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Study of frequency of corneal astigmatism in patients of vernal keratoconjunctivitis

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Abstract
Aim: Our aim was early detection of corneal astigmatism in VKC patients by corneal topography and find out its frequency.
Material and Method: This is a cross sectional observational study done on 100 patients (200 Eyes), between age group of 5 to 15 years and diagnosed with VKC. Parameters like Flat K, Steep K, and Astigmatism were analysed. Data were compared with age and gender matched control group.
Result: Out of 100 patients, 71 were Male and 29 were Female with mean age of presentation 10.36 ± 3.05 years. Average corneal astigmatism in right eye of caseswas1.51 ±0.49 and in control was 0.68± 0.42 (p value, 0.05). Average corneal astigmatism in left eye of cases was 1.49 ±0.49 and in control was 0.69 ±0.44 (p value<0.05).
Conclusion: Frequency of corneal astigmatism in VKC patients is more when compared to general population of same age group. All the cases of VKC should undergo corneal topography for early detection of astigmatism and thus to prevent Keratoconus.

Keywords: Frequency, corneal astigmatism, vernal keratoconjunctivitis

Introduction
Allergic disease as a clinical entity is well known from ancient times [1]. Perennial allergic conjunctivitis and seasonal allergic conjunctivitis are two acute disorders, while vernal keratoconjunctivitis (VKC) and atopic keratoconjunctivitis are two chronic diseases [2]. It is a bilateral, chronic, conjunctival inflammatory condition that occur in persons who are predisposed by atopy [3]. Vernal Keratoconjunctivitis (VKC) was first described by Arlt in 1846, is characterized. The disease usually starts after the age of 5 years and resolves around puberty, very rarely persisting after the age of 25 years [6]. Males are more likely to get the disease, with male-to-female ratios ranging from 4: 1 to 2: 1 in the literature [4, 5].
Keratoconus is described by stromal thinning that occurs because of increased production of proteolytic and lysosomal enzymes and decreasing level of protease inhibitors, resulting in different collagen structure [7, 8]. When certain pathogen are re-entered into body via conjunctiva, they react with allergen-specific IgE on surface of mast cells and basophils, causing vasoactive mediators to be released. The pathophysiology of keratoconus has been linked to increased proteases, protease activity, and inflammatory chemicals in tears. Even in healthy people, rubbing their eyes raises the amount of tear matrix MMP-13, Interleukin-6, and Tumour Necrosis Factor-alpha. This increase in protease activity is thought to be amplified by the aggressive eye rubbing found in allergic conjunctivitis patients, contributing to the formation and progression of keratoconus [9, 10]. Corneal involvement in VKC patients leads to myopic astigmatism type of refractive error leading to keratoconus which leads to visual impairment [9]. There has been evidence of a correlation between keratoconus and a variety of disorders, including ocular allergies. Hilgartner established the first correlation between ocular allergy and keratoconus in 1937 [10].
Corneal topography is used to evaluate the corneal morphology both qualitatively and quantitatively [12].
Systems based on light reflection are applied to an instrument in which rings or Placido discs of known size and spacing are reflected on the cornea's anterior surface. A digital camera captures this image, which is then processed by a computer. We used Atlas 9000 corneal topography system by Carl Zeiss.

On slit lamp examination, early keratoconus and suspects appear normal, and central keratometry (3 mm) provides only a limited assessment. As a result, topography has become the gold standard for screening keratoconus suspects [13].
Various studies have shown positive association between VKC and corneal astigmatism [9, 11, 14] This study was conducted with the aim of detecting frequency of corneal astigmatism and early keratoconus in VKC subjects by topography.

Materials And Methods

This is a cross sectional observational study. All patients in age group 5-15 years of either gender presenting in eye OPD with signs and symptoms of allergy were further subjected to detailed history, slit lamp and fundus examination. Those fulfilling diagnostic criteria of VKC were selected. Inclusion and exclusion criteria were applied. Those fulfilling criteria were enrolled in study. Written informed consent was taken. Corneal astigmatism was measured by placido disc based Carl Zeiss atlas model 2000 topography. Parameters examined were flat K, steep K and astigmatism.
Study was conducted on 100 patients of VKC.
A control group of 100 patients was also taken.

