IMPACTS OF PHOTOTHERAPY ON IMMUNOLOGICAL STATUS OF NEWBORN WITH HYPERBILIRUBINEMIA

By

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ABSTRACT

Background*: Neonatal jaundice in the first week of life is a common problem in the newborn; it is due to an imbalance of bilirubin production and its elimination which can lead to significantly elevated levels of circulating bilirubin (hyperbilirubenemia).*

Aim of the Work*: The aim of this study was to evaluate the effect of phototherapy on the immunological status of newborn.*

Patients & Methods: *This is a prospective randomized simple descriptive follow up study that was conducted on 75 jaundiced neonates ≥37 weeks admitted to the neonatal intensive care unit (NICU) of Al Hussein University Hospital in a period from October 2016 to September 2018. Our cases were divided into three groups according to level of billrubin and type of phototherapy: Group (1) 25 neonates with billrubin level 16-18 mg/dL under single phototherapy, Group (2) 25 neonates with billrubin level >18 to 22 mg/dL under double phototherapy, Group (3) 25 neonates with billrubin level >22 mg/dL under intensive phototherapy and 25 apparently healthy neonates with physiological jaundice as control group. The history, general and local examinations and specific investigations were done by measuring IL6, IL10, CD19, CD4 and CD8.*

Results: *There is no difference between demographic data and level of IL6, IL10, CD19, CD4 and CD8 on all studied groups and there is significant increase between control group and groups exposed to single, double, intensive phototherapy in IL6 only and there are no changes in IL10 levels and CD19, CD4, CD8 percent after exposure to phototherapy*

Conclusion: *Phototherapy used in treatment of neonatal hyperbilirubinemia can affect the level of cytokines IL6 and no effect on IL10 or B19 and CD4, CD8.*

Recommendations: *Avoid unnecessary exposure to phototherapy to avoid possible immunological impacts on immune systems.*

Key words; *Phototherapy, Immunological Status, Hyperbilirubinemia.*

INTRODUCTION

Phototherapy (PT) has been widely used for the treatment of neonatal jaundice for more than 50 years. The side effects of this efficacious therapeutic method, which significantly decreases the exchange-transfusion rates, are still a matter of interest[1].

It has been reported that PT may cause retinal and testicular damage, ileus, patent ductus arteriosus, and hypocalcaemia as well as well-known temporary side effects, such as skin rash, abdominal distention, frequent defecation, and weight loss. Further, it was thought that oxidative stress that resulted from PT might contribute to premature infant diseases, such as retinopathy of prematurity, bronchopulmonary dysplasia, and necrotizing enterocolitis[2].

Another concern related to PT is genotoxicity leading to DNA damage that may be related to cancer development. The light spectrum used for PT includes visible light that has a main therapeutic efficacy and, to a lesser extent, ultraviolet (UV) light. Along with well-known mutagenic and carcinogenic effects of UV light, it has been shown in many in vitro studies that visible light also leads to DNA damage[3].

The immune system is a complex group of cells, tissues and organs that recognize and attack foreign substances, pathogenic organisms and cancer cells. It also responds to injury by producing inflammation[3].

The immune system is a unique system that is divided into two discrete responsive units of defense against pathogens. Those two units are the innate and acquired immune systems. The innate immune system is the nonspecific and abrupt first response, while the acquired immune is unique in its specificity for distinct pathogens and ability to create immunological memory[4].

The fetal immune system develops in a sterile and protected environment, and therefore lacks antigenic experience. It must also be modulated in order to coexist with mother's immune system. Soon after birth, the newborn is exposed to the "hostile world" of bacteria, viruses, fungi and parasites, and must immediately defend itself. The immunologic competence of the neonate progresses rapidly in the first three months of life, as the cells

involved in acquired immunity mature and gain antigenic experience[5].

The immunosuppressive effects of solar radiation are mediated mostly by the middle wave length range ultraviolet B (UVB, 290-320 nm). Therefore, the vast majority of photo immunologic studies utilized UVB. There is also evidence that the long wave length range (UVA, 320-400 nm) can affect the immune system although its effects are less pronounced[6].

