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CLINICAL PROFILE AND CORNEAL TOPOGRAPHICAL CHANGES IN VERNAL KERATOCONJUNCTIVITIES : A TERTIARY CENTRE BASED OBSERVATIONAL STUDY

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ABSTRACT **Introduction:** Vernal keratoconjunctivitis (VKC) is a severe allergic conjunctivitis causing vision-threatening corneal complications. It typically affects males, starts after age 3, and resolves around puberty. Early diagnosis and management can be done using advanced corneal topography, such as the Pentacam. Corneal topography uses three principles Placido disc reflection, scanning slit and Scheimpflug topography. Also used in early screening of keratoconus suspects, post-surgery astigmatism and in ocular surface disorders as ptyregium, limbal dermoid and cases of corneal scars[1]. **Objectives:** This study aims to investigate the clinical profile, risk factors, complications, and topographical changes associated with Vernal Keratoconjunctivitis. **Methodology:** This cross-sectional study was conducted at Dr. SN Medical College, Jodhpur, from May 2024 to July 2025, on 100 patients with vernal keratoconjunctivitis (VKC) aged >5 years, excluding those with pre-existing keratoconus and other ocular conditions. **Results:** The mean age of the patients is 11.38+4.104 years (p = 0.456, NS). The sex distribution with VKC reveals a significant preponderance of males 63 (70.00%) (P<0.001, S). The majority of patients (58.89%) had moderate vision impairment with a visual acuity between 6/12 and 6/24, with a significant association (p<0.001). The most common symptoms of VKC were redness (95.56%), itching (94.44%), and watering (88.89%), with a highly significant association (p<0.001). The majority of patients had average central corneal thickness (CCT) between 540-560 µm, with a significant clustering around this range (p-value = 0.00002). Peripheral corneal thickness was significantly thicker, with 78.89% of patients having values between 565-600 µm (p-value < 0.0001). **Conclusion:** The study emphasizes the importance of identifying VKC risk factors and complications, and highlights the need for adequate treatment, patient education, and regular follow-up to prevent long-term ocular damage.

KEYWORDS : Vernal Keratoconjunctivitis, Corneal Topography, Ocular Allergy

INTRODUCTION

Vernal keratoconjunctivitis (VKC) is the most severe form of allergic conjunctivitis as it cause severe vision threatening corneal complications[1]. VKC was first described by Arlt in 1846. The disease usually starts after the age of 3 years and resolves around puberty, very rarely persisting after the age of 25 years. The male:female ratio observed is 2.3:1[2]. The disease is prevalent in dry hot climates, specifically at the Mediterranean basin, the Middle East, Central and West Africa, India, and South America[3].

Corneal involvement in VKC patients leads to myopic astigmatism type of refractive error leading to keratoconus which leads to visual impairment[4]. Early detection of these subtle corneal changes is vital to help arrest these changes in the early stages before developing further complications. These changes can be measured accurately by corneal topography, making it the gold standard in the screening of keratoconus and other corneal ectasias[5]. VKC is characterized by symptoms like itching, photophobia, watering, foreign body sensation, thick ropy mucoid discharge, blepharospasm and signs like confluent papillary hypertrophy on the limbus and tarsal conjunctiva[6]. Clinically, it is characterized by presence of papillary hypertrophy of the palpebral and/or the limbal conjunctiva, bulbar conjunctival pigmentation, limbal thickening, Horner Trantas dots, and mucous discharge. Patients with VKC experience significant morbidity, which affects the quality of life[7].

VKC has three clinical forms: palpebral, limbal, and mixed. The common risk factors associated with VKC are seasonal variation, allergy to pollen grains, bronchial asthma, atopic dermatitis, and family history of allergic disorders. Patients with VKC frequently have a family or medical history of atopic diseases, such as asthma, rhinitis, and eczema[8]. Complications seen in VKC are shield ulcer, superficial punctate keratitis, keratoconus, glaucoma, and cataract[9]. Early diagnosis and management of KC can be done with latest corneal topography with 3-D analysis such as the Pentacam[10]. Corneal topography uses three principles Placido disc reflection, scanning slit and Scheimpflug topography. Also used in early screening of keratoconus suspects, post-surgery astigmatism and in ocular surface disorders as ptyregium, limbal dermoid and cases of corneal scars[11].

