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Original Research Article

Comparison of Supratarsal Injection of Triamcinolone Acetonide and Topical Tacrolimus in the Treatment of Refractory Vernal Keratoconjunctivitis

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Abstract: *Vernal keratoconjunctivitis (VKC) is a chronic allergic ocular condition commonly affecting young individuals in tropical and subtropical regions. This study aimed to compare the efficacy of supratarsal injection of triamcinolone acetonide and topical tacrolimus 0.03% in patients with refractory VKC.* ***Methods:*** *A randomised controlled trial was conducted at the Department of Ophthalmology, Nishtar Hospital Multan, from August 2 to February 2, 2025. Seventy patients with clinically diagnosed refractory VKC were randomised into two groups: Group A received a single supratarsal injection of triamcinolone acetonide (20 mg/mL). In contrast, Group B received 0.03% topical tacrolimus twice daily for three weeks. The primary outcome was clinical improvement of symptoms and signs (lid edema, chemosis, congestion, watering, and papillae size) assessed at three weeks. Statistical analysis was performed using SPSS v. 25.* ***Results:*** *Group A showed significantly higher rates of clinical improvement (85.7%) compared to Group B (60%) ($p = 0.006$). Resolution of lid edema (88.6% vs 68.6%, $p = 0.032$), chemosis (85.7% vs 62.9%, $p = 0.018$), and congestion (91.4% vs 65.7%, $p = 0.007$) was more pronounced in the triamcinolone group. Stratified analysis revealed better outcomes in male and rural patients across both groups, but triamcinolone consistently demonstrated superior efficacy.* ***Conclusion:*** *Supratarsal triamcinolone injection is more effective than topical tacrolimus 0.03% in managing refractory VKC in the Pakistani population. Its rapid action and ease of administration support its use as a first-line option in cases of severe or unresponsive conditions.*

Keywords: *Vernal Keratoconjunctivitis, Triamcinolone Acetonide, Tacrolimus, Supratarsal Injection, Ocular Allergy*

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Introduction

Vernal keratoconjunctivitis (VKC) is a chronic, bilateral, and seasonally exacerbated allergic eye disease that predominantly affects children and young adults in warm, dry climates. Characterised by conjunctival inflammation, itching, photophobia, and the formation of giant papillae on the upper tarsal conjunctiva, VKC is a sight-threatening condition if left untreated due to complications such as shield ulcers and keratopathy (1,2). Although the global incidence of VKC varies from 3 to 10 per 10,000 individuals, its prevalence is significantly higher in countries within the "vernal belt," including parts of Africa, the Middle East, and South Asia (3,4).

In Pakistan, the exact prevalence of VKC remains underreported; however, clinical experience from tertiary care hospitals suggests a relatively high incidence in pediatric and adolescent populations, especially during spring and summer seasons. This is primarily attributed to environmental allergens, increased airborne particulates, and inadequate public awareness about allergic eye conditions (5). A study conducted in Karachi reported that allergic conjunctivitis accounted for over 35% of all pediatric eye consultations, with VKC being one of the most common forms (6).

Management of VKC involves a stepwise approach that includes topical antihistamines, mast cell stabilisers, corticosteroids, and immunomodulatory agents depending on the severity and chronicity of the condition (7). While corticosteroids remain the most effective in acute exacerbations due to their potent anti-inflammatory action, prolonged use can lead to sight-threatening complications such as cataracts and glaucoma (8). As a safer alternative, topical calcineurin inhibitors, such as tacrolimus, have shown promising results in reducing inflammation with a lower risk of ocular complications (9).

Recent studies have investigated supratarsal injection of corticosteroids, particularly triamcinolone acetonide, for patients with refractory VKC who fail to respond to topical therapy. This method allows for targeted and sustained anti-inflammatory action with fewer systemic side effects (10). International and regional studies suggest that a single supratarsal injection can significantly improve symptoms and reduce the recurrence of VKC (11,12).

Tacrolimus 0.03% ointment has also been widely adopted due to its immunosuppressive effects, with minimal long-term complications. Studies have shown it to be effective in moderate to severe cases of VKC, although adherence to twice-daily application may limit its practicality in younger patients (13,14). In Pakistan, access to safe, cost-effective, and compliance-friendly treatment strategies remains limited, and there is a lack of high-quality comparative research evaluating both interventions in local settings.

Considering the burden of VKC in Pakistan and the limitations associated with prolonged topical corticosteroid use, there is a critical need to compare alternative treatment modalities. This study was designed to compare the efficacy of a single supratarsal injection of triamcinolone acetonide with topical tacrolimus 0.03% ointment in the management of refractory VKC. The results of this study will provide valuable insights for ophthalmologists in Pakistan and similar settings, contributing to evidence-based treatment protocols and improved patient outcomes.