Inclusion Criteria

1. Patients of age group 5-15 years, of either gender, coming to Ophthalmology OPD in NIMS hospital diagnosed with VKC at any stage.
2. Patients who give assent for the study.
3. Patients whose legal guardians sign voluntary informed consent.

Exclusion Criteria

1. Pre-existing corneal pathology which change contour of cornea.
2. Amblyopic patients, high grade of refractive error like high myopia and high Hypermetropia
3. Any opacity in ocular media
4. Any active infection of eye other than VKC
5. History of ocular trauma and or surgery

Inclusion Criteria For Control Group

1. Patients of age group 5-15 years, of either gender, coming to Ophthalmology OPD in NIMS hospital not having VKC.
2. Patients who give assent for the study.
3. Patients whose legal guardians sign voluntary informed consent.

Exclusion Criteria for Control Group

1. Patients coming to Ophthalmology OPD in NIMS hospital diagnosed with VKC.
2. Pre-existing corneal pathology which change contour of cornea.
3. Amblyopic patients, high grade of refractive error like high myopia and high Hypermetropia
4. Any opacity in ocular media
5. History of ocular trauma and or surgery

Result And Observations

Inferences derived from study are discussed herewith.

Age Distribution

Table 1: Age distribution of case and control

	Case			Control		
Age	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
5-10 Years	39	12	51	34	15	49
11-15 Years	32	17	49	33	18	51
			N = 100			N = 100

Table 2: Mean and Standard Deviation of age of case and control

	Case	Control
mean	10.36	10.27
SD	3.05	2.86

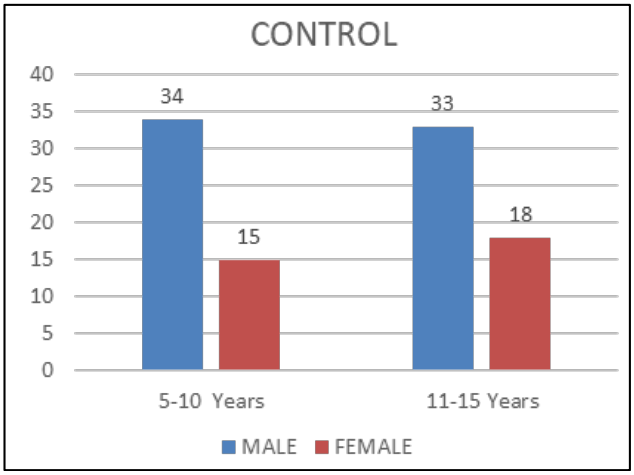

Fig 1: Age distribution of control

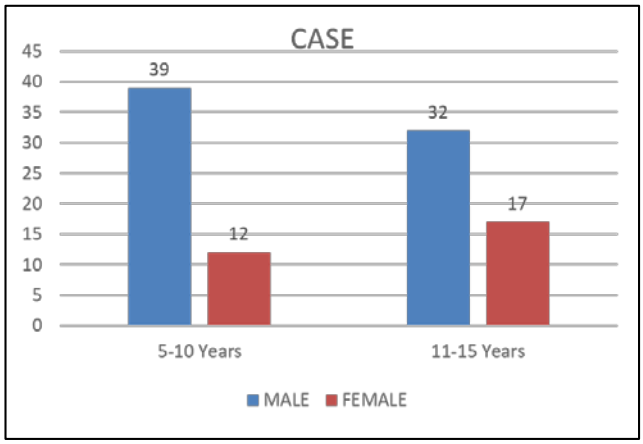

Fig 2: Age distribution of cases

There was no significant difference in the age in both the groups. Mean age of cases was 10.36 ± 3.05 years and that of control was 10.27 ± 2.86 years.

