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PEDIATRIC VERNAL KERATOCONJUNCTIVITIS IN A TERTIARY CARE CENTER: PATTERNS, SEVERITY, AND ALLERGIC ASSOCIATIONS

Ophthalomology

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ABSTRACT

Introduction - Vernal keratoconjunctivitis is a chronic, allergen-triggered ocular condition predominantly affecting young males in warm climates. Its pathogenesis involves both IgE-mediated and cell-mediated immune responses, with varied clinical presentations. Diagnosis is clinical, and management is challenged by recurrence, steroid misuse, and lack of standardized protocols. **Aim** - The study provides valuable insights into the clinical and demographic patterns of VKC in Central-Western Uttar Pradesh. **Material And Methods** - This cross-sectional study at L.L.R. Hospital assessed VKC in 64 children under 18 years, using clinical and laboratory evaluations. Ethical standards were maintained, and detailed histories and ocular examinations were conducted. VKC diagnosis and severity classification followed standardized criteria. **Results** - A total of 64 children with VKC were studied, comprising 46 males (71.88%) and 18 females (28.13%) with a mean age of 8.02 ± 0.47 years. The most affected age group was under 5 years (40.63%), followed by 5–10 years (37.5%). Most patients lived in urban (40.63%) or rural (37.5%) areas, and 78.13% were school-going. Ocular redness (81.25%) was the most common symptom, followed by itching (59.38%) and photophobia (40.63%). Limbal VKC was the most prevalent form (71.88%), and moderate disease severity was most common (56.25%). A prior history of similar complaints was significantly associated with VKC (OR = 3.0, 95% CI: 1.5–6.0). Elevated eosinophil counts were found in 68.75%, and raised IgE in 56.25% of patients. Steroids were used in 93.75%, and cyclosporine 0.05% in 28.13%. Refractive errors were present in 62.5% of cases. **Conclusion** - Vernal keratoconjunctivitis predominantly affects young males, especially in the 0–5 years age group. Elevated eosinophils and serum IgE levels were common, indicating an allergic component. Refractive errors were also frequently observed. Early diagnosis and appropriate treatment modalities can reduce disease-related complications.

KEYWORDS

VKC, CHILDREN, ALLERGIC, STEROIDS

INTRODUCTION –

Vernal keratoconjunctivitis (VKC) is a chronic, bilateral, and asymmetrical allergic inflammation of the ocular surface that predominantly affects the tarsal and/or bulbar conjunctiva, with seasonal exacerbations.[1] The condition exhibits a slight male predominance and typically begins before the age of ten. While most cases resolve during late adolescence, approximately 10% of patients experience disease onset after the age of 20. The clinical and demographic patterns of VKC vary significantly across geographical regions.[2] Globally, VKC accounts for about 1% of ocular diseases, whereas in tropical climates, it represents up to 3% of serious ophthalmic conditions.

Climatic conditions, especially hot and arid weather, play a pivotal role in the prevalence of VKC. The disease is relatively rare in North America and Western Europe but more frequently observed in the Indian subcontinent, the Middle East, South America, and parts of Western Africa. VKC follows a seasonal pattern, with peak incidence in warmer months and occasional exacerbations during winter, which may evolve into a chronic or perennial form.[3] The palpebral variant is more frequently reported in Europe and the United States, while the limbal and mixed variants are more commonly seen in Asia and Africa.

The pathogenesis of VKC involves a multifactorial interplay of genetic, environmental, and immunological components. Both Immunoglobulin E-mediated hypersensitivity and cell-mediated immune responses contribute to the inflammatory cascade. Environmental triggers such as ultraviolet (UV) radiation and airborne allergens can incite conjunctival inflammation. Clinically, patients present with symptoms including intense itching (the most dominant complaint), redness, photophobia, tearing, and lid swelling, often accompanied by conjunctival chemosis.[1] Severe cases exhibit white, ropy mucus discharge-characteristic of VKC-and chronic inflammation marked by eosinophilic and neutrophilic infiltration.[1],

Diagnosis is predominantly clinical, relying on history and ocular examination. VKC is categorized anatomically into three types: palpebral, limbal, and mixed. Papillary hypertrophy of the upper tarsal conjunctiva is a hallmark of the palpebral form, while limbal VKC is characterized by limbal nodular infiltration and Horner–Trantas dots. Corneal involvement varies from superficial punctate keratitis to neovascularization and vision-threatening shield ulcers. Complications such as keratoconus, epithelial erosions, and persistent ulcers may develop over time.[11] [13] Disease recurrence remains a significant management challenge.[1]

Therapeutic approaches often differ among clinicians, even for similar disease severities, due to the absence of standardized grading systems and treatment protocols. The chronicity of VKC contributes to ocular surface remodeling and potential long-term visual impairment.[1] Preventive strategies include minimizing exposure to environmental triggers, maintaining hygiene, and avoiding eye rubbing. Although difficult to prevent entirely, VKC can be controlled with timely medical intervention.[1] [1] However, lack of proper counseling often results in steroid misuse, leading to preventable complications. Striking a balance between therapeutic efficacy and safety is crucial to mitigate tissue damage and drug-related adverse effects. Moreover, children with VKC often suffer from reduced quality of life, as they are restricted from participating in outdoor activities to avoid allergen exposure.[1]

This study aims to evaluate the demographic and clinical profile of VKC in the temperate climate of northern India, specifically focusing on Kanpur city and surrounding areas in Uttar Pradesh.