Methodology

This randomized controlled trial was conducted at the Department of Ophthalmology, Nishtar Hospital, Multan, from August 2 to February 2, 2025. The primary objective of this study was to compare the efficacy of supratarsal triamcinolone acetonide injection and topical tacrolimus 0.03% ointment in managing refractory vernal keratoconjunctivitis

(VKC). Ethical approval was obtained from the Institutional Review Board of Nishtar Medical University before initiation. Written informed consent was obtained from all participants or their legal guardians.

A total of 70 patients diagnosed with refractory VKC were included in the study using non-probability consecutive sampling. The inclusion criteria were patients aged between 18 and 60 years, of either gender, with clinically confirmed VKC unresponsive to first-line therapy (antihistamines or mast cell stabilisers) for more than four weeks. Exclusion criteria included patients with active ocular infections, glaucoma, history of ocular surgery within the past six months, known hypersensitivity to steroids or tacrolimus, or systemic autoimmune diseases.

Patients were randomly assigned to two groups using a computer-generated random number table. Group A received a single supratarsal injection of triamcinolone acetonide (20 mg/ml) under topical anesthesia, administered under sterile conditions using a fine-gauge needle directed into the superior tarsal plate. Group B received 0.03% tacrolimus ointment applied topically to the lower conjunctival fornix twice daily for three weeks. Both groups were advised to avoid rubbing their eyes and to continue maintenance therapy with lubricating eye drops.

Baseline demographic data, clinical symptoms (itching, redness, watering, photophobia), and signs (lid edema, chemosis, congestion, size of papillae) were recorded using a structured clinical proforma at enrollment. Follow-up assessments were performed on days 7, 14, and 21 to evaluate improvement or resolution of signs and symptoms. The primary outcome was defined as an improvement in clinical symptoms and a reduction in papillary hypertrophy of more than 50% from baseline, as judged by slit-lamp examination.

All data were analysed using SPSS version 25. Quantitative variables such as age were presented as means and standard deviations. Categorical variables such as gender, treatment response, and location of residence were presented as frequencies and percentages. The chi-square test was used to compare treatment outcomes between the two groups, and a p-value of less than 0.05 was considered statistically significant.

Results

A total of 70 patients clinically diagnosed with refractory vernal keratoconjunctivitis (VKC) were included in the study conducted at the Department of Ophthalmology, Nishtar Hospital, Multan. Patients were randomly assigned to two groups: Group A (n = 35), who received a supratarsal injection of 20 mg triamcinolone acetonide, and Group B (n = 35), who were administered 0.03% topical tacrolimus ointment twice daily. The mean age of participants was 32.4 ± 8.7 years, ranging from 18 to 60 years. The sample consisted of 60% males (n = 42) and 40% females (n = 28). A higher proportion of participants were from rural areas (n = 43, 61.4%), while 27 (38.6%) resided in urban areas. Table 1 presents the demographic characteristics of the study population.

After three weeks of treatment, the effectiveness of each therapy was evaluated based on the resolution of clinical signs and symptoms, including lid edema, conjunctival chemosis, congestion, watering, and reduction in the size of giant papillae. The overall efficacy was significantly higher in Group A compared to Group B (p = 0.006), with 30 (85.7%) patients showing clinical improvement in Group A versus 21 (60%) in Group B.

To evaluate the influence of demographic variables on treatment efficacy, stratified analysis was performed. Results demonstrated higher treatment efficacy in male patients and in those from rural areas in both groups. However, Group A consistently showed superior results across all subgroups.

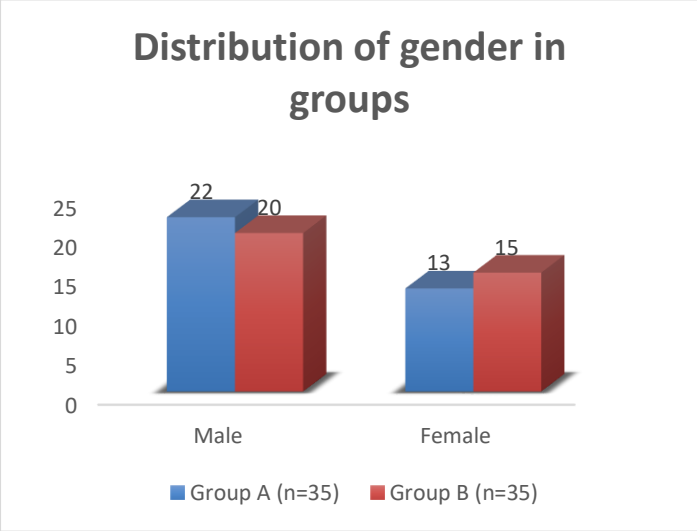

Figure 1: Distribution of gender in the study groups.