This study aims to investigate the clinical profile, risk factors, complications, and topographical changes associated with Vernal Keratoconjunctivitis.

MATERIALAND METHODS

This cross-sectional study was conducted in the Department of Ophthalmology at Dr. SN Medical College, Jodhpur, from May 2024 to July 2025. The study population comprised of patients with VKC visiting the Ophthalmology OPD, aged >5 years, with a confirmed diagnosis of VKC. Patients with pre-existing keratoconus, other conjunctivitis, ocular surface diseases, contact lens use, collagen vascular disease, Marfan's syndrome, Down's syndrome, MVP, infectious keratitis, or corneal degeneration/dystrophy were excluded. Using consecutive sampling, participants were recruited and assessed to investigate the clinical profile, risk factors, complications, and topographical changes associated with VKC.

Sample Size :

Roundoff to 100

$Z_{1-\alpha}$ = Standard normal deviate for 95% confidence interval (taken as 1.96)

P = Expected proportion of keratoconus among vernal kerato conjuctivitis taken as 14% as reported by Gupta Y et al. (2025)[12]

E = Absolute allowable error (taken as 7%)

Sample size was calculated to be to be minimum 93 subjects, which was rounded off to 100 patients of vernal keratoconjunctivitis.

Procedure :

Patients underwent comprehensive ophthalmic examinations, including visual acuity assessment, categorized as >6/12, 6/12-6/24, or <6/24. VKC severity was classified as mild, moderate, or severe based on symptoms and signs. Mild VKC presented with mild itching, occasional tearing, and mild photophobia, with signs including mild conjunctival hyperemia and small papillae. Moderate VKC showed moderate to severe itching, persistent tearing and photophobia, with signs of pronounced papillary hypertrophy, mucous discharge, and limbal infiltrates. Severe VKC exhibited intense itching and photophobia, severe tearing, and blurred vision, with signs of giant papillae, dense mucus discharge, corneal shield ulcers, and limbal hypertrophy, risking corneal scarring and vision loss. Patients were treated with a combination of Olapatadine (0.2% or 0.7%), steroid (Flurometholone 0.1% or Loteprednol 0.5%), and cold compression. Follow-up visits were scheduled at 15 days (or earlier if symptoms worsened), 1 month, and 3 months to monitor disease progression and treatment response.

Standard And Operational Definitions

Grading of VKC[13]

The clinical grading system for Vernal Keratoconjunctivitis (VKC) categorizes the disease into six grades: 0 (Quiescent), 1 (Mild), 2 (Moderate), 3 (Severe), 4 (Very Severe), and 5. The grading is based on symptoms, signs, and corneal involvement. Grade 0 indicates no symptoms or signs, while Grade 1 shows mild ocular inflammation and itching. Grade 2 exhibits moderate conjunctival hyperemia, intense itching, and corneal involvement. Grade 3 is characterized by severe ocular surface inflammation, giant papillae, and corneal complications. Grade 4 indicates very severe corneal involvement, ocular surface inflammation, and risk of vision loss. This grading system enables a thorough assessment of VKC severity and its associated clinical features.

Amsler-Krumeich classification[14]**:** The Amsler-Krumeich classification stages the progression of keratoconus based on refractive error, corneal curvature, and thickness. Stage 1 is characterized by myopia and/or astigmatism <5.0D, central K reading <48D. Stage 2 shows myopia and/or astigmatism between 5.0-8.0D, central K reading <53.0D, and minimum corneal thickness >400µm. Stage 3 is marked by myopia and/or astigmatism between 8.0-10.0D, central K reading >53.0D, and minimum corneal thickness between 300-400µm. Stage 4 is the most advanced, with unmeasurable refraction, central K reading >55.0D, minimum corneal thickness >200µm, and central corneal scarring.

Methodology Of Data Collection And Monitoring:

A written informed consent was obtained from all the participants and from parents in cases of <18years satisfying the inclusion criteria. Detailed history was documented. Presenting aided and unaided visual acuity was recorded with the help of portable Near Vision Chart and Snellen's Distant Vision Chart. Ocular examination was performed using slit lamp bio-microscopy and accessories and Ophthalmoscopy was done with Direct and Indirect Ophthalmoscope if needed. Intraocular pressure was measured digitally and with Goldmann applanation tonometer if required. Fluorescein staining was done to know the corneal involvement.

