Study of Corneal Topographical Changes in Vernal Keratoconjunctivitis

KEYWORDS

DR ANANT SHARMA	DR YOGESH SHUKLA	DR SWATI TOMAR
Department of Ophthalmology NIMS Medical college and hospital NIMS University , Jaipur, Rajasthan, India	PROFESSOR Department of Ophthalmology NIMS Medical college and hospital NIMS University , Jaipur, Rajasthan, India	PROFESSOR Department of Ophthalmology NIMS Medical college and hospital NIMS University , Jaipur, Rajasthan, India

ABSTRACT *AIMS: To carry out a case-control clinical study in patients with vernal keratoconjunctivitis, aiming at information about the topographical changes compared to age matched controls.SETTINGS AND DESIGN: The study is a comparative, observational case series of 100 patients of whom 50 cases with a clinical diagnosis of vernal keratoconjunctivitis (VKC) and remaining 50 patients served as controls.METHODS AND MATERIAL:Patients were divided into 2 groups,Group 1of 50 patients with a clinical diagnosis of vernal keratoconjunctivitis and Group 2 with 50 controls. Patients were submitted to a complete examination and corneal topography.RESULTS: Our study included 38 male and 12 females with mean age of presentation 13.88±4.83 years in VKC cases with age range of 6 to 15 years(70%).Significant number (43% eyes) of cases were found to have topographical abnormalities suggestive of initiation of keratoconus.In Group 2, no patient presented biomicroscopic, refratometric or topographic characteristics of keratoconus.CONCLUSIONS: Results of this study suggested that VKC patients have more abnormal corneal topographic patterns than non-VKC controls.*

INTRODUCTION:

Vernal keratoconjunctivitis is a recurrent, bilateral, interstitial inflammation of the conjunctiva, of periodic seasonal incidence, and self limited character.It occurs in children and adolescents. Vernal keratoconjunctivitis is characterized by classic hallmark of giant papillae, usually in upper palpeberal conjunctiva (Bukely, 1988) & (Ballas Z et al).[2] Majority of patients present with classical symptoms of redness, itching and watering The keratopathy of vernal keratoconjuctivitis typically begins as diffuse superficial punctate keratitis (SPK) and shield's ulcer can occur (friedlander, 1988)..In Long standing disabling disease, lesion such as corneal ectasia and cicatricial entropion have been reported descriptively as a complication of severe and prolonged VKC. Chronic ocular trauma could be the environmental factor ("trigger") associated with keratoconus development in genetically predisposed individuals. Clinical and qualitative analyses have been done to study the frequency of the association between VKC and keratoconus, indicating that a considerable number of patients with sub clinical presentation of keratoconus could underestimate the statistics of this association.

SUBJECTS AND METHODS:

The study is a comparative, observational case series of 100 patients of whom 50 cases with a clinical diagnosis of vernal keratoconjunctivitis (VKC) and remaining 50 patients served as controls. A case control study was designed aiming to measure abnormal corneal changes in VKC patients using computerised corneal topography.Approval from ethical committee of our institute was taken for the study and unpaired t-test was applied to calculate the statistical significance and confidence intervals.

INCLUSION CRITERIA

100 patients of age range from 3-20 years divided in case and controls.

EXCLUSION CRITERIA

Contact lens wearers,history of ocular trauma,known case of collagen vascular disease, marfan's syndrome, down's syndrome,with infectious keratitis ,with shield's ulcers,with corneal degeneration or dystrophy.

On performing computerized corneal topography following findings can be observed:

-K value quantifies the central steepening of the cornea that occurs in keratoconus. A value of 47.00 D or greater is suggestive of keratoconus.

-I-S value quantifies the inferior versus superior corneal dioptric asymmetry that occurs in keratoconus. A value of 1.4 D or greater is suggestive of keratoconus.

-KISA% incorporates the K and I-S value with a measure quantifying regular and irregular astigmatism into one index. This index is highly sensitive and specific in separating normal from keratoconic corneas.A value of greater than 100% is highly suggestive of frank keratoconus and the range from 60-100% represents keratoconus suspects.

Several commonly known indices are of Rabinowitz/ McDonnel, Maeda/Klyce[4], Rabinowitz/Rasheed's KISA% etc. Rabinowitz/Rasheed's[5/6] described KISA% to diagnose keratoconus.

$$KISA\% = \frac{(K) \times (I-S) \times (AST) \times (SRAX) \times 100}{300}$$

SRAX=skewed radial axes .

I-S= Inferior-superior

AST=Astigmatism

The main examination included clinical, slit lamp examination, and videokeratography (computerized corneal topography) to be done by zeiss 'ATLAS 9000 corneal topography system with smart capture software'.