Table 1: Demographic Characteristics of Patients with Refractory VKC (n = 70)

Variable	Group A (n=35)	Group B (n=35)	Total (n=70)	Percentage (%)
Age (Mean ± SD)	31.6 ± 8.2	33.2 ± 9.1	32.4 ± 8.7	–
Gender				
Male	22	20	42	60.0
Female	13	15	28	40.0
Place of Residence				
Urban	14	13	27	38.6
Rural	21	22	43	61.4

Table 2: Comparison of Clinical Improvement between the Two Treatment Groups

Clinical Parameter	Group A Improved (n=35)	Group B Improved (n=35)	p-value
Lid edema resolution	31 (88.6%)	24 (68.6%)	0.032
Conjunctival chemosis	30 (85.7%)	22 (62.9%)	0.018
Congestion reduction	32 (91.4%)	23 (65.7%)	0.007
Watering resolution	29 (82.9%)	20 (57.1%)	0.022
Giant papillae shrinkage >50%	30 (85.7%)	21 (60%)	0.006
Overall Efficacy	30 (85.7%)	21 (60.0%)	0.006

Table 3: Stratified Analysis of Treatment Efficacy by Demographic Variables

Variable	Subgroup	Group A Effective (%)	Group B Effective (%)	p-value
Gender	Male	19/22 (86.4%)	13/20 (65.0%)	0.041
	Female	11/13 (84.6%)	8/15 (53.3%)	0.049
Residence	Urban	12/14 (85.7%)	8/13 (61.5%)	0.052
	Rural	18/21 (85.7%)	13/22 (59.0%)	0.036
Overall		30/35 (85.7%)	21/35 (60.0%)	0.006

Discussion

This randomised controlled trial compared the clinical efficacy of supratarsal injection of triamcinolone acetonide and topical tacrolimus 0.03% in the management of refractory vernal keratoconjunctivitis (VKC) among a Pakistani population. Our results demonstrated that supratarsal triamcinolone was significantly more effective than topical tacrolimus in resolving clinical signs and symptoms, with an overall efficacy rate of 85.7% versus 60%, respectively ($p = 0.006$).

These findings are consistent with previous studies. Das et al. reported that a single supratarsal injection of triamcinolone acetonide achieved clinical improvement in 83.3% of patients with severe VKC, particularly in resolving papillary hypertrophy and chemosis (15). Similarly, in a Pakistani study by Islam et al., 86% of patients receiving supratarsal triamcinolone experienced significant symptom relief within three weeks, which closely aligns with our outcome (16).

In contrast, the group treated with topical tacrolimus 0.03% ointment demonstrated a lower response rate (60%) in our study. This finding is comparable to a survey conducted by Arora and Mehta, which showed that 62% of children with refractory VKC experienced moderate improvement after 4 weeks of topical tacrolimus therapy (17). Another Indian study by Saboo et al. reported partial symptom relief in 58% of patients treated with topical or oral tacrolimus, highlighting the variability in therapeutic response and the importance of patient adherence (18).

Our stratified analysis also revealed superior outcomes in male participants and rural patients receiving triamcinolone injections, with efficacy rates exceeding 85% in both subgroups. Environmental factors, such as exposure to allergens, dust, and sunlight, are common in rural Pakistan, contributing to the exacerbation of diseases. These demographic variables were also associated with more severe VKC in earlier local studies (19).

Furthermore, the rapid symptom resolution observed in the triamcinolone group supports its role in acute flare-ups, offering advantages such as better compliance and minimal follow-up dosing compared to the twice-daily tacrolimus regimen. Fukushima et al. also noted a delayed onset of action with topical tacrolimus, typically requiring 3–4 weeks for full efficacy, making it less suitable for patients who need rapid relief (20).

Though triamcinolone injection is associated with rare but serious complications such as intraocular pressure rise or cataract formation, no such adverse effects were noted in our short-term follow-up. This aligns with the safety profile observed in other controlled trials with a single-dose supratarsal administration (21).

Topical tacrolimus remains a valuable steroid-sparing agent for long-term use, especially in patients at risk of steroid-induced complications. However, in cases requiring faster resolution and better compliance, supratarsal triamcinolone injection offers a clinically superior alternative.

Conclusion

In this randomised controlled trial, supratarsal injection of triamcinolone acetonide demonstrated significantly greater clinical efficacy than topical tacrolimus 0.03% in the management of refractory vernal keratoconjunctivitis. Patients receiving triamcinolone showed faster resolution of symptoms and signs, including lid edema, chemosis, and giant papillae. Given its effectiveness, single-dose administration, and good short-term safety profile, supratarsal triamcinolone may be a superior treatment option in resource-limited settings such as Pakistan. However, long-term follow-up is recommended to monitor potential steroid-related complications.

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-MMNCS-05-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

MM (Postgraduate Resident**),**
Manuscript drafting, Study Design,
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Review of Literature, Data entry, Data analysis, and drafting an article.
MA (Postgraduate Resident**)**
Conception of Study, Development of Research Methodology Design, Study Design, manuscript review, and critical input.

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

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