MATERIAL AND METHODS –

A cross-sectional, population-based survey was carried out at L.L.R. Hospital, Kanpur City (Central-Western Uttar Pradesh), between February and April 2025. The study included 64 children under 18 years of age. The sample size was calculated based on an estimated VKC prevalence of 11%, as reported by Saboo et al. [2013].

Ethical approval was obtained, and the study adhered to the Declaration of Helsinki. Informed consent was secured from either the patient or legal guardian, depending on age.

Children with other ocular allergies, infections, or recent eye trauma or surgery were excluded. All participants underwent anterior segment evaluation using a slit lamp, and intraocular pressure was measured with a Goldmann Applanation Tonometer by an ophthalmologist. Blood samples were taken for CBC and IgE levels.

In diagnosed VKC cases, demographic details, symptom history (onset, duration), and personal/family history of ocular, respiratory, or dermatological allergies were documented. Disease type was categorized as seasonal (intermittent) or perennial (chronic), and severity was graded as mild, moderate, severe, or blinding per Nikhil

S. Gokhale's classification[15].

Diagnostic Criteria:
- **VKC:** Presence of tarsal or limbal papillae ≥1 mm with itching and at least one symptom (e.g., photophobia, discharge, redness, tearing, foreign body sensation) in the past 6 months.
- **Palpebral VKC:** Papillae >1 mm on tarsal conjunctiva without limbal signs.
- **Limbal VKC:** Limbal thickening, opacification, or Horner-Trantas dots.
- **Mixed VKC:** Features of both palpebral and limbal VKC.

Disease Periodicity:
- **Intermittent:** Symptom-free periods >2–3 months, with ≤3–4 episodes/year.
- **Chronic:** Inflammation returns within 1 month of stopping treatment, indicating persistent disease.

Treatment Approach:
- **Mild/Moderate cases:** Managed with cold compresses, allergen avoidance, lubricants, antihistamines, and occasional short steroid pulses.
- **Chronic cases:** Treated with long-term topical immunomodulators (tacrolimus or cyclosporine).
- **Severe cases:** Required short courses of potent topical steroids.

RESULTS –

A total of 64 patients diagnosed with Vernal Keratoconjunctivitis (VKC) were included in this study. The study comprised 46 males (71.88%) and 18 females (28.13%), indicating a male-to-female ratio of approximately 2.6:1. The mean age of the participants was 8.02 years (±0.47 years), with ages ranging from 1 to 18 years. The most affected age group was under 5 years, encompassing 26 subjects (40.63%), followed by the 5–10 years age group with 24 subjects (37.5%).

Regarding residential areas, 24 patients (37.5%) resided in rural areas, 26 (40.63%) in urban settings, and 14 (21.88%) in semiurban regions. Approximately 50 patients (78.13%) were school-going children.

The most common presenting symptom was ocular redness, reported by 52 patients (81.25%), followed by itching in 38 (59.38%), photophobia in 26 (40.63%), and lid edema in 18 (28.13%). Horner-Trantas dots were observed in 16 patients (25%).

Clinical history revealed that 48 patients (75%) had a previous history of similar complaints, 24 (37.5%) had a history of allergic conditions (including respiratory and skin allergies), and 12 (18.75%) had a family history of allergies. The results of the study indicate that a previous history of similar complaints is significantly associated with vernal keratoconjunctivitis (VKC), with an odds ratio (OR) of 3.0 and a 95% confidence interval (CI) of 1.5 to 6.0, suggesting a strong and statistically significant relationship.

In contrast, other examined factors, including family history of allergies (OR = 0.23, 95% CI: 0.05–1.0), personal history of allergies (OR = 0.6, 95% CI: 0.2–1.5), use of kerosene oil or stove (OR = 0.56, 95% CI: 0.2–1.4), and living in rural areas with pollen exposure (OR = 0.6, 95% CI: 0.2–1.5), did not show statistically significant associations with VKC.

The majority of patients (46, 71.88%) presented with the limbal form of VKC, 8 (12.5%) had the palpebral form, and 10 (15.63%) had the mixed form. Severity assessment classified 18 patients (28.13%) as having mild disease, 36 (56.25%) as moderate, and 10 (15.63%) as severe.

Laboratory investigations revealed an increase in lymphocyte count in 14 patients (21.87%), eosinophil count in 44 (68.75%), and elevated IgE levels in 36 (56.25%) children. All patients, except for four (93.75%), received mild steroid therapy. Immunomodulatory treatment with cyclosporine (0.05%) was administered to 18 patients (28.13%). Refractive errors were present in 40 patients (62.5%).

DISCUSSION –

This study reinforces the status of vernal keratoconjunctivitis (VKC) as a significant pediatric public health concern. The condition adversely affects not only the educational performance and daily functioning of children but also impacts the quality of life of their caregivers. As such, preventive strategies, early diagnosis, and appropriate management are essential.

