Open Access

Original Article

Association of Vernal Keratoconjunctivitis (VKC) with Keratoconus in Patients Presenting to Ophthalmology Clinics of Rawal Institute of Health Sciences, Pakistan

Maham Zehra, Mohd Shakaib Anwar, Erum Yousafzai, Qurat-Tul-Ain*, Waseem Akhter, Afia Matloob Rana**

Department of Ophthalmology, Rawal Institute of Health Sciences, Islamabad Pakistan, *Department of Ophthalmology, Armed Forces Institute of Ophthalmology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, **Department of Ophthalmology, HBS Medical and Dental College, Islamabad Pakistan

ABSTRACT

Objective: To establish an association of vernal keratoconjunctivitis with keratoconus.
Study Design: cross-sectional study.
Place and Duration of Study: Department of Ophthalmology, Rawal Institute of Health Sciences, Rawalpindi Pakistan from Dec 2019 to Feb 2020.
Methodology: Patients with an age less than 16 years and a history of VKC were included. Ulcers or scars, systemic connective tissues, and blue sclera were excluded. Follow-up after two weeks and later three months was conducted. Individuals with K readings of less than 45 diopters were considered normal.
Results: Among the 135 individuals enrolled in the study, more males 95(70%) than women 40(30%) were observed. The study also showed more individuals from age groups 1-10 years of age 107(79%). After three months, biomicroscopic findings and corneal topography (Oculus Pentacam HR) revealed that 20 individuals (14.8%) developed keratoconus (p<0.001). The disease severity, periodicity, and eye rubbing lead to the development of keratoconus.
Conclusion: Pediatric keratoconus deteriorates faster than adults, and the management differs for various reasons, such as faster progression and advanced stage of disease at the time of diagnosis. It burdens society as it influences children's quality of life and development. Hence, predisposing conditions such as Vernal keratoconjunctivitis need early diagnosis, recognition of progression, and appropriate intervention to prevent vision-threatening conditions such as keratoconus.

Keywords: Diopters, Keratoconus, Vernal keratoconjunctivitis.

How to Cite This Article: *Zehra M, Anwar MS, Yousafzai E, Ain QT, Akhter W, Rana AM. Association of Vernal Keratoconjunctivitis (VKC) with Keratoconus in Patients Presenting to Ophthalmology Clinics of Rawal Institute of Health Sciences, Pakistan. Pak Armed Forces Med J 2024; 74(2): 424-428. DOI: https://doi.org/10.51253/pafmj.v74i2.8596*

INTRODUCTION

Vernal keratoconjunctivitis (VKC) is a bilateral, chronic, seasonal allergic condition of the eyes. Patients present with severe itching, redness, discomfort, photophobia, burning and stinging, giant papillae, corneal shield ulcers, superficial keratopathy, and keratoconus, which leads to permanent corneal damage and vision loss.[1,2]

Vernal keratoconjunctivitis is estimated to be prevalent in 3.2 per 10,000 inhabitants (0.03%) in the European countries. Literature shows that the prevalence of the disease is 1.24/10,000 persons in the USA.[3] It is reported prominently in school-age children, in 80% of cases (ages 4–7 years), and is documented to be 3-4 times more often in males than females. It is a self-limited condition; however, some adults may persist with the disease.[4,5]

Correspondence: Dr Maham Zehra, Department of Ophthalmology, Rawal Institute of Health Sciences, Islamabad Pakistan
Received: 19 Apr 2022, revision received: 02 Nov 2022; accepted: 03 Nov 2022

The literature also highlights that the diagnosis criteria for VKC are still inadequately defined. Therefore, VKC is underestimated and is causing complications with irreversible damage due to delayed detection of both the disease and impending complications.[6] Keratoconus is a bilateral noninflammatory condition frequently reported among the complications of VKC. It causes corneal protrusion, ectasia, and scarring. The result is distorted or diminished vision. It has an incidence of approximately 1/2000. Ophthalmic examination reveals the presence of Vogt's striae and corneal astigmatism in individuals with keratoconus. VKC, eye rubbing, atopy, and Down syndrome are listed among the positive associations of keratoconus.[7] It is suggested in the literature that early forms of keratoconus may go undetected. Hence, meticulous attention towards the diagnosis will help with time management. Early cases may be treated with spectacles, collagen cross-linking, and intrastromal corneal ring segment implantation. However, corneal transplantation may be required in the advanced

stages of keratoconus, with risks of graft rejection and permanent blindness.[8]

