

## Incidence of environmental and genetic factors causing congenital cataract in Children of Lahore

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### Abstract

**Objective:** To check the incidence of environmental and genetic factors causing congenital cataract in infants.

**Methods:** The descriptive study was conducted at Layton Rahmatullah Benevolent Trust, Lahore, Pakistan, from October 2013 to April 2014, and comprised children under 15 years of age who had rubella syndrome, herpes simplex, birth trauma, trisomy 21, Nance-Horan syndrome or Lowe's syndrome.

**Results:** Of the 38,000 cases examined, 120(0.3%) patients were diagnosed with congenital cataract. Of them, 52(43.33%) were aged between 2 and 5 years, 22(18.33%)  $\leq$  11 years and 10(8.33%)  $\geq$  15 years. Bilateral congenital cataract was observed in 91(75.83%) patients and unilateral congenital cataract in 29(24.17%). Environmental factors caused 72(62.07%) cases and genetic factors caused 44(37.93%).

**Conclusion:** Congenital cataract predominated in boys compared to girls. Early diagnosis and adequate therapy requires specific technology, as well as long-term and permanent care.

**Keywords:** Congenital cataract, Analytical study, Syndromes, Lens of eye, Slit lamp examination. (JPMA 66: 819; 2016)

### Introduction

Molecular genetics have greatly contributed to our knowledge of inherited ocular malformations. Basic and clinical science was limited to a description and classification of phenotypes based on morphology, biochemistry and physiology. Progress was severely hampered by the death of genetic information.<sup>1</sup> Vision loss in eye is mainly due to some environmental changes or genetic factors affecting the lens. The most important risk factors, age and hereditary, are associated with different types of cataract.

The human eye is a complex structure used to collect information about the environment around us and reacts to light allowing vision. Lens of the eye is a transparent biconvex part helping in image formation. It also helps to focus evenly on near objects. Any change in the crystalline structure of the lens leads to cataract. Congenital cataracts (CC) occur due to alterations during embryonic development in the lens fibre. Different syndromes and infections before birth lead to malformations in the eye and aids in CC formation. Though several causes have been found, specific etiology is often difficult to identify, especially in patients suffering from unilateral CC. A clinically and genetically heterogeneous disorder,<sup>2</sup> CC accounts for 1 out of every 2000 live births and causes 10% of all preventable visual loss in children globally.<sup>3,4</sup>

Heredity cataracts account for between 8.3% and 25%. CC formed as a result of deteriorations at different gene loci are phenotypically identical and have aberrant inheritance patterns while cataracts altering phenotypically are found in single large family. Thirteen distinct loci in humans have been identified for phenotypically distinct forms for autosomal dominant CC.<sup>5</sup> In developed countries, about 30 out of 100,000 people have this medical condition. CCs account for 25% of cases, the most common being autosomal dominant, then autosomal recessive or X linked.<sup>3,6,7</sup> The lens alone may be involved, accounting for approximately 70% of CCs.<sup>8</sup>

Infections like varicella, herpes simplex, toxoplasmosis, rubella and syphilis (TORCH) are considered some of the causes behind CC.<sup>9,10</sup> Congenital rubella syndrome (CRS) is still a major problem in developing countries and CC was found in 90% of seropositive patients.<sup>11</sup> Babies having galactosaemia, a metabolic disorder found associated with CC, have lack of clarity in the middle portion of the eye which can be viewed with retroillumination. Marinesco Sjogren, Down's, Patau, Edward and Nance Horan syndromes are considered linked to CC.

CC is evaluated by Snellen chart to check the visual acuity in children  $>3$  years old. Infants below 36 months of age undergo light perception test for this purpose. Other evaluation procedures include ophthalmoscopy and slit lamp examination. TORCH test is done of infants and mothers if congenital cataract is caused due to infections.

Cataracts that cause vision loss should be removed as

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early as possible, preferably within the first week after birth. Cataract surgery is done by providing anaesthesia using an operating microscope. Once the cataract has been removed, focusing power can be retained by contact lens, intraocular lens or glasses. The last step in the treatment is to recover amblyopia that forms if one eye is stronger than the other as in case of a unilateral cataract.

The current study was planned to determine the environmental as well as genetic factors causing CC.

**Patients and Methods**

The descriptive study was conducted at Layton Rahmatullah Benevolent Trust (LRBT), Lahore, Pakistan, from October 2013 to April 2014, and comprised children under 15 years of age who had rubella syndrome, herpes simplex, birth trauma, trisomy 21, Nance-Horan syndrome or Lowe's syndrome.

Snellen chart, light perception, ophthalmoscopy and slit lamp examination were used to diagnose CC. Factors like rubella syndrome, toxoplasmosis, herpes simplex, syphilis and cytomegalovirus and different syndromes like Patau, Nance-Horan, and Down 's syndrome causing CC were examined.

