



INCIDENCE OF HEREDITARY OF OPTICAL ABNORMALITY IN PATIENTS WITH DOWN'S SYNDROME

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ABSTRACT

Background: Down's syndrome is a genetic condition in which a person has 47 chromosomes instead of 46, with an extra copy of chromosome number 21. This extra genetic material disrupts the normal developmental processes leading to medical and physical abnormalities in cases of Down's syndrome. Children with Down's syndrome are characterised by mental retardation but they also have high frequency of various congenital optical anomalies. **Aim and Objective:** This study was done with an aim to estimate the incidence of hereditary of optical abnormality in the patients with Down's syndrome. **Method:** The 1147 cases of optical abnormality as cataract from age group of 0 to 14 years were studied for the occurrence of Down's syndrome during the period of 2012 to 2018. The standard Karyotyping method was used to confirm Down's syndrome. The normal children of equivalent age group were taken as control. The Type of cataract was also recorded. The collected data was compared with estimated statistics of Down's syndrome of Nagpur region. **Result:** From the 1147 diagnosed cases of optical abnormality 27 cases (13 males and 14 females) were confirm with the Down's syndrome (2.35%), which corresponds to the estimated 3.31% frequency of Down's syndrome among the children of Nagpur region. The Down's syndrome frequency (2.35) which is significantly very high in compared with the age matched control patient's frequency of 0.1% (1 in 1000). The five patients had bilateral cataract observed soon after birth, and three of these underwent cataract surgery within the first year of life. **Conclusion:** Early optical abnormality was prevalent in the children with Down's syndrome, whereas the prevalence of cataract was significantly low when compared to controls of same age groups. The frequency of early cataract among children with Down's syndrome is found to be 2.35% which corresponds to the estimated frequency of Down's syndrome i.e 3.31%. The bilateral cataract may appear with the birth.

KEYWORDS: The Type of cataract was also recorded.

INTRODUCTION

Down's syndrome is a genetic abnormality in which an individual has 47 chromosomes instead of 46, with an extra copy of chromosome number 21. The syndrome is described by a British physician named Langdon Down in 1866.^[1] This extra genetic material interrupt the normal developmental processes leading to medical and physical abnormalities like mental retardation and, a special physiognomy and body stature.^[2] The prevalence of Down's syndrome in India is 0.88 per 1000 (1 out of 1139) to 1.09 per 1000 (1 out of 916). The three children of Down's syndrome were report to be born every hour.^[3-5]

In literature the occurrence of early optical abnormality among children aged up to 17 years with Down's syndrome has been reported to be from 5%^[6] and up to 50%.^[7-12] In previous studies of congenital or infantile

cataract, 3-5% of cases were associated with Down's syndrome.^[13-16] However, there is a lack of population based data on occurrence and characteristics of early cataracts in Down's syndrome.

In this study of congenital cataract cases in Nagpur region the primary aim was to estimate the frequency of early cataract among patients with Down's syndrome, and related clinical defects.

MATERIALS AND METHODS

Patient Selection

The 1147 cases of congenital optical abnormality as cataract from age group of 0 to 14 years were studied for the occurrence of Down's syndrome during the period of 2012 to 2018. The other types of cataract like acquired cataract, metabolic cataract, traumatic cataract, toxic

cataract and disease associated cataract were excluded from the study.

Data collection

The common parameters like age, sex and types of optical abnormality were collected. The age at the time of diagnosis of optical abnormality was recorded. Whether the patients have unilateral or bilateral optical abnormality were noted. The normal children of equivalent age group were taken as control. The collected data was compared with the estimated statistics of Down's syndrome in Nagpur region. Parents were also investigated wherever possible.

Cytogenetic Investigation

Cytogenetic investigation was carried out on 27 cases of cataract with clinical features similar to Down's syndrome. PHA-stimulated peripheral blood leucocytes were cultured for 72 hrs in RPMI-1640 medium supplemented with 20% qualified; heat inactivated fetal bovine serum, 100U/ml penicillin and streptomycin, without mitogene at 37°C.

The culture was exposed to colchicine (10µg/ml) for 30 min followed by hypotonic treatment (0.075M KCl) for 20 min at 37°C. Then fixed in Methanol : Glacial acetic acid (3:1) and dropped on wet ice cold grease free slides. The chromosomes were G-banded with trypsin-giemsa banding. Olympus BX51 Research microscope was used to screen, capture and karyotype the metaphase chromosomes. The results interpreted according to

International Standard Chromosome Nomenclature (ISCN).

RESULTS

During the study period from 2012 to 2018, a total of 1147 children aged 0-14 years had a validated diagnosis of non-traumatic, non-acquired cataract. Out of these in 27 (13 males and 14 females) cases the cataract was associated with various syndromes/chromosomal abnormalities. The karyotyping process has confirmed them as Down's syndrome having the frequency of 2.35%, which corresponds to the estimated 3.31% frequency of the Down's syndrome among children of Nagpur region having Down's.^[17]

In table 1 the characteristics of the cases are summarised. The 27 cataract cases found to be associated with the Down's syndrome.

Depending on the appearance, five types of cataract were observed among the 27 patients representing 26 eyes, that is Cerulean cataract, Dense cataract, Nuclear/zonal cataract, Cortical cataract and Posterior cortical cataract.

