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Original Article

Ocular findings on follow-up in children who received phototherapy for neonatal jaundice

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Abstract

Background: To evaluate the ocular findings in children between 3 and 5 years of age who had received phototherapy in the neonatal period and to investigate whether they had phototherapy-related permanent ocular damage clinically.
Methods: The phototherapy group ($n = 57$) consisted of children who had undergone phototherapy for at least 24 h, and the control group ($n = 43$) comprised children who had not received phototherapy. Ophthalmic examinations consisted of assessment of visual acuity, convergence near point, ocular movements, ocular alignment, dynamic retinoscopy, cycloplegic refraction and biomicroscopic examination of anterior segment and posterior segment (using a 90 D lens in the latest).
Results: All children were orthophoric and had normal eye movements. A significant difference was found between the phototherapy group and control group regarding convergence near point 3.0 (2.0−5.0) vs 3.0 (2.0−5.0) ($p = 0.018$), right cycloplegic spherical equivalent 1.0 (0.0−3.0) vs 0.75 (0.0−4.75) ($p = 0.011$) and left cycloplegic spherical equivalent 1.0 (0.075−3.0) vs 0.75 (0.0−5.25) ($p = 0.006$).The study groups were similar according to cycloplegic spherical and cylindrical refractions. However, no significant difference was found between the groups regarding the need for eye glasses.
Conclusion: Although there were significant differences between the phototherapy and the control groups according to the convergence near point and right and the left eye cycloplegic spherical equivalent, the similarity between the groups regarding the need for eyeglasses suggested that difference was clinically insignificant.

Keywords: Dynamic retinoscopy; Neonatal jaundice; Phototherapy; Refraction; Spherical equivalent; Strabismus

1. Introduction

Jaundice is a common problem, accounting for more than half (60%) of term babies and the majority (80%) of preterm babies.[1,2] Hyperbilirubinemia is the most frequent reason for newborns' re-admission to the hospital after they have been discharged from the hospital following delivery.[3] The jaundice usually appears within the first week in the healthy term babies. Early diagnosis and treatment of jaundice is important to prevent damage to brain, vision, and hearing. Close monitoring of babies with jaundice, encouraging breastfeeding, phototherapy, and exchange transfusion in severe cases remain as therapeutic options.[1] The eyes of the newborns are protected with specific patches during the phototherapy procedure, and the newborns are monitored for procedure-related ocular irritation, purpura, and bullous eruptions.[1] The likelihood of retinal injury has been the subject of interest for researchers ever since phototherapy became available for

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treatment. Experimental animal studies demonstrating the harmful effects of phototherapy on retina, particularly at the microscopic level, have highlighted the need for protecting the eyes during the phototherapy procedure.[4] Although follow up visits are recommended for monitoring ocular function, the number of studies on this subject is limited.[4,5] The aim of the present study was to evaluate the ocular findings of children between 3 and 5 years of age who had received phototherapy in the neonatal period, and to investigate whether they had phototherapy-related permanent ocular damage or not.

2. Methods

Hospital records were retrospectively evaluated, and the children who had been hospitalized for hyperbilirubinemia in the neonatal period were included in the study. Approval of the Ethics Committee of Ankara Training and Research Hospital was obtained. After having informed the parents about the study, informed consent was obtained from those who wished to participate in the study. The phototherapy group consisted of children who had undergone phototherapy for at least 24 h, and the control group consisted of children who had not received phototherapy. Children with bilirubin level of >25 mg/dL, those with sepsis, those born at <36 weeks gestational age, those with a birth weight <1500 g, those with ocular findings on examination (cataract, etc.), those with history of metabolic disease, and those with severe ocular disease in the parents or siblings were excluded from the study. Children who had been assigned to the study were contacted for ophthalmological examination.

Data from children who were adherent to the examination were used in the study. Visual acuity was evaluated by the E chart and optotypes, as well as the HOTV chart, in children who were not adherent to either of the former tests. All children underwent dynamic retinoscopy, and their eye movements were evaluated in all directions of vision. The convergence near point was observed using a fixation object with the help of a ruler. Ocular alignment measurement was performed by the cover test and the cover/uncover test for near and far vision separately; a prism was used to measure the angle of deviation. Examination of cycloplegic refraction was performed using a hand-held auto refractometer and retinoscope 45 min after administering 1% cyclopentolate HCl (Siklopleglik, Mefar Pharmaceuticals Ltd., Istanbul, Turkey) 3 times at 5-min intervals. Spherical equivalent was obtained by summing up the spherical refraction with half of the cylindrical refraction. Examination of the anterior segment was performed using the biomicroscope, whereas the examination of the posterior segment was performed using a biomicroscope together with 90 D aspheric lens, as well as by indirect ophthalmoscope in case of non-compliance with the examination.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS, Inc., Chicago, IL, USA) version 15.0. Since the numerical variables were not distributed normally, descriptive statistics were expressed as median (minimum–maximum) and the difference between the two medians was compared using the Mann Whitney-U test. Categorical variables were expressed as percentages and frequencies, and were compared using either the Chi-square test or Fisher's exact test.

3. Results

The study comprised a total of 100 children, 57 of whom (mean age 3.5 ± 0.5 years, 54.4% were male) were in the phototherapy group and 43 (mean age 4.1 ± 4.1 years, 34.9% were male) were in the control group. With regard to the characteristics of the children in the neonatal period, all infants had low birth weight. Only one infant (in the phototherapy group) had developed hypoglycemia; however, none of the infants had either developed meconium aspiration syndrome or undergone exchange transfusion. None of the infants had undergone resuscitation and/or meningitis, and none had a history of medication use or trauma. The characteristics of the study groups are presented in Table 1. The neonatal characteristics of the phototherapy group were similar to those of the control group, except for the rate of children staying in an incubator being higher and the duration of incubation being longer in the phototherapy group.

Ophthalmological examination revealed that all children in both the phototherapy and the control groups were orthophoric and had normal eye movement. The prism cover test (near and far) was normal in all children. Biomicroscopic examination of anterior segment and fundoscopic findings by the retinal examination via +90 Diopter lens after pupillary dilatation were normal in all cases. Amblyopia was not detected in any of the children. Anisometropia was present in one child only (in the phototherapy group). Cyclopentolate-induced delirium was not observed in any of the children. Other

Table 1
General characteristics of the study groups.

	Control group (n = 43)	Phototherapy group (n = 57)	*p*
Age, years	4.1 ± 4.1	3.5 ± 0.5	0.413
Gender, n (%)			
Boys	15 (34.9)	31 (54.4)	0.053
Girls	28 (65.1)	26 (45.6)	
Presence of maternal diabetes, n (%)	2 (4.7)	6 (10.5)	0.460
Premature membrane rupture, n (%)	2 (4.7)	1 (1.8)	–
Type of delivery			
Spontaneous vaginal, n (%)	25 (58.1)	36 (63.2)	0.610
Cesarean section, n (%)	18 (41.9)	21 (36.8)	
Gestational age at birth, weeks	38.63 ± 1.7	38.70 ± 2.0	0.649
Birth weight, g	3116.7 ± 366.0	3135.6 ± 528.3	0.841
Staying in incubator, n (%)	3 (7.0)	53 (93.0)	**<0.001**
Duration of incubation, days	0.28 ± 1.1	3.16 ± 3.2	**<0.001**
Duration of breastfeeding, months	13.14 ± 8.66	15.91 ± 9.36	0.118
Duration of vitamin D use, months	9.5 ± 7.3	12.0 ± 7.5	0.086
Total bilirubin, mg/dl	9.87 ± 4.3	15.64 ± 10.5	0.074