Many experimental models have shown that particular antigen-specific immune responses are suppressed by UVB radiation, while other immune reactions are not affected[7]. Experimental studies have revealed that UVB exposure can impair the immunological resistance to viral, fungal, bacterial infection, parasitic diseases and antigenic tumors[8].

Exposure to UV radiation starts a complex cascade of responses resulting in the down regulation of the immune system[9].

Neonatal phototherapy can significantly increase the levels of cytokines, including TNF-alpha, IL-1 beta, and IL-8, but decrease the level of IL-6 in newborn infants. This change of cytokine levels is thought to be the principal cause of Th-2/Th-1 switch disorder, Th-1 associated with type 1 diabetes mellitus and celiac disease and Th-2 associated with allergic dermatitis and systemic lupus erythematous[10].

NNPT directly causes DNA damage to lymphocytes in jaundiced infant. This injury could affect the genes regulating the Th-2/Th-1 switch and contribute to the disorder [11].

UV light significantly decreases circulating CD4+ T lymphocyte counts, interferes with CD8+ cytotoxic T lymphocytes, and reduces natural killer cell activity. Therefore, UV light in NNPT exposure may affect the immune system and lead to allergy and autoimmunity disorders[12].

The effect of NNPT on immune regulation may partly be due to degrading bilirubin. Unconjugated bilirubin inhibits complement activation through the classical pathway and prevents leukocyte migration[13].

AIM OF THE WORK

The aim of this study was to evaluate the impacts of phototherapy on immunological status of newborn with hyperbilirubinemia.

Ethical Consideration:

1. A written informed consent

was obtained from patient for their legal guardians.
2. An approval by the local ethical committee was obtained before the study.
3. The authors declared no potential conflicts of interest with respect to the research, authorship, and/ or publication of this article.
4. All the data of the patient and results of the study are confidential and the patients have the right to keep it.

Financial Disclosure/Funding:

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PATIENT AND METHODS

This was a prospective randomized simple descriptive follow up study that was conducted on 75 jaundiced neonates ≥37 weeks admitted to the neonatal intensive care unit (NICU) of Al Hussein University Hospital during the period from October 2016 to September 2018.

Inclusion Criteria:

All newborn infants with gestational age ≥ 37 weeks and birth weight ≥ 2500 g who required phototherapy in the first week of life.

Exclusion Criteria:

1. Birth asphyxia.
2. Sepsis.
3. Any infant who required exchange transfusion.
4. Congenital malformations.
5. Congenital infections.
6. Preterm and IUGR.
7. Any infant who required immunoglobulin.
8. Instrumental delivery (vacuum), Cephalehematoma.
9. Starvation.

Our studied cases were classified into 3 groups (as follow according to bilirubin level and intensity of phototherapy).

- **Group (1)** 25 neonates on single phototherapy with (serum bilirubin level 16-18 mg/dL).
- **Group (2)** 25 neonates on double phototherapy with (serum bilirubin level >18 to 22 mg/dL).
- **Group (3)** 25 neonates on Intensive phototherapy with (serum bilirubin level >22 mg/dL).
- Another 25 apparently healthy neonates with physiological jaundice matched with age and sex as a control group.

According to American Academy of Pediatrics International Guidelines (2011)

All the enrolled cases exposed to full medical history and thorough medical examination:

I- Laboratory evaluation including:

1. Complete Blood Count:

Total leukocyte count and differential leukocyte count were done to rule out infection, RBC to rule out polycythemia, Hb% to rule out anemia or polycythemia, Peripheral smear for RBC morphology, and reticulocyte count was also done by **(CBC. Dragon)**.

2. Determination of serum bilirubin (total and direct):

Serial serum bilirubin measurements repeated on daily bases. Total bilirubin and direct bilirubin were measured by (Bilirubin. photo analyzer).

3. Blood group and RH determination for newborn and parents:

The ABO and Rhesus blood grouping was done to rule out ABO and Rh incompatibility as cause of jaundice.

4. Direct Coomb's test:

To rule out exteracorpuscular hemolytic causes of jaundice.

5. Serum C- reactive protein (CRP) (quantitative):

The CRP was done as part of the septic work up to rule out infection as a cause of jaundice.

II- Specific investigations:

1. Interleukin IL-6 and Interleukin IL-10: (Before and after 72 hours of phototherapy) by ELISA, the measuring unit is (pg /ml).