Eight eyes from five cases have dense cataract, either bilaterally or unilaterally, one of these was present since birth. Six eyes from four cases with a cerulean dot type of cataract were recorded. The one cerulean cataract case was bilateral and diagnosed at birth. In three patients the Posterior cortical cataract was observed unilaterally while the cortical cataract was observed in six eyes from five cases either bilaterally or unilaterally.

Table 1: Early cataract cases with Down's syndrome.

Case No	Sex	Age at Cataract diagnosis	Eye	Type of cataract	Age at surgery
1	F	At birth	R L	Dense Dense	2 m 3 m
2	M	At birth	R L	Post Cortical Cortical	2m 4 m
3	F	At birth	R L	Nuclear/Zonal Nuclear/Zonal	8 m 1y
4	F	At birth	R L	Cortical Cortical	2y 3y
5	M	At birth	R L	Cerulean Cerulean	4y 4y
6	F	2y	R L	Cerulean Dense	4y 6y
7	M	3y	R L	Dense Dense	8y 10y
8	F	5y	R L	Post Cortical nuclear/Zonal	7y 11y
9	M	8y	R L	Dense Cortical	9y 10y
10	F	10y	R L	Cortical Cerulean	11y 13y
11	M	12y	R L	Dense Dense	14y 16y

12	F	13y	R L	Cortical Post cortical	15y 16y
13	F	At birth	R L	Dense Dense	2 m 3 m
14	M	At birth	R L	Post Cortical Cortical	2m 4 m
15	F	At birth	R L	Nuclear/Zonal Nuclear/Zonal	8 m 1y
16	F	At birth	R L	Cortical Cortical	2y 3y
17	M	At birth	R L	Cerulean Cerulean	4y 4y
18	F	2y	R L	Cerulean Dense	4y 6y
19	M	3y	R L	Dense Dense	8y 10y
20	F	5y	R L	Post Cortical nuclear/Zonal	7y 11y
21	M	8y	R L	Dense Cortical	9y 10y
22	F	10y	R L	Cortical Cerulean	11y 13y
23	M	12y	R L	Dense Dense	14y 16y
24	F	13y	R L	Cortical Post cortical	15y 16y
25	M	14y	R L	Cerulean Cerulean	16y 17y
26	M	14y	R L	Cerulean Cerulean	16y 17y
27	M	14y	R L	Cerulean Cerulean	16y 17y

DISCUSSION

It is quite difficult to evaluate ophthalmic functions in Down's syndrome patients who cooperate poorly as the result of intellectual disability. Currently, only limited information is available regarding ophthalmic potential in Down's syndrome patients.

This study was conducted during the period of 2008-2012. The present analysis focuses on the cases with Down's syndrome identified among the registered and validated cases of pediatric cataract. Cataracts occurred after trauma or caused by acquired systemic (for example, diabetes) or acquired ocular pathology (for example, uveitis) were not included.

In this study, we tried to estimate the frequency of Down's syndrome among cases of congenital cataract in Nagpur region. Out of 1147 cases of congenital cataract, we found that 27 patients have Down's syndrome, which gives the 2.35% frequency that is significantly very high as compared to the control patients of same age with frequency of 0.1% (1 in 1000). The 2.35% frequency of DS patients also corresponds with the estimated 3.31% frequency of Nagpur region.

Some Down's children with minor cataracts probably escaped recognition in the present context, since the identification of cases was based on a population of paediatric cataract registered at hospitals. This implies the inclusion of mainly advanced cases where surgery should be considered. Optically insignificant opacities in patients with Down's syndrome, as the apparently most prevalent childhood lens pathology observed^[18, 19] were probably ignored in the very young children.

In Puri and Singh^[20] study the increased prevalence of cataract found in those in the 45- to 64-year-old age group may be the result of increased levels of CuZn-SOD, in turn resulting from the location of the associated five exons of SOD1 on chromosome 21. These elevated levels of superoxide dismutase may give rise to increased levels of reactive species, including hydrogen peroxide and hydroxyl radicals, which may increase the risk of cataractogenesis. In our study, the elevated levels of superoxide dismutase may give rise to increased levels of reactive species prenatally.

The American Academy of Pediatrics gives the information about health supervision for children with Down's syndrome which stated that on comparing the data regarding other ophthalmic and systemic disorders,

it seems justified that no definite associations were found between cataract and heart defects or any other systemic findings in the patients with Down's syndrome. As given in the literature an increased frequency of strabismus was found in patients with Down's syndrome and cataract when compared to unselected groups of children with Down's syndrome,^[7,10-12] however, with a similar predominance of esotropia.

The early cataract is only rarely seen in patients with Down's syndrome. Textbook frequencies of cataract in Down's syndrome (15-75%) are apparently based on all ages or mainly on adults.^[18, 25, 26]

In neonatal cataract, Sorsby^[18] gave the much lower figure of 8%, whereas in our study the percent frequency of early cataract is much greater than the normal control participant and match with the estimated frequency of Nagpur region, though many were optically irrelevant according to the lens morphology specifications given. In general, there is support for the bulk of Down's cataract cases being of adolescent or presenile onset.

CONCLUSION

Early cataract was prevalent in the children with Down's syndrome, whereas the prevalence of cataract was significantly very low when compared to age-matched control participants. The frequency of early cataract among children with Down's syndrome is found to be 2.35%, which corresponds to the estimated frequency of Down's syndrome i.e. 3.31%. The bilateral cataract may appear with the birth with the syndrome.

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