VKC is a significant reason for visual debilitation and reduced quality of life in children and young adults. Children with severe VKC have a poor quality of life (QoL) because of limitations in daily activities, schooling, vacationing, and potential psychological and relationship issues.[9] In a study, it was highlighted that Keratoconus patients encounter depressive symptoms more often compared to healthy subjects without visual impairment.[10] Since keratoconus leads to a severe loss of vision, the study's rationale is to focus on awareness of early screening programs for early detection and adequate management to avoid the need for corneal transplantation and help preserve visual acuity. This study aims to find the association of VKC with keratoconus.

METHODOLOGY

The cross-sectional study was conducted at the Department of Ophthalmology, Rawal Institute of Health Sciences, Rawalpindi Pakistan from December 2019 to February 2020 after approval from the Institutional Review Board (IRB=RIHS-REC/050/19). WHO calculator was used to determine the sample size with the association of VKC and keratoconus as 9.7%.[11] Data was collected through non-probability consecutive sampling.

Inclusion Criteria: Children with a history of VKC were included study, regardless of gender, duration of disease, or severity.

Exclusion Criteria: Children with VKC associated with ulcer or scar, systemic connective tissues and blue sclera were excluded.

Informed written consent was obtained from both the patients' parents. Patients were instilling Fluorometholone 0.1% TDS with sodium cromoglycate (4%) plus Tetrahydrozoline HCL (0.05%) eye drops TDS. A detailed history and ophthalmic examination were conducted. Visual acuity was assessed using the Snellen chart. An automated refractometer and keratometer (Unicos URK-700)were used and recorded during the first visit. A follow-up after two weeks and later three months was conducted. Individuals with K readings of less than 45 diopters were considered normal, while individuals with K readings of more than 45 diopters (D) were included in the list of suspected keratoconus.[12] The individuals with keratoconus were further assessed for Fleischer rings, Vogt's stria, punctate epithelial erosions (PEE's), scissor's reflex and oil droplet reflex and diagnosis was confirmed using corneal topography(Oculus pentacam HR).

There is inadequate literature on the classification of VKC. Due to its overlapping symptoms with other allergic conditions of the eye, it is hard to identify. However, patients with VKC were diagnosed based on the presence of papillae. Individuals were labelled VKC if eyelid hyperemia of the bulbar and tarsal conjunctiva was positive upon eversion. Further papillae of different sizes and gelatinous infiltrates in the limbal area (Trantas Horner nodules) suggested VKC, which is generally not evident in seasonal or perennial allergic conjunctivitis. The presence of papillary hyperplasia is considered a must. Hence, as per Zacari *et al*. VKC was divided into palpebral, limbal and mixed.[6]

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 23 and MS Excel 2016 software. Mean and standard deviation were calculated for quantitative variables. Frequency and percentages were calculated for categorical variables. Chi-square and t-tests were applied for inferential statistics. The *p*-value of ≤0.05 was considered significant.

RESULTS:

A total of 135 pre-diagnosed VKC patients aged less than 16 were included. There were more males (95,70%) than women (40,30%). Patients with pre-diagnosed VKC on treatment were included irrespective of gender and age (mean age=8.57±2.37). The sample was divided into two groups, each with a band of ten years of disease duration. The study sample showed more individuals from age groups 1-10 years of age (107,79%). Biomicroscopic findings and corneal topography (oculus pentamer) revealed 20 individuals (14.8%) having keratoconus ($p<0.001$).