2. CD 19, CD4 and CD8 by using the flow cytometry technique

Flow cytometry

Principle:

Flow cytmetry is the process of passing cells singly in a fluid stream through a light beam. The light source is typically a laser and as the cells pass through the laser beam, photons of light are emitted and scattered. These photons are separated and collected by forward and side light scatter detectors. Forward light scatter is parallel to laser beam and corresponds to the size of the cells while the side light scatter is detected at 90 degree angle to the laser beam and corresponds to the nuclear complexity and cytoplasmic granularity. Lymphocytes have small mclei and little cytoplasmic granulations. So they exhibit low forward and low side light scatter. Meanwhile, granulocytes are

larger in size with abundant cytoplasmic granules so they exhibit increased forward and side light scatter. These differences in forward and side light scatter allow identification of lymphocytic monocytic and granulocytic populations. The detected light signal is converted into digital signal by a photomultiplier tube.

Cells bound to flourochrome conjugated monoclonal antibody (mAb) pass in front of the laser beam, excitations of the fluorochrome occurs followed by emission of light which is scattered then collected and detected by the detector. The positive light emission signal is then converted into digital signal and plotted on a histogram. Two of the most widely used flourochromes are the flourescin isothiocynate (FTTC) and phycoerythrin (PE) which can be used simultaneously as they can both be excited by the same light source (Argon laser) yet have different spectra of light emission. This difference in light emission allows them to be detected as separate signals.

Reagents:

- Lysing solution 1.5 mmo1/L NH4XCI.100 mmo1/L NH4C1.100 mmo1/L KHCO3 and 10 mmo1/L tetra (Na-EDTA) made up to 1 liter with distilled water, pH adjusted at 7.2 (catalogue number F2364, 1ot 00016979-1).
- Monoclonal antibodies:
  - Anit-Human CD4 flourescin isothiocynate (FTTC) and CD8 phycoerthrin (PE) monoclonal antibodies Cocktail, (eBioscience Company, Germany, Catalog Number 22-0408).
  - Anit-Human CD19 phycoerythrin-caynine5 (PC5) monoclonal antibodies, (Beckman Coulter Company, France, Catalog Number (A07771).

Procedure:

- 20u1 of Anti–Human CD4 FITC and CD8 PE monoclonal antibodies Cocktail and 10 u1 of Anti–Human CD19 PC5 monoclonal antibodies were added to 50 u1 of the cells.
- Followed by incubation for 20 minutes in dark room.
- Then 1m1 from lysing reagent was added.
- Finally, incubation for another 20 minutes in dark room.

The stained samples were finally mixed and ready for analysis by flow cytometry.

Analysis of samples:

Samples were analyzed immediately. Analysis of lymphocytes was done using EPICS ELITE Coulter flow cytometery.

The region of lymphocytes was identified by their size and granularity and thus they were gated upon.

- Samples were thoroughly mixed prior to flow cytometry analysis.
- Warming up the argon laser was done for 30 minutes before processing the samples.
- Then the protocol for FTTC, PE and PC5 analysis was loaded. Negative control samples were introduced in the machine, the auto flourescence region for FTTC, PE, and PC5 stains was adjusted for each sample.

Methodology:

Plan of the study of all the enrolled cases was to measure IL6, IL10, CD19, CD8 before admission to phototherapy and after discharge from the unit and regular follow up at intervals of two months at the outpatient clinic in Al Hussein University Hospital for 6 months to assess the rate of infections episodes (diagnosis duration any complication) and etiology of hospital admission. The control group was followed up for the same period and reasons.

Before the start of phototherapy and after 72 hours of phototherapy, we repeat specific investigations (IL6, IL10, CD19, CD4, CD8).

3. Follow up:

The enrolled and control cases we regularly followed up to assess the frequency of infection and hospital admission every 2 months for 6 months.

Statistical Design:

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as mean, standard deviations and ranges. Also qualitative variables were presented as number and percentages. The p-value was considered significant as the following: $P > 0.05$: Non significant (NS), $P < 0.05$: Significant (S), $P < 0.01$: Highly significant (HS).

