



BEYOND THE HAZE: DELVING INTO CORNEAL OPACITY AND ITS VISUAL IMPLICATIONS

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ABSTRACT

Purpose: To study the demographical profile and enumerate causative factors of patients of corneal opacity presenting at tertiary care center of Bihar. It is also to elaborate the type of corneal opacity and visual impairment grading in these patients. **Material and Method:** All patients with corneal opacity fulfilling inclusion and exclusion criteria during the one year of study period were taken. Patients were sub categorized on the basis of demographical profile, laterality, causative factor, size and type of corneal opacity and grading of visual impairment. All the data were studied, analyzed and interpreted. **Result:** Total 1123 patients presented with corneal opacity in which there was male predominance in ratio of 2:1 with rural area presentation. Most common etiological factor for corneal opacity was found to be post-microbial keratitis 32.01% followed with trauma 25.2%. Maximum number of patients falls in 7-9 mm in size of corneal opacity with 27.51% followed with more than 9mm of size with 24.22%. Leucomatous corneal opacity of 59.92% was common type of presentation of corneal opacity followed with macular corneal opacity of 16.38%. Majority of patients falls in Grade IV (<6/60-3/60) visual impairment according to WHO classification with 30.54%, followed with Grade III (<3/60-1/60) in 24.13% of the patients. Bilateral blindness was seen in 0.126% and unilateral blindness in 1.28%. **Conclusion:** Infective keratitis is the leading cause of corneal blindness in this study followed by trauma. Occupation and old age are important risk factor. Leucomatous corneal opacity being most common type of corneal opacity with grade III visual impairment. Health awareness and safety measures can minimize the incidence of corneal blindness.

KEYWORDS : corneal opacity, demography, causative factor, visual impairment

INTRODUCTION:

Loss of transparency of cornea due to scarring is defined as Corneal Opacity. Corneal opacity leads to visual impairment or blindness. Blindness causes physical, social and economic dependence of the blind person on the family and society.¹ The term "visual impairment" refers to a functional limitation of the eye(s) or visual system due to a disorder or disease that can result in a visual disability or a visual handicap.² Visual impairment is often defined as a best corrected visual acuity of worse than either 20/40 or 20/60.³ The world health organization (WHO) definition of blindness specifies visual acuity less than 20/400 and/ or remaining visual field less than 10 degrees in the better seeing eye.² Visual acuity of 20/70 to 20/400 (inclusive) is considered moderate visual impairment or low vision.^{1,4} It is estimated that currently there are 45 million individuals worldwide who are bilaterally blind and another 135 million that have severely impaired vision in both eyes.⁵ The fact that there are 180 million people in the world today who are in some way severely visually disabled is a tragic, unacceptable situation in both social and economic terms, but this number does not even begin to address the additional hundreds of millions who are disabled by monocular visual loss.⁵ According to the National Programme for Control of Blindness (NPCB) estimates, there are currently 120,000 corneal blind persons in the country. According to this estimate there is addition of 25,000-30,000 corneal blindness cases every year in the country.⁶ The burden of corneal disease in our country is reflected by the fact that 90% of the global cases of ocular trauma and corneal ulceration leading to corneal blindness occur in developing countries.

The Andhra Pradesh Eye Disease Study reported that a significant burden of corneal blindness in the rural population of Andhra Pradesh was avoidable of the 0.66% prevalence of corneal blindness in at least one eye in this population, nearly 95% was avoidable.⁶ Prevalence of corneal disease was 3.7% and that of corneal blindness was 0.12% in rural population of Haryana⁶

Corneal Opacity is one of the leading cause of the blindness. By finding its causes it can prevented or can be treated accordingly. Corneal Opacity has been managed in Bihar, state of eastern India for a long

time but there is no information on epidemiological pattern, risk factors and demographic profile. Though a large number of studies from South India have reported, there are only few studies from eastern India that have determined the epidemiological pattern and risk factors involved in corneal opacity and majority of them were performed more than a decade ago. Therefore, we aim to initiate a hospital-based study in Bihar so as to establish a baseline description of the risk factors, prevalence, demographic profile in the state of Bihar. This study will expect to enable evidence-based practice in the management by providing vital information.