Males and females were almost equally affected by the two groups. ($p=0.969$). Out of the total, 14, 10%) of males developed keratoconus, and 4% of females (n=6) were affected. Age showed an insignificant association with keratoconus ($p=0.929$). Among all the patients diagnosed with keratoconus, 13(9.6%) showed periodicity throughout the year, while 7(5.2%) showed periodicity 2-3 times a year ($p=0.985$). Among all those who had keratoconus, 16(11.9%) showed 1-10 years of disease duration, and 4(3%) had >10 years of disease duration ($p=0.929$), as shown in Table-I.

The examination of keratoconus individuals showed the presence of Fleischer rings, Vogt stria, and PEE (p<0.001). Individuals reported a frequent change of glasses and the habit of rubbing their eyes to combat itching from VKC. It was recorded that individuals with keratoconus reported having a history of frequent glass changes (p<0.001) (Table-II).

Table-I: Association Between Keratoconus, Periodicity and Duration of Disease (VKC) (n=135)

Periodicity	Keratoconus		*p*-value
	No	Yes	
Throughout the year	75(55.6%)	13(9.6%)	0.985
2-3time a year	40(29.6%)	7(5.2%)	
Duration of disease			
1-10 years	91(67.4%)	16(11.9%)	0.929
>10 years	24(17.4%)	4(3%)	
Total	115(85.2%)	20(14.8%)	

Table-II: Association Between Keratoconus and Signs of VKC on Slit Lamp, Opthalmoscope, Retinoscope, Glasses Change and Rubbing of Eyes (n=135)

Slit Lamp Examination (signs of VKC)	Keratoconus		*p*-value
	No	Yes	
No	113(83.7%)	1(0.7%)	<0.001
Fleisher ring	0(0%)	8(5.9%)	
Vogt stria	1(0.7%)	6(4.4%)	
Punctate epithelial erosions	1(0.7%)	5(3.7%)	
Opthalmoscope Examination			
No reflex present	115(85.2%)	1(0.7%)	<0.001
Oil droplet reflex	0(0%)	19(14.1%)	
Retinoscopic Reflex			
No reflex present	115(85.2%)	6(4.4%)	<0.001
Siccssor reflex present	0(0%)	14(10.4%)	
History of Glass Changes			
No	115(85.2%)	7(5.2%)	<0.001
Yes	0(0%)	13(9.6%)	
History of Eye Rubbing			
No	115(85.2%)	7(5.2%)	<0.001
Yes	0(0%)	13(9.6%)	
Total	115(85.2%)	20(14.8%)	

Table-III: Comparison of K-Reading at Zero Weeks, at 2 Weeks and at 3 Months in Keratocnus and non Keratoconus Patients (n=135)

K-reading at Zero Week	Keratoconus		*p*-value
	No (N=115)	Yes (N=20)	
Right eye	42.61±1.2	43.66±1.3	0.001
Left eye	42.81±1.2	43.90±1.0	0.003
K Reading at 2 Weeks			
Right eye	42.59±1.1	44.27±1.2	<0.001
Left Eye	42.84±1.2	44.00±1.0	<0.001
K reading at 3 Months			
Right eye	42.60±1.2	44.43±2.3	<0.001
Left eye	42.81±1.2	46.15±2.6	<0.001

Keratometry helped confirm the K readings (diopters) falling in the range of inclusion for keratoconus. The mean K- value for the keratoconus individuals at week zero was (right eye mean=43.75±1.280, left eye mean= 44.00±0.951), which got deranged to (right eye mean=46.66±2.158, left eye mean=46.37±2.495) (Table-III).

DISCUSSION

Keratoconus is a progressive noninflammatory condition that has been reported to have an association with VKC.[13] Our study showed that around 15% of the patients with severe VKC and continuous periodicity ended up with keratoconus. More males were affected than females being affected. A study showed similar results where 58.6% had VKC association with more males affected than females. The severity of the disease was also documented more in VKC patients with keratoconus.[14] Another study discussing the prevalence of keratoconus was 11.2% among keratoconus patients.[15] A similar study by Alrobaian *et al*.[16] showed patients with keratoconus associated with VKC, with up to 96.3% being males. This highlighted gender association with the development of keratoconus in the VKC condition. (p=0.038).

