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Research Paper

Prevalence of Dry Eye in Vernal Keratoconjunctivitis in Pediatric Patients

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Abstract

Vernal keratoconjunctivitis (VKC) is a chronic, non-contagious allergic conjunctivitis caused by a hypersensitivity to airborne allergens characterized by chronic inflammation of the ocular surface usually affects pediatric children. This hospital-based cross-sectional study was undertaken to determine the prevalence of dry eye in VKC-affected pediatric patients presenting to the outpatient department of ophthalmology, National Medical College, Birgunj, Nepal. Ocular surface disease index (OSDI), tear-film breakup time (TBUT) using a slit lamp, and Schirmer's test I (STI) were screened following standard procedure and guidelines. Out of 2871 children with active symptoms of allergic conjunctivitis, 177 children produced VKC. The prevalence of VKC was significantly higher among boys than that of girl's children with a male-female ratio of 3.2:1. About 55% of VKC-affected children aged more than five years. More than 97% of children were affected in both eyes. The limbal type VKC (48.59%) was prevalent followed by the palpebral type (36.16%) and mixed type (15.25%) respectively. According to tear-film breakup time (TBUT); 103 children had TBUT in less than 10 sec which implies that more than 58% VKC affected children were suffering from dry eye disease. Schirmer's test I for dry eye among the children showed 55.36% dry eye. The variation in the prevalence of dry eye disease might be due to climatic variations.

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1. INTRODUCTION

Allergic conjunctivitis is an inflammatory response of the conjunctiva to an allergen. It is part of a larger systemic atopic reaction and complaints of redness and swelling of the conjunctiva with severe itching and increased lacrimation. Vernal keratoconjunctivitis (VKC) or Spring Catarrh is a T-lymphocyte-mediated chronic, non-contagious allergic conjunctivitis with seasonal recurrences usually appearing during the spring and summer seasons [1,2]. VKC is caused by a hypersensitivity to airborne allergens characterized by chronic inflammation of the ocular surface. Environmental factors played a significant role in the expansion of VKC, with augmented frequency in dry, warm, and windy climates [2]. VK usually affects pediatric age-group children (predominantly 5– 10 years) and young adults. Interestingly VKC generally diminishes before or just after puberty [3]. It is more common among males than females [2,3,4]. Itching, redness, and photophobia are the major symptoms of VKC. Though this is a self-limiting illness, it often leads to visual impairment if not treated during the active stage of the disease due to secondary corneal complications.

The VKC prevalence can vary widely worldwide even within the country due to variations in geography and climate. The prevalence of VKC is most common in the Indian sub-continent, Central and West Africa, and the Mediterranean region but is also common in North America and Australia [2,3,5,6]. In most of the cases, VKC is under-recognized and under-diagnosed allergic conjunctivitis therefore the epidemiological data on prevalence of VKC are limited. It was estimated that the worldwide prevalence of allergic conjunctivitis in the general population was 6–30%. Whereas; its estimated prevalence among children was 30% [7]. A recent study done by Miyazaki *et al.*, (2020) reported the prevalence of VKC in Japan was 1.2% whereas in African countries its prevalence ranged from 4 to 11.1% [6]. Dry eye syndrome is a common ocular surface disease that negatively affects one's quality of life. It is characterized by inflammation of the ocular surface and reduction in tear production, therefore ultimately loss of homeostasis of the tear film to lubricate the ocular surface. There are multiple causative factors associated with dry eye. VKC is one of the most causative factors of dry eye disease. Traditionally, Dry eye syndrome and VKC were considered different diseases, but now dry eye syndrome is an underdiagnosed complication of VKC. However, epidemiological studies on the prevalence of dry eye syndrome among the pediatric population of Nepal are scanty. Therefore, this hospital-based cross-sectional study was undertaken to determine the prevalence of dry eye in VKC-affected pediatric patients.

