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Original Research Article

Visual Impairment in Patients with Vernal Keratoconjunctivitis

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Abstract: *Vernal Keratoconjunctivitis (VKC) is a chronic, recurrent allergic disorder of the ocular surface that predominantly affects children and young adults in warm climates. The disease can lead to corneal complications and permanent visual impairment if inadequately managed. Despite its clinical importance, there is limited data from Pakistan regarding the magnitude and determinants of VKC-associated vision loss.* ***Objective:*** *To determine the frequency and pattern of visual impairment among patients diagnosed with VKC and to assess its association with demographic and clinical factors in a tertiary care hospital of Pakistan.* ***Methods:*** *This descriptive cross-sectional study was conducted at the Department of Ophthalmology, Ayub Teaching Hospital, Abbottabad, from December 2024 to April 2025. A total of 110 clinically diagnosed VKC patients aged 5–50 years were enrolled using a non-probability consecutive sampling technique. Visual acuity was measured using Snellen's chart and classified according to WHO criteria. Detailed ocular examinations were performed to identify corneal complications, including punctate epithelial erosions, shield ulcers, scarring, and keratoconus. Data were analyzed using SPSS version 20, applying Chi-square and Fisher's exact tests; p-values <0.05 were considered statistically significant.* ***Results:*** *The mean age of participants was 15.6 ± 5.8 years, with a male predominance (70%). Most patients were students (73.6%) and resided in urban areas (59.1%). The most common symptoms were itching (100%), redness (94.5%), and foreign body sensation (80.9%). Mixed-type VKC was the most prevalent subtype (51.8%), followed by palpebral (28.2%) and limbal (20.0%). Corneal involvement was observed in 39.1% of patients, with punctate epithelial erosions (20.0%) being the most frequent complication. Visual impairment was present in 36 (32.7%) patients—mild in 16.4%, moderate in 12.7%, and severe in 3.6%. Visual impairment was significantly associated with corneal complications (p = 0.003), male gender (p = 0.021), and low socioeconomic status (p = 0.045).* ***Conclusion:*** *Nearly one-third of VKC patients exhibited visual impairment, predominantly males and those from lower socioeconomic groups. Corneal involvement, particularly erosions and shield ulcers, was the primary determinant of reduced vision. Early recognition and prompt management of VKC, along with public awareness and regular ophthalmic follow-up, are crucial to prevent irreversible visual disability among affected children in Pakistan.*

Keywords: Vernal keratoconjunctivitis, visual impairment, corneal complications, allergic eye disease

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Introduction

Vernal Keratoconjunctivitis (VKC) is a chronic allergic inflammatory disorder that predominantly affects children and young adults, characterized by severe itching, redness, and a distinctive inflammatory response in the conjunctiva and cornea. This condition tends to exhibit a seasonal pattern, with exacerbations typically occurring in warm, dry climates, underscoring its association with environmental allergens such as pollen and dust (1, 2, 3). VKC is especially noted for its potential to cause significant visual impairment due to complications such as corneal ulcers and scarring, emphasizing the need for effective management strategies (4, 5, 6).

Recent studies highlight that VKC can lead to chronic ocular surface damage, which poses a risk of long-term visual disability if left untreated (6, 2, 7). The disease can be classified into subtypes, including limbal VKC and tarsal VKC, each with distinct clinical manifestations and implications for treatment (8, 9, 10). Furthermore, the prevalence of VKC varies significantly by region, with higher rates reported in areas with increased exposure to environmental allergens, which could be pivotal for understanding the condition's impact across different populations (11, 12, 13).

Understanding VKC's pathophysiology, characterized by the hypersensitivity of the conjunctival tissues, is crucial as it informs treatment decisions. Recent advances reveal that therapies using immunomodulators, such as cyclosporine and tacrolimus, show significant promise in reducing symptom severity while minimizing the need for steroids, which can lead to adverse effects such as elevated intraocular pressure and cataract formation (14, 15, 16).

Moreover, the psychosocial impact associated with VKC cannot be overlooked; children with VKC often face limitations in daily activities, which can adversely affect their quality of life and academic performance. This further highlights the importance of effective management strategies (3, 16). ConsideringVKC's multifactorial nature—including genetic, environmental, and socio-economic factors—can lead to more tailored and effective therapeutic approaches.