Approval of the institutional Ethical Committee was taken prior to initiating the study.

Statistical Analysis:

Proportion and percentage were calculated for qualitative data and analysed by Chi-square test. Mean (SD), were calculated for quantitative data and appropriate statistical tests were applied wherever needed. P-value of less than 0.05 was taken as statistically significant.

RESULTS

Table 1 : Age And Sex Distribution

	Number of Patients	Percent	Chi Square	P value
Age Range (years)				
>5	4	4.44	24.74	0.456 (NS)
5-10	35	38.89		
10-15	31	34.44		
> 15	20	22.22		
Sex Distribution				
Male	63	70.00	19.44	<0.001 (S)
Female	27	30.00		

Table 2 : Clinical Profile

	Number of Patients	Percent	Chi Square	P value
Vision				
>6/12	22	24.44	32.44	<0.001 (S)
6/12 - 6/24	53	58.89		
< 6/24	15	16.67		
Symptoms				
Itching	85	94.44	54.11	< 0.001 (S)
Redness	86	95.56		
Watering	80	88.89		
Photophobia	62	68.89		
Discharge	45	50.00		
Foreign Body Sensation	64	71.11		

Table 3 : Risk Factors

Risk Factors	Number of Patients	Percent	Chi Square	P value
Family H/o Allergy	12	13.33	2.53	0.112 (NS)
H/o Allergy	51	56.67	23.15	<0.0001 (S)
Exposure to Dust	72	80.00	35.67	<0.0001 (S)
H/o Asthma	53	58.89	20.39	<0.0001 (S)

Table 4 : Complications

Complications	Number of Patients	Percent	Chi Square	P value
Keratoconus	8	8.89	15.29	0.0015
Keratitis	22	24.44		
Pseudogerontoxon	7	7.78		
Corneal Ulcer	5	5.56		

Table 5 : Astigmatism

Astigmatism		Mean	Chi Square	Chi Square	P value
Astigmatism <1D	OD	0.64	0.18	5.4	0.067
	OS	0.63	0.18		
Astigmatism 1-2 D	OD	1.71	0.16		
	OS	1.70	0.16		
Astigmatism >2D	OD	2.78	0.16		
	OS	2.78	0.16		

Table 6 : Topography

Topography		Mean	SD	t value	P value
K1	OD	43.98	3.15	0	1
	OS	43.98	3.12		
K2	OD	43.55	5.23	0.03	0.975
	OS	43.54	5.23		

Table 7: Keratoconus Parameters

Keratoconus Parameters		Number of Patients	Percent
Inferosuperior Asymmetry value	Normal	70	63.00
	Abnormal	20	18.00
Keratoconus (by both criteria)	Present	42	37.80
	Absent	48	43.20

Table 8

Central Corneal Thickness	Number of Patients	Percent	Chi Square	P value
Very Thin: CCT below 510 µm.	11	12.22	24.3	0.0002
Thin: CCT between 510 µm and 535 µm.	20	22.22		
Average: CCT between 540 µm and 560 µm.	47	52.22		
Thick: CCT between 565 µm and 600 µm.	12	13.33		
Peripheral Corneal Thickness				
Very Thin: CCT below 510 µm.	0	0.00	133	<0.0001
Thin: CCT between 510 µm and 535 µm.	4	4.44		
Average: CCT between 540 µm and 560 µm.	15	16.67		
Thick: CCT between 565 µm and 600 µm.	71	78.89		

DISCUSSION

Due to VKC being a chronic conjunctival disease with corneal involvement, corneal topography has emerged as an essential tool for screening and detecting early changes and identifying subjects at risk prior to more progressive, irreversible changes. The ease of use and accuracy of modern corneal topographers, including Schiempflug topographers, allow quick and comfortable readings to be taken with minimal patient discomfort, thus facilitating the management of these VKC patients.

AGE & SEX DISTRIBUTION

Himabindu S et al (2023)[15] reported a mean age of 11±1.5 years, which is consistent with the present study's finding of 11.38 ± 4.10 years. In contrast, Shah M et al (2022)[16] reported a slightly lower mean age of 10.36 ± 3.65 years, while Ahmed SM et al (2018)[17] reported a slightly higher mean age of 13.00 ± 1.00 years.