MATERIAL AND METHOD:

This is a Cross Sectional & Observational study, conducted at tertiary care center of Bihar in duration of one year (May 2020- April 2021). The inclusion criteria were diminution of vision due to corneal opacity, all age groups, impairment of vision to blindness due to corneal opacity and written, informed consent from all patients. Exclusion criteria were diminution of vision due to other ocular cause with corneal disease, viral positive cases (HIV I&II, HbsAg, Anti HCV) and patients not willing to participate the study

Methodology:

All patients clinically diagnosed to have corneal opacity involving visual axis and resulting some degree of visual impairment, in duration of one year (May 2020 to May 2021) was examined after fulfilling inclusion criteria. A detailed clinical history was recorded of each patient. Age, sex, occupation, socio-economic status, literacy and laterality of the affected eye will also be recorded. Detailed past history was taken. This was the diagnostic criteria for making etiology- history of trauma, watering, pain, decreased vision suggestive of any infective pathology like keratitis (bacterial, viral, fungal), Foreign body injury, Chemical burn, history of vomiting, diarrhea suggestive Vitamin A deficiency, cataract surgery for pseudophakic bullous keratopathy & cornea surgery for keratoplasty, congenital white opacity for congenital corneal opacity or rashes, fever for chicken pox, Steven Johnson syndrome.

Etiological classification and findings was based on patient's history

and previous documentations. Ocular investigation was performed in detail. Visual Acuity (VA)- Snellen's chart was used for cooperative patients, for children Counting finger, Preferential looking test, Optokinetic Nystagmus, Cardiff Acuity chart, if nothing possible the was based on pupillary reaction. Ocular Movements in all cardinal directions. Slit Lamp Evaluation: Anterior Segment, which include Lid, Conjunctiva, Cornea, Anterior Chamber, Pupillary Reaction, Lens. Corneal opacity will be categorized as A) Nebular: faint opacity due to superficial scar involving bowman's layer and superficial stroma, B) Macular: Semi dense opacity due to scar involving half of stroma, C) Leucomatous: Dense white opacity due to scarring of more than half of stroma. D) Adherent Leucoma: scar of corneal tissues in which iris is adhered

Corneal opacity whose depth cannot be determined on slit lamp Anterior Segment OCT will be performed. Size of corneal opacity, whether associated with vascularization, thinning, Staphyloma, facet, defect, edema, infiltrates. Intraocular Pressure was measured by noncontact tonometry. Posterior Segment Evaluation was done by dilated funduscopy was using Indirect Ophthalmoscopy wherever possible. If Funduscopy was not possible then the Ultrasound was used to evaluate posterior segment. Refraction: Cycloplegic refraction in children was done if required or possible.

Statistical Analysis: The data for each patient were entered into Excel tables, and SPSS for Windows Version 24.0 was used to analyze the data.

OBSERVATION AND RESULT:

Total number of patients presented to OPD in one year of duration was 81,426 out of which 1123 patient had corneal blindness. Detail history and examination was done in all patients. Following results were observed.

Table 1: Distribution of Male and Female

Male	728	64.82%
Female	395	35.17%

Table 2: Distribution according to age group

Age Group	Male	Percentage	Female	Percentage
0-10	118	10.50%	69	6.1%
11-20	83	7.3%	54	4.8%
21-30	54	4.8%	20	1.7%
31-40	193	17.1%	97	8.6%
41-50	185	16.4%	92	8.1%
51-60	54	4.8%	38	3.3%
>61	41	3.6%	25	2.2%
	Total=728		Total=395	

Ratio of Male: Female is 2:1 as shown in Table 1. Distribution of male and female in different age group was done (Table 2). The patients presented in between 31-40 years of age group (25.7%) had high number of presentation and then to 41-50 years of age group (24.5%). Mean age group was 37 ± 17 years. Age range was 0-85 years.