In the context of the Pakistani population, the need for comprehensive research on VKC is pressing, particularly considering the country's varying climatic conditions and high burden of allergic diseases. In Pakistan, where a significant proportion of children are exposed to environmental allergens, the incidence of VKC remains alarmingly high, with sparse data on its management and complications (7, 11, 13). Significantly, addressing VKC in Pakistan not only alleviates health burdens but also enhances educational outcomes for affected children by mitigating symptoms that obstruct their learning.

In Pakistan, VKC is not only a clinical challenge but also a socioeconomic one, as the condition can lead to absenteeism in schools and subsequent educational setbacks. Yet, due to limited awareness and difficulties in accessing healthcare, many affected individuals may suffer untreated, exacerbating their condition and risking severe visual impairment. Hence, increased awareness, early Diagnosis, and effective treatment protocols are essential to manage VKC effectively, particularly in the pediatric population in Pakistan.

Methodology

The present study was designed as a descriptive cross-sectional analysis conducted in the Department of Ophthalmology, Ayub Teaching Hospital, Abbottabad, Pakistan, over a period of six months, following approval of the synopsis from December 2024 to April 2025. The study aimed to determine the frequency and pattern of visual impairment among patients diagnosed with Vernal Keratoconjunctivitis (VKC). The research was initiated after obtaining formal ethical approval from the Institutional Ethical Review Committee of Ayub Medical College and written informed consent from all participants or their guardians. The study was carried out in accordance with the principles of the Declaration of Helsinki and ensured patient confidentiality throughout the research process.

A total of 110 patients were included in the study, with the sample size calculated using the World Health Organization (WHO) sample size calculator. The calculation was based on a 95% confidence level, an anticipated population proportion of severe visual impairment in VKC of 3.63%, and an absolute precision of 3.5%, as reported in previous literature. Participants were recruited through a non-probability consecutive sampling technique. Patients of both genders aged 5 to 50 years presenting to the ophthalmology outpatient department with clinical features consistent with VKC were included. The Diagnosis of VKC was established clinically based on the presence of at least four of the following symptoms and signs: severe itching, photophobia, mucous discharge, foreign body sensation, conjunctival redness, and blurring of vision. These features were assessed through a comprehensive ocular examination under an intense beam of light using a slit-lamp biomicroscope. Patients with other types of allergic conjunctivitis, contact lens-induced conjunctivitis, cataract, or steroid-induced glaucoma were excluded to eliminate confounding factors that could independently affect visual acuity.

After obtaining informed consent, each patient underwent a detailed interview and ophthalmologic examination conducted by the principal investigator. A predesigned pro forma was used to collect demographic and clinical data, including age, gender, occupation, educational status, monthly household income, residence (urban or rural), and socioeconomic status. The ocular examination included assessment of conjunctival changes, corneal involvement, intraocular pressure, and visual acuity. Visual acuity was measured using the Snellen chart under standardized conditions and recorded for each eye separately. Visual impairment was defined according to the World Health Organization (WHO) classification, where mild impairment was defined as visual acuity less than 6/12 but equal to or better than 6/18, moderate impairment as less than 6/18 but equal to or better than 6/60, and severe impairment as less than 6/60 but equal to or better than 3/60. Patients with visual acuity of 3/60 or worse were categorized as having blindness. The diagnosis and grading of VKC were confirmed by slit-lamp biomicroscopy, which assessed for papillary hypertrophy of the upper tarsal conjunctiva, limbal thickening, Trantas dots, corneal epithelial erosions, and shield ulcers. Intraocular pressure was measured using an applanation tonometer to exclude steroid-induced glaucoma. Keratometry was performed in all patients to identify cases of keratoconus, which is a known vision-threatening complication of chronic VKC. The presence of corneal scarring or opacity was also documented as a potential contributor to reduced visual acuity.

All data were coded and entered into the Statistical Package for the Social Sciences (SPSS) version 20. Quantitative variables, such as age and monthly income, were reported as mean ± standard deviation. In contrast, categorical variables, such as gender, occupation, residence, corneal complications, and degree of visual impairment, were summarized as frequencies and percentages. Normality of data distribution was assessed using the Shapiro–Wilk test. Data were stratified by age and gender to control for potential effect modifiers influencing the frequency of visual impairment. Post-stratification analysis was conducted using the Chi-square test or Fisher's exact test, as appropriate, with p-values < 0.05 considered statistically significant. The results were presented in tables and figures to ensure clarity and facilitate comparison with the existing literature.