Our study results showed that the severity of VKC was present in almost all cases in which keratoconus was developed. A similar study done by Naderan *et al*.[17] Showed that the severity of VKC caused the development of keratoconus. However, the seriousness of keratoconus was also linked with the severity of VKC. Thus, interventions and precautions were necessitated in cases presenting with severe symptoms of VKC to avoid progression to keratoconus.

Our study results showed that patients had a more palpebral type of VKC followed by limbal mixed with a mean disease duration of around five years and patients with disease more frequent in a 1-10 years age band. This is similar to results shown by Irfan *et a*l. with a mean duration of the illness being 4±1.6 years and more patients falling in the first 12 years age group, with palpebral conjunctivitis being the most frequent type followed by limbal and mixed.[18]

Vkc is linked with rubbing-related complications, which are due to itching and watery eye sensations that trigger the habit of chronic eye rubbing. Forceful and continued rubbing may lead to corneal ectatic conditions and keratoconus. The effect is attributed to mechanical trauma causing corneal thinning.[19] Our results showed that almost all individuals who

developed keratoconus with the VKC had a history of eye rubbing and frequent glasses change. A study by Rahman et al. highlighted that individuals developed keratoconus on the dominant hand side of the eye due to vigorous rubbing. Out of 200 individuals,125 had a history of eye rubbing. This would lead to rapid vision changes, causing potential deterioration of quality of life. It also necessitates controlling itching as the priority management point to avoid rubbing and, hence, keratoconus.[20]

CONCLUSION

According to our study, VKC affects males more than females, and the progression of the disease into keratoconus depends upon the age at which the patient develops VKC. It is severe at the start of the disease, and exposure to risk factors aggravates it further, such as dust and allergens. Hence, VKC, which can easily cause a vision-threatening condition, keratoconus, needs to be diagnosed as early as possible, along with recognition of risk factors and progression. Our recommendation is to monitor VKC regularly to prevent vision-threatening complications like keratoconus.

Conflict of Interest: None.

Authors' Contribution:

Following authors have made substantial contributions to the manuscript as under:

MZ & MSA: Conception, study design, drafting the manuscript, approval of the final version to be published.

