

# Red Reflex Examination in Neonates for 2 Years Screening

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## ABSTRACT

**Background:** Red reflex is a simple test that can detect potentially life-threatening ocular abnormalities. In 2012, a red reflex screening campaign started in Umbria, central Italy. In the present study, we report the results of eye examination in the routine first visit of newborns in a private hospital within 2014-2016.

**Methods:** The red reflex test was carried out as a part of the first health visit of newborns in a private hospital for 2 years. The eyes of all newborns were examined on the first day of life by a handheld ophthalmoscope. The suspected cases with cataract were referred to the Ophthalmologic Department of Mashhad University of Medical Sciences, Mashhad, Iran, for the confirmation of the diagnosis.

**Results:** During the 2 years of the study, a total of 10,484 neonates were delivered in this hospital 10 of whom were referred for ophthalmology consultation due to suspected abnormal red reflex. In 2 cases (0.019%), the diagnosis of congenital cataract was confirmed by an ophthalmologist.

**Conclusion:** The results of the current study are consistent with the findings of previous studies, although the reports on red reflex screening are sporadic in the literature. Due to low cost and easy performance and in spite of high false-positive red reflex test, it appears to be useful for the early diagnosis of congenital low-vision disease for the prevention of vision impairment. In addition, the present study confirmed that the red reflex test should become a part of the first newborn examination immediately after birth.

**Keywords:** Congenital cataract, Newborn, Prevalence, Red reflex

## Introduction

Leukocoria or white pupillary reflex is a bad sign in newborns. It can be caused by the opacification of any structures lying in the visual axis, including the cornea, lens, vitreous, and retina. The majority of these conditions are significant for visual impairment which should not be delayed until the child gets older. On the other hand, retinal conditions, such as retinoblastoma, can be life-threatening. Therefore, the screening and evaluation of leukocoria should be performed at every well-baby and well-child visit (1). This screening can be conducted by testing for an intact red reflex using a direct ophthalmoscope.

Congenital cataract (CC) is the most common treatable cause of visual impairment in childhood. It is responsible for about 10% of low vision cases in children (2). The early diagnosis and treatment

of CC have become a priority of the global Vision 2020 initiative of the World Health Organization (WHO) (3). In children with CC, vision can be saved if the disease is diagnosed and treated soon after birth. The incidence of low vision due to congenital causes is reported as 1-6 cases per 10,000 live births in the western world (2).

A cataract is different based on the location, severity, and degree of vision obstruction. Sutural cataracts are opacities in the anterior and posterior 'Y' sutures representing the early fetal lens fibers. However, these cataracts do not cause visual problems and are typically incidentally observed during an eye examination.

Nuclear cataracts result from opacification in the center of the lens, and more than 3 mm in diameter is visually significant because they

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occlude the visual axis. Lamellar cataracts are considered opaque layers in the middle of the lens with a clear lens on either side. These cataracts typically indicate an intrauterine insult at one stage of development opacifying the layer that developed at that stage; however, these cataracts are not usually significant.

Furthermore, anterior and posterior subcapsular cataracts, polar cataracts, and lenticonus are centrally located at the level of the capsule of the lens. Generally, posterior cataracts are more visually significant than anterior ones because they are located close to the nodal point from which light rays should pass to get to the retina (1).

There have been very limited reports concerning the result of red reflex screening in neonates (4-5). With this background in mind, the present study reports the results of the 2-year (2014-2016) investigation of screening using the red reflex test for the assessment of the frequency distribution of CCs in a private maternity hospital in the northeast of Iran.

## Methods

All the newborns delivered in the private maternity hospital were tested for red reflex by a direct handheld ophthalmoscope in the routine newborn examination during the first 24 h of age. In this hospital, all the neonates routinely receive well-baby visits on the first day of life by a neonatologist. The newborns who were observed with cataract or opacification of the lens of more than 75% vertically or horizontally were referred to an ophthalmologist for the confirmation of the diagnosis. In this study, we report a single-center clinical experience with conducting the red reflex test as a part of the routine newborn physical examination in a private hospital in Mashhad, northeast of Iran, within 2 years.