2. METHODS AND MATERIALS

This hospital-based cross-sectional study was conducted in pediatric children presenting to the outpatient department of ophthalmology, National Medical College, Birgunj, Nepal from March 2023 to February 2024.2871children with symptoms of active allergic conjunctivitis presenting to the department of ophthalmology, National Medical College during the study period were initially included in the study. Children aged 10 years or below with clinical symptoms of allergic conjunctivitis like tearing, burning, photophobia, and tear film instability were included in the study. Children with pre-existing dry eye, a history of any intra-ocular surgery, any eyelid abnormality, having vitamin A deficiency were excluded from the study. The diagnosis of VKC among the included children was done based on the recognized criteria described in the literature [8]. Among the 2871 children with the active symptom of allergic conjunctivitis, 177 children produced clinically active VKC. This study was approved by the Institutional Ethics Committee, National Medical College, Birgunj. The purpose of the study and study procedure were explained to the parents of the children and informed consent was obtained from them. The ocular surface disease index (OSDI) was evaluated in all the enrolled children with the clinical symptoms of allergic conjunctivitis like tearing, burning, photophobia, and tear film instability. Of those, children having OSDI scores more than 12 were further screened for dry eye tests including the tear-film breakup time (TBUT) using the lamp, and Schirmer's test I (STI) following standard procedure and guidelines [9]. The dry eye was defined as a TBUT < 10 sec [10]. The categorical variables were summarized by frequency and percentage and quantitative variables were summarized by their mean and standard deviation respectively. The student's t-test was used to assess the difference in quantitative variables and the Chi-square test was used for categorical variables. The data was analyzed by using SPSS software version 20.0 (SPSS Inc., Chicago, Illinois, USA), and a p-value <0.05 was considered as a level of significance.

3. RESULTS

A total of 2871 children visited the outpatient department of ophthalmology, National Medical College with active symptoms of allergic conjunctivitis during the study period met the eligibility criteria and were included in the study. The average age of the selected children was 7.08±3.41 years. Among them, there were 2055 boys and 816 girls.

Table 1: Sex variation of allergic conjunctivitis among the children

		Boys (n=2055) *f* (%)	**Girls (n=816) *f* (%)**	**All together (n=2871) *f* (%)**
Age	≤5 years	848 (65.28)	451 (34.72)	1299 (45.25)
	>5 years	1207 (76.78)	365 (23.22)	1572 (54.75)
Affected Eye	Right	19 (0.92)	8 (0.98)	27 (0.94)
	Left	21 (1.02)	6 (0.74)	27 (0.94)
	Both	2015 (98.05)	802 (98.28)	2817 (98.12)
VKC		136 (6.62)	41 (5.02)	177 (6.17)

The VKC prevalence among the children was studied based on the recognized criteria and it was revealed that out of 2871 children with active symptoms of allergic conjunctivitis, 177 children produced VKC. The prevalence of VKC was higher among the boys than that of girl children. Boys (76.84%) were significantly more likely to be affected in VKC than that of girls (23.16%). About 55% of VKC-affected children aged more than five years. More than 97% of children were affected in both eyes.

Table 2: Sex variation of VKC among the children

		Boys (n=136) *f* (%)	**Girls (n=41) *f* (%)**	**All together (n=177) *f* (%)**
Age	≤5 years	62 (78.48)	17 (21.52)	79 (44.63)
	>5 years	74 (75.51)	24 (24.49)	98 (55.37)
Affected Eye	Right	2 (1.47)	1 (2.44)	3 (1.69)
	Left	1 (0.74)	1 (2.44)	2 (1.13)
	Both	133 (97.79)	39 (95.12)	172 (97.18)

Different types of VKC among the affected children were studied and from the results, it was revealed the limbal type VKC (48.59%) was prevalent followed by palpebral type (36.16%) and mixed type (15.25%) respectively when both sexes were considered together.

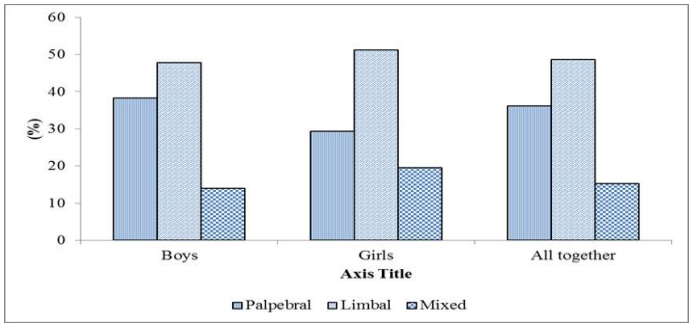

Fig 1: Distribution of children according to type of VKC

When the type of VKC was studied across the sexes; the limbal type (Boys: 47.79%; Girls: 51.22%) was prevalent in both sexes followed by the Palpebral type (Boys: 38.24%; Girls: 29.27%) and mixed type (Boys: 13.97%; Girls: 19.51%) respectively. Tear-film breakup time (TBUT) among the VKC affected was studied and the results showed that 103 children had TBUT less than 10 sec which implies that more than 58% of VKC affected children were suffering from dry eye disease. The prevalence of dry eye disease was slightly higher in boys (58.82%) than girls (56.1%).

Table 3: Prevalence of dry eye based on Tear-film breakup time (TBUT)

	Boys (n=136) *f* (%)	**Girls (n=41) *f* (%)**	**All together (n=177) *f* (%)**
TBUT ≥10 s (non-dry eye)	56 (41.18)	18 (43.9)	74 (41.81)
TBUT <10 s (dry eye)	80 (58.82)	23 (56.1)	103 (58.19)

Among the 103 dry eye-affected children; about 46% were mildly; 9.6% were moderately and around 2% were severely affected.