Chi-square test was used to check the prevalence of environmental and genetic factors between different age groups and values were considered significant at  $p < 0.05$ . Variables analysed were age, gender, viral infection and genetic syndromes.

**Results**

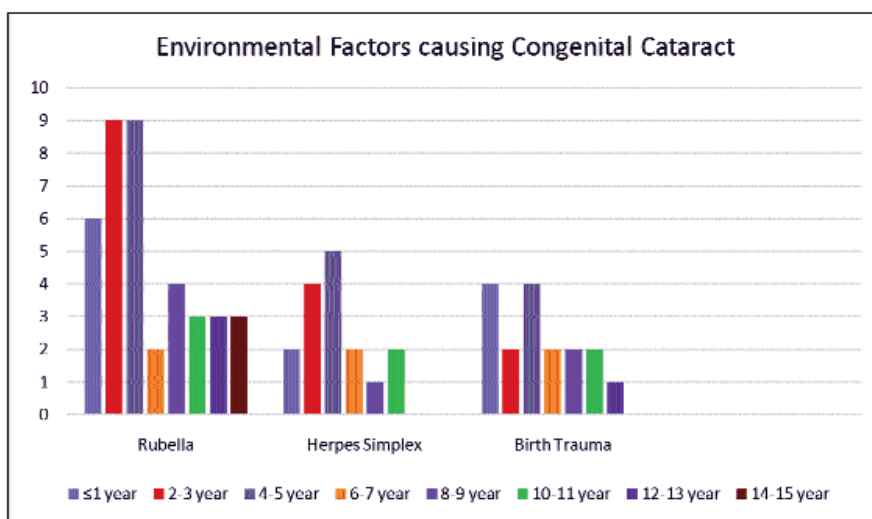
Of the 38,000 cases studied, 120 (0.3%) were of CC, out of which 4 (3.3%) were of family history. Of 120 patients, 27 (22.5%) were girls and 93 (77.5%) were boys, with age range of 1-15 years.

Of the total, 52 (43.33%) were aged 2-5 years, 22 (18.33%)  $\leq 11$  years and 10 (8.33%)  $\leq 15$  years. Bilateral CC was observed in 91 (75.83%) and unilateral CC in 29 (24.17%).

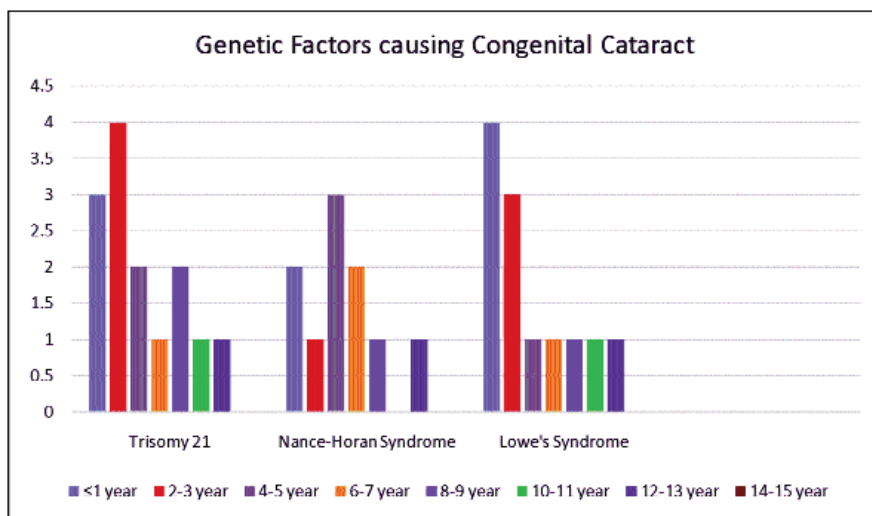
Environmental factors were found

behind 72 (62.07%) cases; 39 (32.5%) of rubella syndrome, 16 (13.33%) of herpes simplex and 17 (14.17%) of birth trauma. In rubella cases, 6 (15%), 9 (23%), 9 (23%), 2 (5%), 4 (10.2%) were observed in age group of 1, 2-3, 4-5, 6-7, 8-9 years, respectively, while 3 (7.7%) cases each were in 10-11, 12-13 and 14-15 groups (Figure-1).

In herpes simplex, 2 (12.5%), 4 (25%), 5 (31.25%), 2 (12.5%), 1 (6.25%), 2 (12.5%) were found in less than or equal to 1, 2-3, 4-5, 6-7, 8-9, 10-11 years of age, respectively, while no case was observed among 12-to-15-year-olds. Similarly, birth trauma was seen in 17 (14.17%) cases out of which 4 (23.5%), 2 (11.7%), 4 (23.5%), 2 (11.7%), 2 (11.7%), 2 (11.7%), 1 (5.8%) cases were observed in less than or equal to 1, 2-



**Figure-1:** Incidence of environmental factors causing congenital cataract according to age.



**Figure-2:** Incidence of genetic factors causing congenital cataract according to age.

3, 4-5, 6-7, 8-9, 10-11, 12-13 years of age respectively and no case was seen in age group of 14-15 years (Figure-1).