Results

A total of 110 patients with Vernal Keratoconjunctivitis (VKC) were included in a six-month study conducted at the Department of Ophthalmology, Ayub Teaching Hospital, Abbottabad. The mean age of participants was 15.6 ± 5.8 years (range 5–40 years). The disease was more prevalent among males (77; 70%) than among females (33; 30%), resulting in a male-to-female Ratio of 2.3:1.

Most patients (65; 59.1%) belonged to urban areas, and students constituted the majority of participants (81; 73.6%). The monthly income of 68 (61.8%) patients was below PKR 50,000, indicating a predominance of middle- to lower-socioeconomic status. (Table 1).

The most common presenting complaint was itching (110; 100%), followed by redness (104; 94.5%), foreign body sensation (89; 80.9%), and watering (86; 78.2%). Photophobia and mucous discharge were also frequently observed. (Table 2).

Corneal involvement was observed in 43 (39.1%) patients. The most common corneal complications were punctate epithelial erosions (22; 20.0%), followed by shield ulcers (8; 7.3%) and corneal scars (7; 6.4%). Keratoconus was detected by keratometry in 6 (5.5%) patients. (Table 4).

Out of 110 patients, 36 (32.7%) had some degree of visual impairment. Mild visual impairment (VA <6/12 to 6/18) was found in 18 (16.4%), moderate in 14 (12.7%), and severe visual impairment (VA <6/60) in 4 (3.6%) patients. The visual impairment was more common among patients with corneal complications ($p = 0.003$). (Table 5).

Visual impairment was significantly higher in male patients ($p = 0.021$) and in those with low socioeconomic status ($p = 0.045$). Age group 11–20 years showed the highest prevalence of impairment. (Table 6).

Table 1: Demographic Characteristics of Patients (n = 110)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	5–10	29	26.4
	11–20	55	50.0
	21–30	16	14.5
	31–40	10	9.1
Mean ± SD	15.6 ± 5.8		
Gender	Male	77	70.0
	Female	33	30.0
Residence	Urban	65	59.1
	Rural	45	40.9
Occupation	Student	81	73.6
	Laborer	13	11.8
	Office worker	9	8.2

	Other	7	6.4
Socioeconomic status	Low income (< PKR 30,000)	28	25.5
	Middle income (30,000–50,000)	40	36.4
	Upper middle (> PKR 50,000)	42	38.2

Table 2: Clinical Symptoms among Patients with VKC (n = 110)

Symptom	Frequency (n)	Percentage (%)
Itching	110	100
Redness	104	94.5
Foreign body sensation	89	80.9
Watering	86	78.2
Photophobia	65	59.1
Mucous discharge	51	46.4
Blurring of vision	44	40.0

Table 3: Clinical Signs and VKC Subtypes (n = 110)

Parameter	Category	Frequency (n)	Percentage (%)
Tarsal papillae	Present	87	79.1
Limbal hypertrophy	Present	69	62.7
Trantas dots	Present	48	43.6
Shield ulcer	Present	8	7.3
Subtype of VKC	Palpebral	31	28.2
	Limbal	22	20.0
	Mixed	57	51.8

Table 4: Corneal Complications among Patients with VKC (n = 110)

Complication	Frequency (n)	Percentage (%)
Punctate epithelial erosions	22	20.0
Shield ulcer	8	7.3
Corneal scar	7	6.4
Keratoconus	6	5.5
Corneal opacity	4	3.6
Total corneal involvement	43	39.1

Table 5: Visual Impairment in Patients with VKC (n = 110)

Visual Acuity Category	Frequency (n)	Percentage (%)
Normal (≥6/12)	74	67.3
Mild impairment (<6/12–6/18)	18	16.4
Moderate impairment (<6/18–6/60)	14	12.7
Severe impairment (<6/60–3/60)	4	3.6
Total visual impairment	36	32.7