Table 3: Etiology of corneal opacity

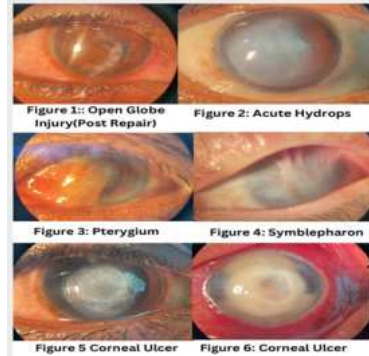
S.NO.	Etiology	Number of patients	% of patients
1.	Congenital	20	1.78%
2.	Pterygium	103	9.17%
3.	Post-Microbial Keratitis	360	32.01%
4.	PBK/ABK	110	9.79%
5.	Failed Keratoplasty	114	10.15%
6.	Vitamin-A Deficiency	51	4.5%
7.	Trauma	283	25.2%
8.	Corneal Degeneration & dystrophy	82	7.30%

Etiology of corneal opacity are described in table 3. Most common etiology for corneal opacity was found to be post-microbial keratitis 32.01% followed with trauma 25.2%.

Third common cause was Failed Keratoplasty of 10.15% followed with pseudophakic aphakic Bullous Keratopathy of 9.79 % then pterygium 9.17%, corneal degeneration and dystrophy 7.03%, vitamin A deficiency 4.5%. Minimum presentation was of congenital glaucoma 1.78% (Table 3) and few images in figure 1 to 6.

Table 4: Percentage of patients according size of corneal opacity

S. No.	Size of Corneal Opacity	Number of patients	Percentage (%)
1	<3mm	143	12.73%
2	3-5mm	130	11.57%
3	5-7mm	269	23.95%
4	7-9mm	309	27.51%
5	>9mm	272	24.22%



Maximum number of patients falls in 7-9 mm corneal opacity with 27.51% followed with more than 9mm with 24.22%, then 5-7mm with 23.95%, then less than 3 mm with 12.3% then followed with 3-5mm of 11.57% as shown in table 4.

Table 5: Distribution of patients according to type of Corneal Opacity

S.No.	Type of corneal opacity	Number of patients	Percentage (%) of Patients
1	Nebular	128	11.39%
2	Macular	184	16.38%
3	Leucomatous	673	59.92%
4	Adherent Leucoma	138	12.28%

Leucomatous corneal opacity 59.92% was common type of presentation of corneal opacity followed with macular corneal opacity of 16.38%. Minimum number of patients presented with Adherent Leucoma (12.28%) and Nebular corneal opacity (11.39%) as described in table 5.

Table 6: Visual Impairment in corneal opacity (according to WHO classification)

S.N o.	Visual Acuity	Category	Number of Patients	Percentage % of patients
1	NO PL	Blind (Grade V)	46	4.09%
2	<1/60-PL+ve	Blind (Grade IV)	343	30.54%
3	<3/60-1/60	Very Severe Visual impairment (Grade III)	271	24.13%
4	<6/60-3/60	Severe Visual Impairment (Grade II)	202	17.9%
5	<6/18-6/60	Moderate Visual Impairment (Grade I)	133	11.80%
6	6/6-6/18	Mild or No Visual Impairment (Grade 0)	128	11.39%

Visual impairment in corneal opacity patients was described as shown in Table 6. Maximum number of patients falls in Grade IV (30.54%), followed with Grade III (24.13%) and Grade II (17.9%), then Grade I (11.8%) and Grade 0 (11.39%). Minimum number of patients falls up in Grade V (4.09%) as shown in table 6.

S. No .	Laterality	Number of patients	Percentage of patients
1	Unilateral	1050	1.28%
2	Bilateral	103	0.126%

DISCUSSION:

Corneal blindness accounted for 0.126 %and 1.28% of bilateral and unilateral blindness, respectively. The most common causes of blindness in the area were corneal opacity from post-microbial keratitis (32.01%) and ocular trauma (25.2%). In the South Indian population, corneal blindness was predominantly due to infectious keratitis (59.5%) and trauma (23.2%). Studies from Thailand and Gambia also report the common causes of corneal blindness.