## Results

During 2 years of study, a total of 10,484 neonates were delivered in this hospital and screened with the red reflex examination. Accordingly, 10 newborns with central, vertical, or horizontal opacification of the lens were referred for ophthalmology consultation due to suspected abnormal red reflex. All newborns were term with a mean birth weight of 3300 g. In these neonates, more than one-half, the lens were vertical or horizontally not clear. In two newborns, the diagnosis of CC was confirmed due to using corticosteroids by the mother during the first month of pregnancy for one of them and positive family history of cataract for another, giving a

frequency distribution of 1.9 per 10,000 neonates. Therefore, the prevalence of CCs in this hospital was reported as 0.19 in every 1,000 live births.

## Discussion

Children are considered a priority in Vision 2020, as the WHO's global initiative for the prevention of avoidable visual impairment (6). Moreover, CC is responsible for about 10% of low vision cases among children (2). The CC is the most common cause of preventable childhood partial visual impairment or blindness. It can be prevented both by primary prevention, such as rubella immunization, or secondary prevention by the early screening of the pupillary red reflex.

The red reflex test uses the transmission of light from an ophthalmoscope through all the normal transparent parts of the eye structures. The positive predictive value of the test is reported as 42% (7); therefore, any factors avoiding or blocking this optical pathway will result in an abnormality of the red reflex. In 2012, a red reflex screening campaign started in Umbria, central Italy (8). Screening newborns with the red reflex is widely accepted. In addition, the American Academy of Pediatrics (1) and British Pediatric Association (9) recommended considering red reflex examination a component of eye evaluation in the neonatal period and all subsequent routine health examinations to minimize the risk of delay in the diagnosis of serious, vision-threatening, or life-threatening disorders.

In spite of the above-mentioned recommendation, there are large variations in conducting a red reflex examination. In most countries, recommendations or guidelines include the red reflex examination with a handheld ophthalmoscope at least twice, the first one in the newborn period and second one in the first 6-8 weeks of life (10). In the present study, the prevalence of documented CC was reported as 0.19 in every 1,000 live births.

Sheeladevi et al. observed that the overall prevalence of childhood cataracts and CC rates were 0.32/10,000 and 22.9/10,000 children, respectively. The incidence is within the range of 1.8 to 3.6/10,000 per year. On the other hand, the prevalence rates of childhood cataracts in low-income and high-income countries were observed to be 0.42 to 2.05/10,000 and 0.63 to 13.6/10,000, respectively. There was no difference in the prevalence based on laterality or gender (11).

In a cross-sectional study carried out in Egypt on 2,500 cases presenting with genetic disorders, the most common ocular anomalies were CC,

retinal dystrophies, glaucoma, and retinoblastoma in the order of frequency (12). In a study conducted in Israel during 2000-2008, the prevalence of CC was reported as 0.68 per 10,000 newborns (13). In the United States and Europe, based on a routine notification system for monitoring congenital anomalies, the annual prevalence of congenital or infantile cataract has been estimated to be approximately 1 per 10,000 of the total number of births (14). The British Congenital Cataract Interest Group reported 2.29 per 10,000 cases by the age of 1 year with congenital and infantile cataracts (15).

A cohort study carried out in the United Kingdom, within 1995-1996, demonstrated congenital and infantile cataracts in less than half of the cases at the age of 8 weeks or under (16). Bhatti et al. (17) in a similar study in the United States showed that 38% of the neonates were diagnosed with CC after the age of 6 weeks. Sotomi et al. (18) showed that none of 27 newborns with CC were diagnosed by the newborn ophthalmic examination within 10 years of experience in a single center.

Many studies carried out on the prevalence of CCs have demonstrated differences in region and population due to various epidemiological characteristics. The frequency of CC is quite varied from study to study due to regional and socioeconomic factors. For examples, one study on 200,000 children with blindness due to CC (by Foster et al.; 1997) and another study (by Lin et al.; 2014) showed the prevalence of 1 to 15 per 10,000 children worldwide and 1 to 3 per 10,000 births in developing countries, respectively.

However, a third study observed the prevalence of childhood cataracts to be 0.42 to 2.05 per 10,000 children in developing countries, compared to 0.63 to 13.6 per 10,000 children in developed countries (Sheeladevi et al.; 2016) (19,20,21). Therefore, there are different distribution totally in the present study it was similar to those reported for studies in developing countries.

## Conclusion

In this study, the prevalence of CC was 0.19 in every 1,000 live births in a private hospital.

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## Conflicts of interest

The authors declare that there is no conflict of

interest.

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