Shobra al Aam Hospital, Egypt*
[c] *Clinical and Chemical Pathology Department, Faculty of Medicine, Cairo University, Egypt*

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KEYWORDS
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Abstract
Background: Neonatal jaundice is one of the most common problems that affect newborn infants, and phototherapy is usually used for treatment.
Objectives: Evaluation of the effect of phototherapy on neonatal immune system through measuring the percentage of B and T lymphocytes and determining the frequency of development of infections and need for hospitalisation during the first six months of life.
Methods: A prospective cohort study was conducted on 50 full term new-borns; 25 with indirect hyperbilirubinaemia and treated with conventional phototherapy and 25 healthy matched neonates as untreated controls. The percentages of CD19+, CD4+ and CD8+ lymphocytes were measured by flow cytometry before phototherapy and 72 h after exposure. Follow-up of the study group for the occurrence of infections for a period of six months after phototherapy.
Results: The study showed a significant difference in CD19+ lymphocytes percentage between patients before phototherapy and controls (P value < 0.01), also a significant correlation between serum levels of total bilirubin in patients and CD19+ lymphocytes percentage (P value < 0.05). There was no significant difference between the percentages of CD19+, CD4+ and CD8+ lymphocytes in patients before or after 72 h of exposure to phototherapy (P value > 0.05). Also, there was no correlation between the percentages of CD19+, CD4+ and CD8+ lymphocytes after 72 h of exposure to phototherapy and the occurrence of infections (Gastrointestinal tract and Respiratory tract infection) after six months of follow-up (P value > 0.05). More studies are needed with larger number of patients to determine the effect of phototherapy on immune system.

☆ The work was carried out in the Faculty of Medicine, Cairo University, Clinical Pathology Department.

* Corresponding author.
E-mail address: docnermoo@gmail.com (N.M. Riad).

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Introduction

Neonatal jaundice is one of the most common conditions; about 60% of term and 80% of preterm infants develop jaundice in the first week after birth.[1] Hyperbilirubinaemia can become dangerous, causing encephalopathy or kernicterus.[2] Phototherapy is usually used to treat severe hyperbilirubinaemia in term and large preterm infants.[3] During the last few decades, concerns about potential toxic effects of phototherapy have been expressed. One possible harmful consequence is affection of lymphocytes subtypes and subsequently cytokines production which can affect the immune system functions in infants.[4] Ultraviolet (UV) light used in phototherapy can cause a number of cellular changes in irradiated skin. Langerhans cells are dendritic antigen presenting cells in the epidermis, upon sensing a danger signal; they migrate to draining lymph nodes where they initiate activation of cell-mediated immunity. UV radiation may damage Langerhans cells and even high doses may lead to their death in the skin.[5] Phototherapy could influence the immature immune system of the new-borns, probably by direct effect on T lymphocytes in the thin skin.[6,7] UV radiation also causes infiltration of skin by macrophages which then migrate to draining lymph nodes where they produce IL-10 and contribute to the immunosuppressive microenvironment.[8] One of the most important outcomes of UV induced suppression of the immune system is impaired activation of effector and memory T lymphocytes as well as increased activation of regulatory T cells.[9] UV light, although a small component of neonatal phototherapy, markedly decreases circulating CD4T lymphocyte, interferes with CD8 cytotoxic T lymphocytes, and reduces NKT cell activity. Therefore, it affects the immune system and may lead to development of autoimmunity diseases and allergy.[1] The current study was conducted to evaluate the effect of phototherapy on B and T lymphocytes through measuring the percentage of CD19, CD4 and CD8 subsets in new-borns with indirect hyperbilirubinaemia before phototherapy and 72 h after exposure and monitoring clinically the frequency of occurrence of infections and need for hospitalisation of these new-borns for a period of six months after phototherapy.

Subjects and methods

This prospective cohort study was conducted on 50 full term new-borns from neonatal intensive care units in Cairo University paediatric hospitals. Consent was obtained from parents of neonates included in this study.

They were classified into two groups.

1-Patients Group: 25 full term new-borns of gestational age more than 37 weeks, postnatal age less than or equal to 14 days, with neonatal indirect hyperbilirubinaemia and treated by conventional phototherapy based on American Academy of Paediatrics recommendations.[10] Phototherapy was carried out as follows: the infants were uncovered except for shielded genitalia and eyes. White fluorescent lamps emitting light at a wavelength of 420–470-nm and placed at 40 cm distance from the neonates. All patients were exposed to continuous phototherapy, except during the time of feeding and cleaning.

2-Untreated control group: 25 matched healthy full term new-borns without neonatal jaundice and did not receive phototherapy.

Preterm infants, neonates suffering from sepsis or any congenital anomalies and neonates with hypoxic ischaemic encephalopathy or in need of exchange transfusion were excluded.

Full history taking and clinical examination of the study groups including: birth weight, height, skull circumference and system examination (General, Cardiac, Chest, CNS) was done.

Sample collection

Two blood samples were collected from neonates with indirect hyperbilirubinaemia: one before phototherapy and the other one 72 h after exposure. Only one sample was collected from the untreated control group.

2 ml of blood was collected in EDTA vacutainers and analysed by flow cytometry within 24 h after collection to measure the percentage of CD19+, CD4+ and CD8+ lymphocytes in peripheral blood.

For flow cytometric analysis the following monoclonal antibodies were used:

- Anti-Human CD19 phycoerythrin-cyanine5 (PC5) monoclonal antibody, (Beckman Coulter Company, France, Catalogue Number A07771).
- Anti-Human CD4 flourescin isothiocynate (FITC) and CD8 phycoerythrin (PE) monoclonal antibodies Cocktail, (eBioscience Company, Germany, Catalogue Number 22-0408).

Procedure

10 μl of Anti-Human CD19 PC5 monoclonal antibody and 20 μl of Anti-Human CD4 FITC and CD8 PE monoclonal antibodies Cocktail were added to 50 μl of the blood sample, followed by incubation for 20 min in dark room, then 1 ml from lysing reagent was added and finally, incubation for another 20 min in dark room. The stained samples were mixed and analysis of lymphocytes was done using EPICS ELITE Coulter flow cytometer (Fig. 1A and B).

Follow-up

Clinical follow-up of patients group for a period of six months after phototherapy for monitoring of occurrence and frequency of infection and need for hospitalisation. Most respiratory virus infections in early childhood are confined to the upper respiratory tract, leading to symptoms of the common cold, with cough, sore throat, hoarseness, runny nose, nasal congestion, headache, low grade fever, and sneezing. Upper respiratory tract infection in infants may lead to lethargy and poor feeding.[11] Infective gastroenteritis in young children is characterised by the sudden onset of diarrhoea, with or without vomiting. Most cases are due to a viral infection but some are caused by bacterial or protozoal infections. The illness usually resolves without treatment within days but severe diarrhoea can rapidly cause dehydration.[12]

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