Gender Distribution

Table 3: Gender Distribution of Cases and Control

	Case	Control
Male	71	67
Female	29	33
Total	100	100

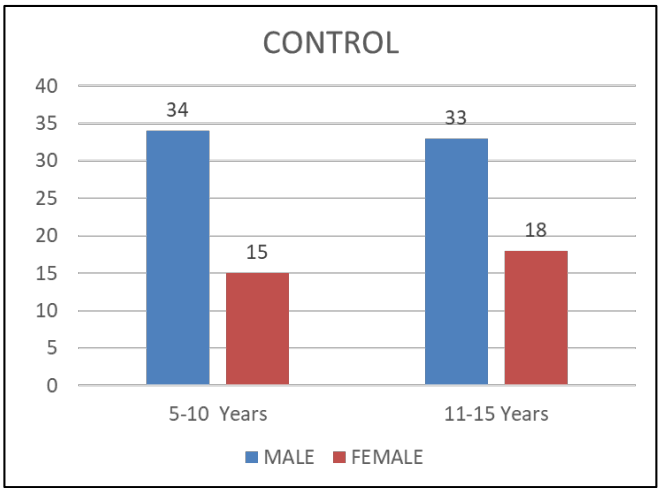

Fig 3: Age distribution of control

Average Corneal Astigmatism

Table 4: Average Corneal Astigmatism in case and control

	Case	Control	P value
Right Eye	1.51 D ± 0.49	0.68 D ± 0.42	<0.05
Left Eye	1.49 D ± 0.49	0.69 D ± 0.44	<0.05

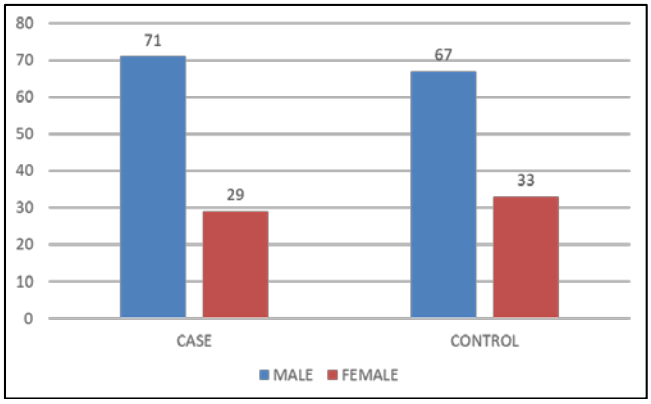

Fig 4: Gender Distribution of cases and control

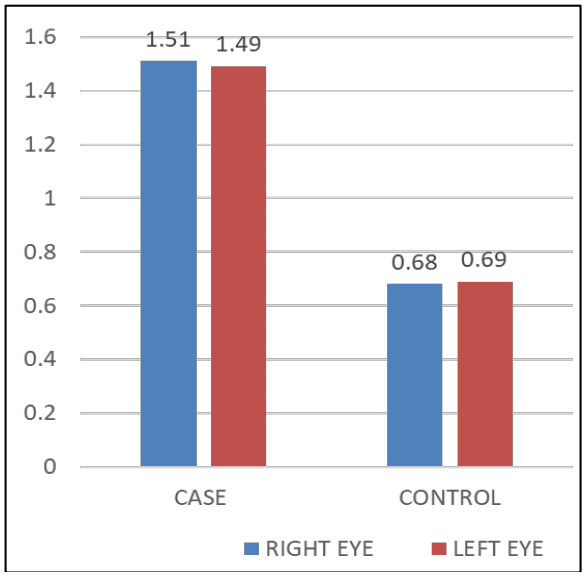

Fig 5: Average corneal astigmatism in case and control

Average corneal astigmatism in right eye of cases was found to be 1.51 D ± 0.49 and in control it was 0.68 D ± 0.42. (p value <0.05)

Average corneal astigmatism in left eye of cases was found to be 1.49 D ± 0.49 and in control it was 0.69 D ± 0.44. (p value <0.05)

P value <0.05 indicates statistically significant difference between case and control. So Positive association was found between VKC and corneal astigmatism.

There is no significant difference in average corneal astigmatism of right eye and left eye of cases and control. So no laterality was found.

Table 5: Distribution of eyes according to corneal astigmatism in case

Corneal Astigmatism	Right eye	Left eye
<0.5 D	1	4
0.5 – 1 D	15	11
1.1 – 1.5 D	33	39
1.6 – 2 D	37	35
2.1 – 2.5 D	13	9
>2.5 D	1	2
	N = 100	N = 100

Table 6: Distribution of eyes according to corneal astigmatism in control

Corneal Astigmatism	Right eye	Left eye
<0.5 D	40	36
0.5 – 1 D	38	44
1.1 – 1.5 D	16	12
1.6 – 2 D	6	8
2.1 – 2.5 D	0	0
>2.5 D	0	0
	N = 100	N = 100

In case group of our study, only 16 patients were having astigmatism of <1 D in their right eye and 15 patients in their left eye. Majority of patients that is 70 patients were having astigmatism between 1 D to 2 D in their right eye and 74 patients in their left eye. Only 13 patients of case group were having astigmatism between 2.1 D to 2.5 D in their right eye while 9 patients in their left eye. Only 1 patient was having astigmatism of >2.5 D in right eye and 2 patients were having that much in their left eye.