EY & QTA: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

WA & AMR: Data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Feizi S, Javadi MA, Alemzadeh-Ansari M, Arabi A, Shahraki T, Kheirkhah A. Management of corneal complications in vernal keratoconjunctivitis: A review. Ocul Surf 2021; 19: 282-289. https://doi.org/10.1016/j.jtos.2020.10.005
2. Arif AS, Aaqil B, Siddiqui A, Nazneen Z, Farooq U. Corneal Complications And Visual Impairment In Vernal Keratoconjunctivitis Patients. J Ayub Med Coll Abbottabad 2017; 29(1): 58-60.
3. Singhal D, Sahay P, Maharana PK, Raj N, Sharma N, Titiyal JS. Vernal Keratoconjunctivitis. SurvOphthalmol 2019; 64(3): 289-311. https://doi.org/10.1016/j.survophthal.2018.12.001
4. Leonardi A, Doan S, Amrane M, Ismail D, Montero J, Németh J, et al; VEKTIS Study Group. A Randomized, Controlled Trial of Cyclosporine A Cationic Emulsion in Pediatric Vernal Keratoconjunctivitis: The VEKTIS Study. Ophthalmology 2019; 126(5): 671-681. https://doi.org/10.1016/j.ophtha.2018.12.027
5. Babineaux S, Blalock S, Katz J. Epidemiology of Vernal Keratoconjunctivitis in the United States: A Claims Data Analysis. Invest Ophthalmol Vis Sci 2020;61(7):4592.
6. Zicari AM, Capata G, Nebbioso M, De Castro G, Midulla F, Leonardi L, et al. Vernal Keratoconjunctivitis: an update focused on clinical grading system. Ital J Pediatr 2019; 45(1): 64. https://doi.org/10.1186/s13052-019-0656-4
7. Godefrooij DA, de Wit GA, Uiterwaal CS, Imhof SM, Wisse RP. Age-specific Incidence and Prevalence of Keratoconus: A Nationwide Registration Study. Am J Ophthalmol 2017; 175: 169-172. https://doi.org/10.1016/j.ajo.2016.12.015
8. Hos D, Le VNH, Hellmich M, Siebelmann S, Roters S, Bachmann BO, et al. Risk of Corneal Graft Rejection After High-risk Keratoplasty Following Fine-needle Vessel Coagulation of Corneal Neovascularization Combined With Bevacizumab: A Pilot Study. Transplant Direct 2019; 5(5): e452. https://doi.org/10.1097%2FTXD.0000000000000894
9. Krachmer JH, Feder RS, Belin MW. Keratoconus and related noninflammatory corneal thinning disorders. SurvOphthalmol 1984; 28(4): 293-322. https://doi.org/10.1016/0039-6257(84)90094-8
10. Hashemi H, Heydarian S, Hooshmand E, Saatchi M, Yekta A, Aghamirsalim M, et al. The Prevalence and Risk Factors for Keratoconus: A Systematic Review and Meta-Analysis. Cornea 2020; 39(2): 263-270. https://doi.org/10.1097/ico.0000000000002150
11. Gupta Y, Sharma N, Maharana PK, Saxena R, Sinha R, Agarwal T, et al. Pediatric Keratoconus: Topographic, Biomechanical and Aberrometric Characteristics. Am J Ophthalmol. 2021; 225: 69-75. https://doi.org/10.1016/j.ajo.2020.12.020
12. Mahmoud S, El-Massry A, Goweida MB, Ahmed I. Pediatric Keratoconus in A Tertiary Eye Center in Alexandria: A Cross-sectional Study. Ophthalmic Epidemiol 2022; 29(1): 49-56. https://doi.org/10.1080/09286586.2021.1892154.
13. Moschos MM, Gouliopoulos NS, Kalogeropoulos C, Androudi S, Kitsos G, Ladas D, et al. Psychological Aspects and Depression in Patients with Symptomatic Keratoconus. J Ophthalmol 2018; 2018: 7314308. https://doi.org/10.1155%2F2018%2F7314308
14. Shehadeh MM, Diakonis VF, Jalil SA, Younis R, Qadoumi J, Al-Labadi L, et al. Prevalence of Keratoconus Among a Palestinian Tertiary Student Population. Open Ophthalmol J 2015; 9: 172-176. https://doi.org/10.2174/1874364101509010172
15. Umale RH, Khan MA, Moulick PS, Gupta S, Shankar S, Sati A, et al. A clinical study to describe the corneal topographic pattern and estimation of the prevalence of keratoconus among diagnosed cases of vernal keratoconjunctivitis. Med J Armed Forces India 2019; 75(4): 424-428. https://doi.org/10.1016%2Fj.mjafi.2018.07.012
16. Alrobaian M, Elsayed M, Alotaibi AK, AlHarbi M, May W, Stone DU, et al. Safety and efficacy of corneal cross-linking in pediatric patients with keratoconus and vernal keratoconjunctivitis. Middle East Afr J Ophthalmol 2019; 26(2): 95-100. https://doi.org/10.4103%2Fmeajo.MEAJO_240_18
17. Naderan M, Rajabi MT, Zarrinbakhsh P, Bakhshi A. Effect of Allergic Diseases on Keratoconus Severity. OculImmunol Inflamm 2017; 25(3): 418-423. https://doi.org/10.3109/09273948.2016.1145697
18. Irfan M, Khan SAR, Jan W, Zeeshan, Khalid K. Frequency of different types of vernal keratoconjunctivitis in patients

presenting to a tertiary care hospital. J Postgrad Med Inst 2020; 34(4): 227-230.

19. Ben-Eli H, Erdinest N, Solomon A. Pathogenesis and complications of chronic eye rubbing in ocular allergy. Curr Opin Allergy Clin Immunol 2019; 19(5): 526-534. https://doi.org/10.1097/aci.0000000000000571
20. Rahman A, Rahman S, Faridi J. Keratoconus: early onset, the worst prognosis, eye rubbing and hand-dominance. Adv Ophthalmol Vis Syst 2020; 10(4): 79-84. https://doi.org/10.15406/aovs.2020.10.00390