RESULTS

Table (1): Age of onset of jaundice among different groups

		Control group	Patients on single phototherapy	Patients on double phototherapy	Patients on intensive phototherapy	Test value	P-value	Sig.
		No. = 25	No. = 25	No. = 25	No. = 25			
Onset of jaundice (day)	Mean ± SD	3.26 ± 0.44	3.24 ± 0.6	3.08 ± 0.61	2.76 ± 0.89	3.126	0.129	NS
	Range	3 – 4	2 – 4	1.5 – 4	1 – 4			
Level of total bilirubin (mg/dL)	Mean ± SD	9 ± 2	17 ± 1	20 ± 2	23.5 ± 1.5	9.23	0.103	NS
	Range	7 – 11	16 – 18	18 – 22	22 – 25			

This table show there is no significant difference between onset of jaundice and level of bilrubin between the three studied groups.

Table 2: Immunological results of the studied groups before phototherapy

Specific investigation on admission		Control group	Patients on single phototherapy	Patients on double phototherapy	Patients on intensive phototherapy	Test value	P-value	Sig.
		No. = 25	No. = 25	No. = 25	No. = 25			
IL-6 (pg/ml)	Mean ± SD	330.72 ± 83.9	342.8 ± 80.7	372.04 ± 59.94	370.48 ± 65.62	4.503	0.105	NS
	Range	218 – 432	221 – 441	228 – 444	218 – 441			
IL-10 (pg/ml)	Mean ± SD	15 ± 10.07	14.96 ± 3.78	17.6 ± 6.85	15.4 ± 7.93	9.568	0.100	NS
	Range	12 – 80	10 – 30	10 – 33	1 – 35			
CD19	Mean ± SD	16.44 ± 2.71	18.96 ± 4.47	20.12 ± 4.25	16.44 ± 2.27	6.788	0.070	NS
	Range	12 – 22	11 – 30	14 – 30	12 – 20			
CD4	Mean ± SD	43.04 ± 6.45	43.28 ± 6.17	44.84 ± 4.01	50 ± 6.56	7.566	0.060	NS
	Range	35 – 59	31 – 55	35 – 52	36 – 60			
CD8	Mean ± SD	15.4 ± 3.01	17.24 ± 2.59	17.4 ± 2.69	19.56 ± 3.72	7.859	0.200	NS
	Range	10 – 21	12 – 21	12 – 22	12 – 27			
CD4/CD8 ratio	Mean ± SD	2.88 ± 0.87	2.53 ± 0.37	2.66 ± 0.4	2.61 ± 0.46	1.712	0.170	NS
	Range	1.71 – 5	2.06 – 3.92	1.81 – 3.38	1.88 – 4.25			

There are no significance differences between studied group

and control group regarding to immunological result before phototherapy.

Table 3: Immunological results of the studied groups after stoppage of phototherapy

Specific investigation after discharge		Control group	Patients on single phototherapy	Patients on double phototherapy	Patients on intensive phototherapy	Test value	P-value	Sig.
		No. = 25	No. = 25	No. = 25	No. = 25			
IL-6	Mean ± SD	396.52 ± 89.43	411.4 ± 73.89	455.4 ± 79.13	475.52 ± 104.46	6.317	0.030	S
	Range	231 – 553	330 – 549	226 – 442	220 – 633			
IL-10	Mean ± SD	14 ± 9	13.5 ± 3.6	18.6 ± 6.85	16.5±3.2	35.764	0.100	NS
	Range	10 – 60	10 – 20	10 – 23	13 – 22			
CD19	Mean ± SD	13.93 ± 0.61	22 ± 2.45	21.76 ± 3.62	17.08 ± 4.08	42.084	0.060	NS
	Range	13.1 – 14.9	18 – 29	17 – 30	10 – 25			
CD4	Mean ± SD	40.92 ± 6.31	47.48 ± 6.64	47.96 ± 7.53	45.4 ± 7.95	5.061	0.300	NS
	Range	28 – 50	35 – 60	33 – 59	31 – 60			
CD8	Mean ± SD	16.64 ± 2.33	19.56 ± 1.96	18.72 ± 4.8	17.96 ± 2.81	3.826	0.102	NS
	Range	12 – 20	15 – 25	12 – 28	12 – 25			
CD4/ CD8 ratio	Mean ± SD	2.48 ± 0.42	2.46 ± 0.29	2.66 ± 0.61	2.53 ± 0.25	1.217	0.308	NS
	Range	2 – 3.69	2 – 3.11	1.75 – 3.93	2.1 – 3.21			

This table show there is significant increase in IL-6 and normal IL10, and normal CD19, CD4, CD8 regarding to immunological result after phototherapy.