The study showed that the prevalence of corneal blindness was higher among the older participants, male gender and people with lower educational status. Previous epidemiology studies in India and the

People's Republic of China have reported age and male sex as risk factors for poor visual outcome. These studies examined corneal diseases in rural populations only; thus, they were unable to discern whether rural location was associated with disease prevalence. Another study examined the prevalence of corneal blindness in Ningxia, People's Republic of China but did not show any significant association between rural living and corneal blindness.⁷ Corneal blindness is a public health problem; the findings of this study can serve as the basis for appropriate eye health care planning and prioritization of the available health resources towards reducing the incidence of corneal blindness in the local government. Lower prevalence of bilateral prevalence was reported by Wang et al⁸ and Dandona et al⁹ Snellen chart was used in this study, though visual acuity assessment has been found to be significantly better with Log MAR chart, and it is preferable for a population-based study.^{8,9} Several studies have shown that most blindness of corneal origin were unilateral.^{9,10,11} Periodic health education on the need for timely visitation to an eye specialist when the need arises (especially for individuals who were already blind in one eye) should be conducted by the community health workers in the local government. Corneal blindness was associated with increasing age in this study, and this result is consistent with reports from other studies.^{12,15} A higher prevalence of corneal blindness was found among the participants older than 40 years. Wang et al also reported that the older age group was associated with an increased prevalence of corneal blindness.⁸ This age group engaged more in farming activities, which predispose them to corneal injury. Similar findings were reported by Li et al¹¹ in a rural Chinese population and in the Andhra Pradesh Eye Disease Study.⁶ Corneal ulceration has been recognized as a silent epidemic in developing countries, especially the South-east Asia Region. By extrapolation of Indian estimates of the incidence of corneal ulcer, approximately 1.5-2 million people develop corneal ulcer annually in our country. Gonzales *et al.* estimated that the annual incidence of corneal ulceration in Madurai District of South India was 1130 per million population.^{19,20}

Corneal blindness due to infectious keratitis has been more commonly reported in the rural population, particularly in those belonging to the lower socioeconomic strata and those who are illiterate with poor knowledge about proper eye care.^{15,16} The avoidable causes of corneal blindness reported in this study were keratitis in childhood, trauma, aphakic bullous keratopathy, severe astigmatism post cataract surgery, keratitis in adulthood and traditional eye medicines.¹⁵ In a study from North India, 43 of 102 patients suffered bilateral injuries and nearly 45% of the eyes had severe-grade burns. Penetrating injuries remain an important cause of acquired corneal scarring in the pediatric age group. In a study involving 204 children below 14 years of age, the most common cause of injury was bow and arrow (15.2%), followed by household appliances (14.3%).^{12,13,14}

Tandon et al of New Delhi reported 62.6% corneal infection, 5.7% chemical injury, 7.1% corneal dystrophy, 5.4% keratomalacia, 6.9% bullous keratopathy, 3.6% corneal degeneration as the cause for corneal blindness in India.¹⁵ Mathew S. OLiva et al quote that keratitis (21%) and trauma (26%) were the leading cause of ocular morbidity in South India; also found that 71.4% occur before 15 years and in urban areas. 27.51% patients falls into 7-9 mm size of corneal opacity and 59.92% leucomatous variety. In this study maximum number of patients were graded in Group IV (<1/60-PL+ve) with 30.54%. Ritika Mukhija, Noopur Gupta et al 115 eyes (20.1%) with nebular corneal opacity, 263 (46.1%) with macular, 162 (28.4%) with leucomatous and 31 (5.4%) with an adherent leucoma, maximum number of patients was under nebular corneal opacity but in this study patients were under leucomatous variety with 59.92%.^{18,25,26} Mycotic keratitis is more common in the tropics and sub-tropical regions, and the major precipitating factor is trauma, followed by prior application of corticosteroids.²¹ In a hospital-based study on epidemiological profile of fungal keratitis, agriculture-related ocular trauma was the principal cause (70.3%) of mycotic keratitis.²² Because of the difficulty of treating corneal blindness once it has occurred, public health prevention programmes are the most cost-effective means of decreasing the global burden of corneal blindness.^{12,15} There is a need for communities based study on the aetiology of corneal opacity and plan a programme for prevention of the major cause of corneal opacity.

CONCLUSION:

Infective keratitis is the leading cause of corneal blindness in our study, trauma being next important. Occupation and old age are important risk factor. Leucomatous opacity being most common type of corneal opacity with grade III visual impairment. Health awareness and safety

measures can minimize the incidence of corneal blindness. Curable or treatable blindness requires a spectrum of care, including medication, optical rehabilitation and corneal transplantation. Overall, continued assessment of the burden of corneal blindness with periodic review of trends is required to effectively plan preventive, promotive and rehabilitative blindness control strategies.

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