Genetic factors causing CC were observed in 44(37.93%) patients. Trisomy 21 was seen in 17(38.64%) of the total cases observed out of which 3,4,2,1,2,1,1 cases were seen in less than or equal to 1, 2-3, 4-5, 6-7, 8-9, 10-11, 12-13 years of age respectively and no patient was seen in age group of 14-15 years, Nance-Horan syndrome was observed in 12(27.27%) cases out of which 2,1,3,2,1,1 cases were seen in less than or equal to 1, 2-3, 4-5, 6-7, 8-9 and 12-13 years of age respectively, while no case was enrolled in age groups 10-11 and 14-15 years. Lowe's syndrome was seen in 15(34.09%) cases out of which 4,3,1,1,1,1 was seen in age group less than or equal to 1, 2-3, 4-5, 6-7, 8-9, 10-11 and 12-13 years; no case was seen in age group 14-15 years (Figure-2).

Other associated pathologies were 9(10.71%) cases of hypertension, 6(7.14%) of diabetes, 5(5.95%) of myopia, 55(65.48%) of Nystagmus, and others including squint, hepatitis, and leukaemia 9(10.72%).

## Discussion

Congenital cataract is the most common type of lenticular opacity with current annual birth prevalence estimated to be approximately 1/10,000 total births.<sup>12</sup> The condition is rare and occurs in developed countries with a frequency of 30 cases among 100,000 births, with another 10 cases being diagnosed during childhood. It reflects mainly genetically caused developmental alterations in the lens and surrounding ocular tissues.<sup>13</sup> This study was aimed at determining the incidence of genetic and environmental factors causing CC in patients

Bilateral CC was observed in 75.83% of the patients, mostly boys. By contrast, a cohort of all children born in Denmark and aged under 17 years during 1977-2001 was established, and CC cases were identified. Bilateral CC cases were male dominated at 62%.<sup>14</sup> In another study involving 1027 children (529 boys and 498 girls), 64% cases were of bilateral CC.

The age group of our study population was between 1 to 15 years, which is similar to enrolled cases in India with a range 1 month 3 years.<sup>15</sup> In our study, about 62.07% causes were environmental and about 37.93% were genetic at the time of diagnosis. Johar et al examined the reasons of childhood cataracts and found the preventable circumstances in four western states of India.<sup>16</sup> Of the 172 children, 88.4% were found to have non-traumatic cataract and 11.6% had traumatic cataracts. Among non-traumatic cataracts, 7.2% were hereditary, 4.6% caused by CRS, 15.1% secondary and in 73% no cause was identified.

About 32.5% of total CC patients were with rubella syndrome in our study. CRS is an important cause of deafness, heart disease, cataract, mental retardation and many other permanent problems in children. The seroprevalence of CRS among congenitally malformed babies was 12% in 1991 and varied from 0.6 34.5% during the period 1998 2002.<sup>17</sup> In a study of 48.5% CC patients, the prevalence of rubella cataract, based on serology and isolation of the virus, was 11.3%.<sup>18</sup> There were 13.33% of herpes simplex patients. In India, the T.gondii deoxyribonucleic acid (DNA) in 32.7% of lens was aspirated from CC patients and no case of herpes infection was found.

Cataracts are also evident in syndromes with systemic deformities comprising Trisomy 21, Turner's syndrome, Trisomy 13, Lowes Syndrome, Nance Horan syndrome, Marnesco Sjogren syndrome, etc. to name a few. Mental defects are common. About 13% of Down's syndrome cases with CC were found in Brazilian study compared to our study's 11.67%. No case of autosomal dominant Marfan syndrome was found in our study compared to 0.625% in a UK study. Moreover, we found 15 patients with Lowe's syndrome, a metabolic renal disorder.

Different pathologies, such as nystagmus, diabetes, myopia and hypertension, were found to be associated with CC patients. Severe specific adverse perinatal events, particularly hypoglycaemia, hypoxia, and hypothermia as well as disorders of glucose metabolism in mothers of affected children, were linked to CC.

Limitations of this study included inadequate technical expertise in the hospital which prevented some relevant tests, particularly TORCH test, which is used to diagnose infections that cause CC. No proper assessment of what caused the condition was done and many patients were not aware of its complexities.

Counselling of the parents is very important and its need is stressed. It is important to make the parents understand that the treatment of the child starts only after surgery. The necessity for regular follow-up, need to enforce the constant wearing of glasses, or contact lens despite intraocular lens (IOL) implantation and the requirement of occlusion therapy after surgery should be emphasised during counselling.

## Conclusion

There was little proof that environmental factors, such as infections, cause the disease. Moreover, the differences according to gender and other risk factors in both unilateral and bilateral CC showed that they had different aetiologies.

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