The gender distribution shows a consistent preponderance of males. Himabindu S et al (2023)[15] reported a male-to-female ratio of 63.63% males and 36.36% females, while Shah M et al (2022)[16] reported a slightly higher proportion of males (71%) and females (29%). Ahmed SM et al (2018)[17] reported a similar gender distribution, with 63.3% males and 36.7% females.

VISION

Ahmed SM et al (2018)[17] reported that 70% of patients had a visual acuity of 6/6 or better, indicating relatively preserved vision. In contrast, Radhika R (2021)[18] reported a lower proportion of patients with good visual acuity, with only 20% having a visual acuity of 6/6 or better. The present study's findings fall between these two reports, with 24.44% of patients having a visual acuity of 6/6 or better and 58.89% having a visual acuity of better than 6/12.

SYMPTOMS

Choudhary A et al (2024)[19] reported that 88.75% of patients experienced itching, 85% had redness, and 68.75% had watering. Nidhi et al. (2021)[20] reported a higher proportion of patients with itching (95%) and watering (82%), but did not provide data on redness. Hakak B et al. (2018)[21] reported a high prevalence of itching (100%) and redness (99%), but did not provide data on watering. The present study's findings are consistent with these reports, with 94.44% of patients experiencing itching, 95.56% having redness, and 88.89% having watering.

RISK FACTORS

Mittal P et al (2022)[22] reported that 17% of patients had a family history of allergy. Radhika R et al (2021)[18] reported a lower proportion of 7% with a family history of allergy. Ahmed SMM et al (2019)[17] reported a higher proportion of 20.1% with a family history of allergy. The present study's findings are consistent with these reports, with 13.33% of patients having a family history of allergy. Additionally, the present study reported that 56.67% of patients had a personal history of allergy. The present study's finding of a higher proportion of patients with a personal history of allergy (56.67%) compared to a family history of allergy (13.33%) suggests that VKC may be more closely linked to individual allergic tendencies rather than familial predisposition.

COMPLICATIONS

Mittal P et al (2022)[22] reported the highest proportion of keratoconus, with 14.2% of patients developing the condition. Thiagarajan D et al (2023)[23] reported a slightly lower proportion of 10.3%. Mostaf et al (2022)[24] reported a similar proportion of 11.3%. The present study reported the lowest proportion of keratoconus, with 8.89% of patients developing the condition. The present study's finding of a lower proportion of keratoconus (8.89%) compared to other studies suggests that early diagnosis and treatment of VKC may help reduce the risk of developing keratoconus.

ASTIGMATISM

Thiagarajan D et al (2023)[23] reported that 1.6 D (diopters) was the average severity of keratoconus in their study population. Shah M (2022)[16] reported a similar average severity of 1.51 D. The present study reported a slightly higher average severity of 1.7 D. All three studies reported average severities within a relatively narrow range of 1.51-1.7 D.

CENTRAL CORNEAL AND PERIPHERAL CORNEAL THICKNESS

Hakak et al (2018)[21] reported a mean CCT of 495.9 ± 30.7 µm, indicating a relatively thin cornea. In contrast, the present study reported a significantly higher mean CCT of 546 ± 26.14 µm. The present study's finding of a thicker CCT (546 µm) compared to Hakak et al (2018)[21] (495.9 µm) may indicate that VKC patients in the present study had less severe corneal thinning or that the disease was at an earlier stage.

In the present study majority of patients 71 (78.89%) have thick peripheral CCT between 565 µm and 600 µm, while no patients have very thin CCT (below 510 µm). The thin and average CCT categories have relatively fewer patients, with 4 (4.44%) and 15 (16.67%) patients, respectively.

CONCLUSION

The study highlights the importance of identifying risk factors and complications associated with VKC. A personal history of allergy, exposure to dust, and a history of asthma were found to be significant risk factors for VKC. Additionally, certain complications such as keratitis were more commonly associated with VKC. The study's findings on corneal topography and thickness measurements provide valuable insights into the ocular characteristics of VKC patients. VKC treatment should be adequate and continuous through patient or caregivers education on good ocular health and regular, long-term follow-up are essential.

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