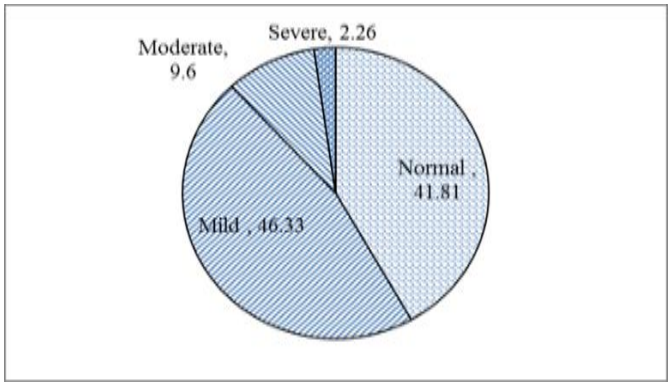

Fig 2: Distribution of VKC patients with deranged TBUT

Schirmer's test I for dry eye was also done and showed a similar result (55.36% dry eye). The incidence of mild and moderate dry eye among the children was 48.02% and 7.36% respectively.

4. DISCUSSION

VKC is a chronic, non-contagious allergic conjunctivitis that usually affects pediatric children and significantly affects their productivity and quality of life. In the present study out of 2871 children with allergic conjunctivitis,6.17%were affected by VKC. Our results were consistent with the findings of Lambiase *et al.,* (2009), a hospital-based study done in the Italian population documented 6.5% VKC; and a community-based study done in Northwest Ethiopia by Hayilu *et al.,* (2016) stated 5.8% VKC prevalence [11,12]. However; our result was higher than a recent hospital-based study conducted by Chaudhary *et al.,* (2023) among patients with conjunctivitis in Nepal showed VKC was seen in 3.33% of patients [13]. A school-based study on VKC prevalence done in Egypt reported a 3.3% prevalence [14]. Smedt *et al.,* (2011) reported a 4% VKC prevalence among school children in Rwanda [15]. A community-based cross-sectional study was conducted in Ethiopia and reported the prevalence of VKC among the children was 11.10% [16]. A higher prevalence of VKC was also reported in several school-based studies such as in Bangalore City, India (18%) in Nigeria (18.1%), and in Koulikoro, Mali (37.2%) [17,18,19]. The prevalence of VKC can vary widely across the country and within the same country may be due to variations in geography and climate which have a greater influence on allergic diseases of the eye including VKC [16]. The results of the present study showed that the prevalence of VKC among boys was more as compared to girls with a 3.2:1 ratio. This was supported by several studies [2,3,4]. A recent study in India also documented M: F ratio of 3.4:1 [20]. Another recent study done in Nepal reported male: female ratio was 5.6:1 [21]. The higher prevalence of VKC in males is not well known. Some hormonal factors might be influencing the development of VKC among boys [21]. Even though the pathogenesis of pollens, grasses, sunlight, wind exposure, and other reasons for VKC are not well known, it is assumed that males are highly prone to exposure to these conditions as they spend much time in outdoor activities [13,21]. This study revealed that the limbal type VKC was most prevalent in children followed by palpebral type and mixed type. Our result was consistent with the findings of Al-Akily and Bamashmus. (2011) and Tenmang *et al.,* (2022) where a higher incidence of limbal VKC was reported [22,23]. Whereas; other studies reported mixed type VKC was prevalent [13,20]. This study revealed that the prevalence of dry eye disease among VKC-affected children was 58.19%. A recent cross-sectional study on dry eye associated with VKC in children in India revealed around 61% of VKC-affected children had dry eye disease [24]. A study conducted in Southern California exhibited 57.7% dry eye disease; thereby emphasizing that patients concomitantly suffer from allergic conjunctivitis and dry eye disease [25]. While in another study documented about 40% of dry eye disease was

reported to co-occur in VKC-affected children [26]. A recent systematic review and meta-analysis on allergic conjunctivitis and dry eye disease documented that 47.2% of the patients with allergic conjunctivitis exhibited comorbid dry eye disease [27]. The variation in the prevalence of dry eye disease might be due to climatic variations.

5. CONCLUSION

This study showed that out of 2871 children with allergic conjunctivitis, 6.17% were affected by VKC. The prevalence of VKC among boys was more as compared to girls with a 3.2:1 ratio. The limbal type VKC was most prevalent in children followed by the palpebral type and mixed type. This study revealed that the prevalence of dry eye disease among VKC-affected children was 58.19%. The variation in the prevalence of dry eye disease might be due to climatic variations.

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