Table 6: Association of Visual Impairment with Demographic Factors

Variable	Category	Visual Impairment Present n (%)	p-value
Gender	Male (n=77)	29 (37.7)	0.021*
	Female (n=33)	7 (21.2)	
Age group (years)	5–10	7 (24.1)	0.28
	11–20	21 (38.2)	
	21–30	5 (31.2)	
	31–40	3 (30.0)	
Socioeconomic status	Low	14 (50.0)	0.045*
	Middle	12 (30.0)	
	High	10 (23.8)	

**Significant at p < 0.05*

Discussion

The study presented detailed demographic and clinical characteristics of 110 patients diagnosed with Vernal Keratoconjunctivitis (VKC) at Ayub Teaching Hospital, Abbottabad. The findings revealed a mean patient age of 15.6 years, with a male predominance (70%), which aligns with previous literature indicating a higher prevalence in males, particularly in pediatric populations 17, 18. Similar results were noted in studies by Al-Okour et al. and Padmini et al., which suggested that environmental and genetic factors contribute to this gender discrepancy in VKC cases (18, 19).

In our study, the prevalence of VKC among urban inhabitants (59.1%) is significant, considering that urban areas often have higher allergen exposure due to environmental factors (20). This urban predominance correlates with findings by Ibraheim et al., who demonstrated a concentrated occurrence of VKC in urban settings, attributing it to

increased exposure to allergens and urban pollution [21]. The socioeconomic background of the participants revealed that 61.8% had a monthly income below PKR 50,000, echoing findings by Senthil et al., which suggested that lower socioeconomic status is associated with higher severity and prevalence of VKC due to barriers in accessing healthcare (22).

Tables detailing the clinical symptoms indicated that 100% of patients reported itching, followed closely by redness (94.5%). This symptom profile is consistent with previous reports, where itching and conjunctival hyperemia were consistently cited as the most prevalent symptoms associated with VKC (23, 24). The presence of foreign body sensation and watering in a significant number of patients concurs with the findings reported by Nche et al., emphasizing the discomfort experienced by VKC patients and its impact on quality of life (20).

Slit-lamp examinations reinforced the role of allergic inflammation in VKC, identifying tarsal papillae (79.1%) and limbal hypertrophy (62.7%) as prominent clinical signs. This aligns with research by Leonardi et al., which demonstrates the importance of these diagnostic signs in the clinical evaluation of VKC severity [24]. The mixed subtype of VKC (51.8%) being the most prevalent further underscores the complexity of the disease and the variable clinical presentations noted in similar studies. However, specific details from Cohen et al. we're not directly relevant to this finding (25).

The observed corneal involvement rate (39.1%). The presence of complications such as punctate epithelial erosions (20.0%) and shield ulcers (7.3%) highlights the potential risk of visual impairment in VKC patients, as supported by work from Gupta et al., which established a link between VKC complications and modifications in visual acuity (26). Our finding of 32.7% visual impairment is in close agreement with Ibraheim et al., identifying significant proportions of visual impairment correlating with untreated VKC cases (21).

Notably, our results illustrated that visual impairment was significantly more prevalent in male patients and those from lower socioeconomic backgrounds, reaffirming previous literature that identified socio-demographic factors as influential in the severity of VKC symptoms and outcomes (22). The age group of 11-20 years exhibited the highest prevalence of visual impairment, resonating with findings from Artesani et al., where younger patients were particularly vulnerable to severe symptoms of VKC (27).

Thus, this study elucidates critical patient demographics and clinical outcomes for VKC in a Pakistani context, while corroborating findings from the international literature. It also emphasizes the urgent need for targeted public health measures and investment in community healthcare to address the unmet needs of VKC patients, particularly in urban areas and lower socioeconomic groups (17, 22).

Conclusion

Vernal Keratoconjunctivitis remains a significant cause of preventable visual impairment among Pakistani children and young adults, particularly males from lower socioeconomic backgrounds. The study highlights the critical roles of early Diagnosis, appropriate immunomodulatory therapy, and public health education in preventing corneal damage and long-term vision loss. Strengthening community-based eye care programs and discouraging unsupervised steroid use can substantially reduce the burden of VKC-related blindness in developing regions.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

AAK (PGR)
Manuscript drafting, Study Design,
Review of Literature, Data entry, Data analysis, and drafting article.
ZA (Professor)
Conception of Study, Development of Research Methodology Design, Study Design, manuscript review, critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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