Table 4: Relation between immunological results and occurrence of infections and hospital admission at 2 months after discharge

Follow up of the infants	Control group	Group 1	Group 2	Group 3	Test value	P-value	Sig.
Infant required hospitalization (neonatal sepsis)	1 (2.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3.03	0.387	NS
Infant not required hospitalization							
Conjunctivitis	0 (0.0%)	1 (2.5%)	0 (0.0%)	0 (0.0%)	3.03	0.387	NS
Common cold	3 (7.5%)	2 (5%)	3 (7.5%)	2 (5%)	0.444	0.931	NS
Otitis media	1 (2.5%)	0 (0.0%)	0 (0.0%)	1 (2.5%)	2.041	0.563	NS

No history suggestive of infection	21 (90%)	22 (92.5%)	22 (92.5%)	22 (92.5%)	0.265	0.966	NS

There is no significant increase in the rate of infection and hospital admission after 2 months in the studied groups.

Table 5: Relation between immunological results and occurrence of infections and hospital admission at 4 months after discharge

Follow up of the infants	Control group	Group 1	Group 2	Group 3	Test value	P-value	Sig.
Infant required hospitalization	0 (0.0%)	2 (5%)	0 (0.0%)	0 (0.0%)	6.122	0.105	NS
Infant not required hospitalization							
Common cold	3 (7.5%)	2 (5%)	4 (10%)	3 (7.5%)	0.758	0.859	NS
Otitis media	1 (2.5%)	0 (0.0%)	0 (0.0%)	1 (2.5%)	2.041	0.563	NS
Bronchiolitis	4 (10%)	4 (10%)	5 (12.5%)	4 (10%)	0.213	0.975	NS
Acute diarrhea	2 (5%)	3 (7.5%)	3 (7.5%)	3 (7.5%)	0.306	0.958	NS
Croup	0 (0.0%)	1 (2.5%)	0 (0.0%)	0 (0.0%)	3.030	0.387	NS
No history suggestive of infection	16 (77.5%)	16 (77.5%)	12 (67.5%)	16 (77.5%)	2.000	0.572	NS

There is no significant increase in the rate of infection and hospital admission after 4 months in the follow up in the studied cases.

Table 6: Relation between immunological results and occurrence of infections and hospital admission at 6 months after discharge

Follow up of the infants	Control group	Group 1	Group 2	Group 3	Test value	P-value	Sig.
Infant required hospitalization	1 (2.5%)	0 (0.0%)	1 (2.5%)	0 (0.0%)	2.041	0.563	NS
Infant not required hospitalization							
Common cold	2 (5%)	1 (2.5%)	3 (7.5%)	3 (7.5%)	1.343	0.718	NS
Otitis media	0 (0.0%)	1 (2.5%)	2 (5%)	0 (0.0%)	3.78	0.286	NS
Bronchiolitis	2 (5%)	3 (7.5%)	1 (2.5%)	0 (0.0%)	3.546	0.314	NS
Acute diarrhea	1 (2.5%)	2 (5%)	1 (2.5%)	1 (2.5%)	0.632	0.889	NS
Croup	1 (2.5%)	0 (0.0%)	1 (2.5%)	1 (2.5%)	1.031	0.793	NS
No history suggestive of infection	18 (82.5%)	18 (82.5%)	16 (77.5%)	20 (87.5%)	1.587	0.662	NS

There is no significant increase in the rate of infection and hospital admission after 6 months in the follow up in the studied cases.

DISCUSSION

Phototherapy, a non-invasive easily available therapy has been widely used for the treatment of neonatal jaundice for more than half a century. Its efficiency in decreasing plasma bilirubin concentration is well documented[13].

The total serum bilirubin ranged from (16-29 mg/dL) before admission to NICU.