Various indices were derived from topographic maps like astigmatism, corneal irregularity measurement[CIM], shape factor[SF], eccentricity, toric keratometric mean[TKM], keratometry and to be compared with controls. All readings were taken by a single observer.

Patients were divided in 4 groups-

Group A   3-5 years of age

Group B   6-10 years of age

Group C   11-15 years of age

Group D   16-20 years of age

Rabinowitz criteria was used to label clinical and keratoconus suspects.

RESULTS:
Table:1-7

[Table 1]: Age Incidence of Cases & Controls

	Cases			Controls		
MEAN±SD	13.88±4.83			12.52±4.41		
Age Group(Years)	Male	Female	Total	Male	Female	Total
3-5	4	0	4(8%)	3	1	4(8%)
6-10	16	3	19(38%)	13	5	18(36%)
11-15	10	5	15(30%)	10	6	16(32%)
16-20	8	4	12(24%)	5	7	12(24%)
Total	38	12	50(100%)	31	19	50(100%)

[Table 2]: Average Corneal Astigmatism of Cases & Controls

	Males	Females	Total	MEAN±SD
Cases	3.47	4.77	1.89	1.89±1.75
Controls	1.88	1.29	0.82	0.82±0.75

[Table3]: Average of corneal irregularity measurement[CIM] in Cases & Controls with their Distribution

	Cases				Controls			
Mean±SD	2.07±1.79				1.15±1.09			
	Male	Female	Total	Percent Age	Male	Female	Total	Percentage
Normal	12	4	16	16%	26	20	46	46%
Borderline	15	2	17	17%	15	7	22	22%
Abnormal	49	18	67	67%	21	11	32	32%
Total	76	24	100	100%	62	38	100	100%
Inference	CIM is Significantly More Associated with Cases as Compared to Controls With *P<0.0001*							

[Table 4]: Average of shape factor[SF] in Cases & Controls with Their Distribution

	Cases				Controls			
Mean±SD	0.51±0.20				0.44±0.17			
	Male	Female	Total	Percentage	Male	Female	Total	Percentage
Normal	21	7	28	28%	32	22	54	54%
Borderline	16	3	19	19%	9	8	17	17%
Abnormal	39	14	53	53%	21	8	29	29%
Total	76	24	100	100%	62	38	100	100%
Inference	SF is Significantly more Associated with Cases as Compared to Controls with *P<0.01*							

[Table 5]: Average of toric k mean[TKM] in Cases & Controls with Distribution

	Cases				Controls			
Mean±SD	46.74±3.49				44.14±2.00			
	Male	Female	Total	Percentage	Male	Female	Total	Percentage
Normal	25	5	30	30%	37	26	63	63%
Borderline	16	2	18	18%	15	8	23	23%
Abnormal	35	17	52	52%	10	4	14	14%
Total	76	24	100	100%	62	38	100	100%
Inference	TKM is Significantly more Associated with Cases as Compared to Controls With *P<0.0001*							

[Table 6]: Average of Eccentricity in Cases & Controls with Distribution

	Cases				Controls			
Mean±SD	0.69±0.14				0.62±0.12			
	Male	Female	Total	Percentage	Male	Female	Total	Percentage
Normal	22	7	29	29%	36	24	60	60%
Abnormal	54	17	71	71%	26	14	40	40%
Total	76	24	100	100%	62	38	100	100%
Inference	Eccentricity is Significantly More Associated with Cases as Compared to Controls with *P<0.0001*							

SUMMARY AND CONCLUSION:

Significant number (43% eyes) of cases were found to have topographical abnormalities suggestive of initiation of keratoconus.Astigmatism is usually the first manifestation of corneal disfigurement. Average corneal astigmatism was found to be significantly more in cases (1.89) as compared to controls (0.82).Central corneal power of some corneas was significantly higher than others. Significant CCP (>47) was present in 10 eyes while Axial I-S value (>1.4)was positive in 21 eyes, suggesting superior or central steepening while in some cases there was trend of superior steepening suggested by negative I-S value which was significant in 17 eyes.Average central corneal asymmetry between 2 eyes of a patient was also found to be higher in cases (0.89) than control (0.33).Corneal irregularity measurement was an irregularity index incorporated in computer software and served us by determining the irregularity of whole cornea. It was found moderately abnormal in cases (2.07) as compared to controls (1.15). Shape factor was another index to detect abnormalities of shape of cornea. It was found as borderline to slightly abnormal in cases (0.51) but normal in controls (0.44).TKM (Toric Keratometric Mean) is the average corneal curvature at the apex, which was found more in cases (46.74) than in controls (44.14).Eccentricity is a measure determined by the shape of the cornea. The eccentricity indicates the departure of the peripheral curvature from the apical radius and so defines the degree of asphericity. It was also found more in cases (0.69) than in controls (0.62).Data obtained by topographic analysis of the corneal anterior surface of both groups clearly demonstrated that patients with VKC presented corneal contour changes when compared to patients with normal corneal asphericity of evident clinical interest the fact that the mean anterior corneal curvature of patients with VKC was more accentuated than in the control group(p<0.0001).It is important to emphasize that the observed statistically significant difference between patients with VKC and other topographical abnormalities diagnosed by clinical criteria and patients diagnosed exclusively by topographic criteria (p<0.0001) demonstrated that 1 of 3 patients with VKC presented topographic corneal change of corneal anterior surface related to keratoconus in long untreated cases, undetected by initial clinical examination.In the proposed conditions of this study, we conclude that there was higher frequency of abnormal top-