In control group of our study, majority of controls that is 78 were having astigmatism of <1 D in their right eye and 80 controls in their left eye. 22 controls were having astigmatism between 1 D to 2 D in their right eye and 20 controls in their left eye. None was having astigmatism of >2 D in either right or left eye.

Discussion

In present study, the mean age was 10.36 ± 3.05 years and in control, it was 10.27 ± 2.86 years (range 5-15 years) which is comparable with study done by Sethi *et al.* [22] in the year 2018, where out of 155 patients 115 (74%) were in the age group of 6 – 15 years. The mean age at presentation was 10.31 years ±4.05. Study conducted by Birjees *et al.* [14] (2018), Paulo Elias Correa Dantas *et al.* [17] (2005), Saboo *et al.* [23] (2006), mean age of presentation matches to our study.

In our study, male to female ratio was found to be 2.4:1. Out of 100 patients, 71 were male and 29 were female. In study done by Jivangi *et al.* [24] (2015), it was 2.7:1.13, similar to our study. Similarly in a study conducted by Gupta *et al.* [9] (2018), Birjees *et al.* [14] (2018), Saboo *et al.* [23], male to female ratio was comparable to our study confirming the overall pattern of VKC being more prevalent in males.

In our study, average corneal astigmatism in cases was 1.51 ± 0.49 D and 1.49 ± 0.49 D in right and left eye respectively, which in controls was 0.68 ± 0.42 D and 0.69 ± 0.44 D. Statistical significance was found with p value <0.05. Astigmatism is mostly the earliest abnormalities in the development of corneal abnormality.

Studies done by Gupta *et al*. [9], Radhika Umale *et al* [20], Adel G. Zakya *et al*. [21], Birjees Hakak *et al*. [14], Anant Sharma *et al*. [19], Gautam V *et al*. [18] Dantas *et al*. [17] came to the inference that VKC patients have a higher incidence of astigmatism and keratoconus than the general population of the same age group.

VKC patients showed aberrant VKG patterns in roughly 27% of cases, according to Totan *et al*. [15], but the authors did not compare them to the control group. Nearly 71 percent of VKC patients had an aberrant pattern of corneal topography, although only 15 percent (6 out of 40) had topographically identified keratoconus, according to Lapid-Gortzak *et al*. [16].

Frequency of corneal astigmatism is more in patients having VKC than in normal population of same age group. Subtle cases of VKC having astigmatism are unmasked on corneal topography. So by doing corneal topography in all patients having VKC, we can diagnose suspects of keratoconus. Thus by early detection, we can provide preventive measures, treatment and slow down the progression. Due to early detection and timely intervention, we can save good quality and quantity of vision. So, all cases with VKC should routinely be subjected to corneal topography.

As ours was the time bound study, sample size was restricted to 100 and we could not study on larger population. Our study was restricted to patients of Jaipur district only. Placido disc based Carl Zeiss Atlas model 9000 corneal topography machine was used to measure corneal astigmatism. It evaluates only anterior surface of cornea. More detailed result would have been obtained if posterior surface would also have been evaluated using Pentacam or Tomography.

Conclusion

To Summarize the results observed

- The mean age at presentation in cases was 10.36 ± 3.05. 71 males and 29 females were included in our study.
- In cases, Male: Female ratio was found to be 2.4:1. So male predominance was found in our study.
- Average corneal astigmatism in right eye of cases was found to be 1.51 D and in control it was 0.68 D. (p value <0.05). Average corneal astigmatism in left eye of cases was found to be 1.49 D and in control it was 0.69 D. (p value <0.05).So Positive association was found between VKC and corneal astigmatism.
- There is no significant difference in average corneal astigmatism of right eye and left eye of cases and control. So no laterality was found.

So with this study we conclude that frequency of corneal astigmatism in VKC patients is more when compared age and gender matched group. All the cases of VKC should undergo corneal topography for early detection of astigmatism and thus to prevent keratoconus by providing preventive measures and timely intervention.

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