They were 46 males (46%) and 54 females (54%) with gestational age ranging from 37 weeks to 41 weeks with median 38 weeks and weight ranging from (2.6-3.9 kg) with median 3.250kg, (50SVD and 50CS).

Two samples were collected at starting and after stoppage of phototherapy (single, double, intensive).

As regard cytokine e.g. IL6, our results agree with **Kurt et al.[9]** who found that phototherapy treatment can affect the function of the immune system in newborns via alterations in cytokine production specially IL6.

From table (3), our results agree with **Maisels et al.[18]** who found that UV radiation induces an increase in IL6, IL8 and INF alpha. Although, phototherapy at a wavelength of 420-480 nm, especially the blue light does not contain ultra violet radiation, yet these results might also apply to this particular wavelength.

From table (3), our results disagree with **Sirota et al.[19]**, who found no change in serum IL6 concentrations after 72 hours of phototherapy administered to term infants by a bank of four lamps (9). Similarly found comparable stationary level of IL6 with significant increase in release of IL10 after phototherapy. They claimed that IL6 and IL10 are produced from keratinocytes in association with phototherapy.

From table (3), our results contrary to that, other studies showed decreased serum IL6 after 24 hours of initiation of phototherapy and claimed anti-inflammatory effect in term and late preterm newborns. Keratinocytes release cytokines,

and these factors enter the circulation, so they suggested that phototherapy inhibits IL6 production by keratinocytes[10].

From table (3), our results agree with **Kurt et al.[9]** added that phototherapy treatment can affect the function of the immune system in newborns via alterations in cytokine production. Which were defined by **Toshio and Tadamitsu[20]** as soluble mediators that aid cell-to-cell communication in immune responses. They include IFNs, chemokines, lymphokines, interleukins (IL6, IL10), TGF-b, colony-stimulating factors (CSF), and TNF and are characterized by functional redundancy and pleiotorpy. And according to **Bijjiga and Martino[21]** the balance of cytokines is critical for normal immune responses. Irregular cytokine levels can shift the immune responses from being beneficial to being harmful.

From table (3), our results agree with **El Rashedy et al.[16]** who studied the effect of phototherapy on some lymphocytes subsets (CD4, CD8, CD19) in 30 term neonates with indirect hyperbilirubinemia and 25 healthy term neonates as control group. They found no statistically significant difference between lymphocytes subsets before and after 72 hours of exposure to phototherapy.

From table (3), our results do not go in agreement with **Kurt et al.[9]** who investigated the influence of the use of phototherapy on some lymphocyte subsets and cytokine production in the prevention or treatment of neonatal hyperbilirubinemia. He found that the percentage of T (CD4, CD8) lymphocyte subset was significantly lower in newborns at 72 hours of exposure to phototherapy.

From table (3), our results disagree with **Karabayir et al.[14]**. He noticed a significant increase in CD4+ % after eight hours of the phototherapy ($p< 0.05$) but agree with the same author there was non-significant change in lymphocyte subsets 48 hours after phototherapy ($p> 0.05$).

From table (6), also this does not agree with **ElFeky et al.[23]** who found that there was an increase of the number of hospital visits in the first six months of life.

CONCLUSION

Phototherapy used in treatment of neonatal hyperbilirubinemia can increase the level of IL6 and no effect on IL10 and no effect on B cell (B19) and T cell (CD4, CD8) although previous studies

were not homogenous with our results so more studies are needed.

RECOMMENDATIONS

Avoid unnecessary exposure to phototherapy to avoid possible immunological impacts on immune systems.

LIMITATIONS OF THE STUDY

Our cases were started by 107 jaundice neonates and ended by 100 cases only, 7 neonates not included in our study due to lack of compliance of parents and not follow systematized roll of the study.

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تأثير العلاج الضوئي علي الحاله المناعيه فى الأطفال حديثي الولادة المصابين بزيادة مادة البليروبين

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الملخص العربي

اليرقان الوليدى ومشكلة شائعة فى الأطفال حديثى الولادة وهو نتيجة وجود خلل فى إنتاج البيليرون التخلص منه مما ينتج عنه ارتفاع نسبة البيليروبين فى الدم مما قد يؤدى للإصابة اعتلال الدماغ.