Our study demonstrated a clear male preponderance, with 71.88% of the cases being male, yielding a male-to-female ratio of approximately 2.6:1. This is consistent with findings from other multicentric studies, such as that by Saboo et al., who reported ratios ranging from 3.3 to 3.5:1 [20], and Lambiase et al., who reported a male predominance of 3.5:1 [4]. Similarly, studies by Sheikh et al. and Laiba et al. also support this male bias [21,22]. However, these findings contrast with those of Ukponmwan et al., who reported a female preponderance in a Nigerian cohort [5], highlighting possible regional and environmental influences on VKC epidemiology.

The majority of VKC cases in our study occurred in children under 10 years, with the most affected group being those under five years (40.63%), followed by the 5–10 year age group (37.5%). These results are similar to findings from a Ugandan study, which identified children between 5 and 9 years as the most commonly affected age group [23]. It is hypothesized that environmental factors, including exposure to ultraviolet (UV) radiation and airborne allergens such as dust and pollen—especially due to wind—may contribute to early-onset VKC. Children are particularly vulnerable due to increased outdoor activity during the first decade of life.

The mean age of participants was 8.02 ± 0.47 years, ranging from 1 to 18 years. Our observation that only two patients were above 15 years aligns with the understanding that the incidence of VKC declines with age. Leonardi et al. reported that only 4% of VKC cases are seen in patients above 20 years [3].

In terms of clinical presentation, the limbal form of VKC was the most prevalent in our cohort (71.88%), followed by the mixed (15.63%) and palpebral (12.5%) forms. These findings are in agreement with a multicentric Italian study that reported 53.8% of VKC cases as limbal [4]. In contrast, Alemayehu et al. found the mixed form to be predominant (53.1%) [25], while Ukponmwan observed that 82.6% of VKC cases were of the palpebral type in Nigeria [5]. Furthermore, Vajpayee et al. documented the bulbar variety as the most frequent form (75%) [26]. Such variations in VKC subtypes across studies may be attributed to geographical, climatic, and genetic differences.

The severity of VKC in our study was classified as mild in 28.13% of patients, moderate in 56.25%, and severe in 15.63%. The most frequently reported symptom was ocular redness (81.25%), followed by itching (59.38%), photophobia (40.63%), and lid edema (28.13%). These symptoms are consistent with the known clinical profile of VKC, which also includes conjunctival hyperemia, photophobia, foreign body sensation, mucous discharge, and the distinctive "morning misery" phenomenon [27].

From a clinical history perspective, 75% of our patients had a previous history of similar complaints, and this factor showed a statistically significant association with VKC (OR = 3.0, 95% CI: 1.5–6.0). However, no statistically significant associations were found with personal history of allergies (OR = 0.6, 95% CI: 0.2–1.5), family history of allergic diseases (OR = 0.23, 95% CI: 0.05–1.0), exposure to kerosene or stove smoke (OR = 0.56, 95% CI: 0.2–1.4), or rural residence (OR = 0.6, 95% CI: 0.2–1.5). In contrast, Lambiase et al. and Bonini et al. observed systemic allergic associations in 41.5–48.7% of patients [4,14], whereas other studies, including those from Nigeria, did not find significant familial atopic associations [28].

Therapeutically, almost all patients (93.75%) received corticosteroid therapy, and 28.13% were treated with topical cyclosporine A (0.05%). Bonini et al. reported a low incidence (2.1%) of steroid-induced complications[14], though other literature has indicated a higher risk of cataract and glaucoma with prolonged steroid use in children. This underscores the importance of cautious steroid administration and the need for regular follow-up.

The efficacy and safety of cyclosporine A in VKC management are well-documented. Keklikci et al. reported successful treatment of VKC using 0.05% CsA in a placebo-controlled randomized trial [29], and Yücel and Ulus found it beneficial in refractory VKC cases [30]. In addition, Mahdy et al. demonstrated that subcutaneous immunotherapy can significantly reduce clinical symptoms and serum

IgE levels, potentially offering a long-term solution[31].

Refractive errors were identified in 62.5% of patients in our study. Bonini et al. observed permanent visual loss in 6% of VKC patients[14], emphasizing the long-term ocular morbidity associated with inadequate or delayed treatment. Laboratory investigations in our cohort revealed eosinophilia in 68.75% of patients, elevated serum IgE levels in 56.25%, and lymphocytosis in 21.87%, consistent with the immunoallergic nature of VKC as reported by Pucci et al.[32] .

CONCLUSION -

This study contributes valuable insights into the epidemiology, clinical profile, and management of VKC in a paediatric population. While our findings align with several international studies, variations across regions emphasize the need for context-specific strategies. Appropriate use of immunomodulators, cautious steroid therapy, and parent education are key to effective VKC management. Future research with longitudinal follow-up and randomized designs will further strengthen the evidence base.

Limitations -

This study had several limitations, including the inability to conduct follow-up assessments due to time constraints. Furthermore, recall bias may have influenced historical data, and neither randomization nor blinding was implemented, limiting the generalizability and internal validity of the findings.

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