ographical findings in VKC than in the control group, when computerized corneal topography was used as instrument of detection than detected by clinical criteria.

DISCUSSION:

Our study included 38 males (76%) and 12 females(24%) with mean age of presentation was 13.88±4.83 years(Table 1) in VKC cases with most commonly presenting in the age range of 6 to 15 years(70%) which is comparable with study done by **M.R. Shoja, M.R. Besharati et al (2006)**[7] who also included 93 male and 57 female subjects. The patients mean age was 13.07 ± 4.71 (range 8-24) years. In our study, astigmatism was significantly more in cases as compared to controls(Table 2). Average astimatism being 1.89 for cases and 0.82 for controls which is a statistically significant (p<0.0001). Astigmatism is usually the earliest abnormalities in the development of abnormalities of cornea. In a study done by **J.A. P. Gomes et al (2005)**[8], maximal corneal power was significantly higher in VKC patients than in the control group. Furthermore, significantly more astigmatism and corneal asymmetry were detected in eyes with VKC. **Yaron S. Rabinowitz**[5/6] in a correlation between videokeratography and clinical signs of keratoconus found out that there were significant differences at baseline between the normal, keratoconus-suspect, and early keratoconus groups in all indices.The respective means were central K: 44.17 D, 45.13 D, and 45.97 D; I–S: 0.57, 1.20, and 4.44; log(KISA): 2.49, 2.94, and 5.71 (all *P*<.001 after adjusting for covariates). The average central corneal power of VKC cases was 45.50 diopter as compared to the central corneal Power of controls which was 43.38 D thus, the average central corneal powers of cases was slightly more than controls(2.12 Diopter) thus indicating that the correlation between the central corneal power and VKC was insignificant(Table 3). The central corneal power of > 47 (> 48 in some literatures), is considered as a significant criteria in categorising the case as a subclinical keratoconus if other criteria are also present. In our study, these were 10 cases (or eyes) in with the central power was > 47. In a study by **Shamik Bafna Thomas Kohnen Douglas D. Koch**[9] in *1998* to compare the values for corneal power determined by computerized videokeratography found out that mean central corneal power was 42.86 diopters (D) with each of the formulas. Normally the corneas of two eyes of a patient are symmetrical with a slight difference (<0.25). In our study, it was 0.89 D which is significant (p<0.0001). Axial I-S value is also taken as a significant criteria for classifying an eye as clinical or subclinical keratoconus if it is > 1.4 D. (1.2 by some workers) in our study there were 21 out of 100 eyes having I-S value of > 1.4 which is 21% of cases. There were 3 eyes in control group also having I-S value > 1.4.In another study by Steele et al,2008,**Cameron JA,(1989)**[10] & **Khan et al,(1988)**[11] assessed the prevalence of corneal abnormalities in relatives of patients with VKC. Of 178 eyes from relatives of patients with VKC 45 (25.3%) had one or more keratoconic traits. According to Rabinowitz diagnostic criteria, we got 15 eyes out of 100 eyes as having frank keratoconus, 28 eyes with features of keratoconus suspect and 57 normal corneas. None of the corneas were abnormal in control group(Table 4,5,6). Thus, in our study 43% corneas of cases of VKC exhibited the corneal topographical changes of subclinical keratoconus. The corneal irregularity index in 67 eyes (67%) are found to be in the abnormal range(Table 4,7) topographically which is raised to moderately abnormal values (>1.1), Recently, **Totan et al**[12], demonstrated that nearly 27% of VKC patients had abnormal VKG patterns but the authors did not compare them with the control group. **Lapid-Gortzak et al**[13], found an

abnormal pattern of corneal topography in nearly 71% of VKC patients, but only 15% (6 out of 40 patients) presented with topographically detected keratoconus

LIMITATION:

Children below 3 years of age could not be included in the study.

Parameters like posterior curvature of cornea could not be included in the study.

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