وقد استخدم العلاج الضوئى لعلاج فرط البيليروبين بالدم فى الاطفال حديثى الولادة لسنوات حيث قلت نسبة الاصابة بالاعتلال الدماغى والأحتياج لتغيير الدم الكامل فى الاطفال حديثى الولادة كعلاج لليرقان الوليدى.

ومن المتفق عليه أن الأثار الجانبية للعلاج الضوئى لا تمثل خطورة واضحة بل ويمكن السيطرة عليها ومنها اعراض قصيرة المدى منها تأثر علاقة الرضيع بأمه واضطراب فى درجات حرارة جسمه ونسبة الأملاح بدم الطفل الخديج وتعرضه للجفاف نتيجة الحرارة المنعثة من اجهزة العلاج الضوئى وقد يؤدى للأصابة بمتلازمة الطفل البرونزى وأضطراب الساعة البيولوجية لديه كما قد يؤدى العلاج الضوئى بعض الآثار طويلة المدى مثل أمراض الحساسية وتلف فى شبكية العين وبالتالى فمن الضرورى وضع المبادئ التوجيهية القائمة على الأدلة وأجهزة ضوء جديدة .

وبدائل علاجية جديدة للحد من الآثار الجانبية للعلاج الضوئى.

كذلك هناك ابحاث تثبت ان لعلاج الضوئى له تأثير مباشر على السيتوكينات التى لها وظائف متعددة بالجسم من اهمها تحفيز الجهاز المناعى ومقاومة البكتيريا والفيروسات كذلك التحكم فى كثير من الخلايا مثل كرات الدم البيضاء بأنواعها المختلفة والخلايا المنتجة لكرات الدم الحمراء والخلايا الكراتينية.

الانترلوكين (10) والذى يلعب دورا هاما فى تبسيط رد الفعل المناعى بالجسم والانتر لوكين(6) الذى يلعب دورا هاما فى تحفيز رد الفعل المناعى بالجسم هما أحدى عناصر السيتوكينات للذان يتم

افرازهما بخلايا متعددة بالجسم ومنها الخلايا الكراتينية التى يتم فيها تحويل البيلروبين الى مادة غير سامة عن طريق العلاج الضوئى .

وتلعب كرات الدم البيضاء من النوع ب وت دور حيوى فى مناعة الجسم حيث التعرض على الميكروبات وقتلها أن امكن ذلك.

وكان الهدف من هذة الدراسة هو معرفة تأثر الجهازالمناعى لحديثى الولادة عند تعرض إلى العلاج الضوئى لدى المصابين بزيادة فى مادة البليروبين وأن صح ذلك إلى أى مدى وذلك من خلال دراسة مستوى .(Interleukin-6)

Interleukin-10ودلائل كرات الدم البيضاء (CD4, CD8, CD19)

وتطرقت الدراسة الي ذلك من خلال أربعة مجموعات عدد الواحدة منهم مريض وتعرض المجموعة الاولى(25) مريض الى العلاج الضوئى الأحادى .

تعرض المجموعة الثانية (25) مريض إلى العلاج الضوئى الثنائى وتعرض المجموعة الثالثة (25) مريض الى العلاج الضوئى المكثف ومقارنة تلك المجموعات مع المجموعة الضابطة .

والنتائج اوضحت الاتى زيادة إحصائية فى(6) Interleukin ومستوي طبيعي من Interleukin 10ومستوي طبيعي من CD19,CD4,CD8 وبالمتابعة إلى هذة المجموعات علي مدار ستة أشهر لا توجد حالات عدوي ذات دلالة احصائية مميزة ولا توجد حالات حجز بالمستشفي ذات دلالة احصائية مميزة بين المجموعات الثلاثة مقارنة بالمجموعة الضابطة.

ولم يتم ملاحظة أى زيادة فى معدل الحجز بالمستشفى .

ومن الجدير بالذكر أن الدراسات السابقة فى حيث تأثير العلاج الضوئى على الحالة المناعية لحديثى الولادة لم تكن ثابتة زيادة أونقصان أو عدم كغير وهذا يؤكد أننا فى إحتياج لمزيد من الدراسات لبحث مدى تأثير هذا العلاج الضوئى.