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# Topographic corneal changes in children with vernal keratoconjunctivitis: A report from Kathmandu, Nepal

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ABSTRACT

*Purpose:* The present study was conducted to determine corneal topographic characteristics of children with vernal keratoconjunctivitis (VKC) and compare the corneal topographic indices in VKC subjects with normal subjects

*Material and method:* In the hospital based comparative study, 115 consecutive subjects with VKC and 102 age and sex matched normal subjects were selected for the videokeratography with NIDEK ophthalmic operating system. Keratoconus-like topography was determined based on the expert classifier system. Other assessments included visual acuity testing with LogMAR chart, slit lamp biomicroscopy, dilated fundus examination, measurement of central corneal thickness and intraocular pressure. Topographic indices were analyzed and compared using unpaired *t*-test among different groups. Sensitivity and specificity was estimated by the ROC curve.

*Result:* Among 115 subjects with VKC, males comprised of 86 subjects (66.1%) and mean age of presentation was 10.9 (SD 4.9) years with mixed VKC in 56.5%. Keratoconus-like topography was present in 13 subjects (11.3%). The keratoconus predictiv index (sensitivity 92.3%, specificity 98.5%), the opposite sectoral index (sensitivity 84.6%; specificity 93.2%), the differential sectoral index (sensitivity 92.3%; specificity 90.8%) were found to be signficantly associated with VKC subjects having keratoconus-like topography.

*Conclusion:* A high prevalence of keratoconus-like topography was observed in patients with VKC.



## 1. Introduction

Vernal keratoconjunctivitis (VKC) is a chronic allergic disease with seasonal recurrence of ocular surface inflammation characterized by intense itching, tearing, photophobia, and mucous discharge, associated with conjunctival hyperemia and chemosis [1–3]. It is characterized by persistent inflammation with an increased number of mast cells, eosinophils, basophils, neutrophils, macrophages, and lymphocytes in the conjunctival tissues [3,4]. It usually affects children in the prepubertal period who usually recover after puberty, approximately 4–10 years after onset [5]. The classification of VKC is based on the main site of the papillary reaction: tarsal, limbal or both [6].

VKC often presents as a relatively benign and self limited condition, disabling lesion such as corneal ectasia have been reported descriptively as a complication of severe and prolonged VKC [7,8]. Chronic ocular trauma and rubbing of eye due to pruritus could be the environmental factor ("trigger") associated with keratoconus development in genetically predisposed individuals [7]. The corneal thinning induces irregular astigmatism, myopia, and protrusion leading to mild to marked impairment in the quality of vision [9]. Videokeratography is at present the most commonly used method in practice for detecting keratoconus-like pattern that may later be confirmed by clinical signs [10].

In the recent past, a study from this institute reported 0.45% clinical cases of keratoconus among 220 VKC subjects [11]. In the literature, incidence of subclinical keratoconus cases has been reported to be from 22.5% to 28% [12–14]. In our clinical practice, we see many patients of VKC every year but corneal topography is not performed in every case. In Nepal, few research papers have been published so far on clinical profile of VKC cases without performing corneal topography [11,15,16]. However, a study on the

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pattern of corneal topography in VKC cases and early detection of subclinical cases of keratoconus among them is very much needed. Hence, this study has been undertaken to determine corneal topographic characteristics of children with vernal keratoconjunctivitis and compare the change in corneal topographic indices in VKC subjects with normal subjects.

## 2. Materials and methods

### 2.1. Subjects and study designs

A hospital based cross sectional and comparative study was carried out among 115 consecutive subjects with VKC and 102 age and gender matched normal subjects from January 01, 2011 to June 30, 2012 at B. P. Koirala Lions Center for Ophthalmic Studies, Tribhuvan University Teaching Hospital, Kathmandu, Nepal.

Patients with disease other than VKC, previous history of shield ulcer, corneal scars, history of surgery and un-willing to participate in the study were excluded. Age and gender matched subject with normal ocular finding and refractive error $\leq -3.00$ D spherical and $\leq -1.75$ D cylinder were considered as a normal comparable group.

The purpose and procedure of study were clearly explained to and verbal consent was received from all subjects. The approval of implementation of the study was received from the ethics review committee of Institute of Medicine, Kathmandu. The research protocol adhered to the provision of the Declaration of Helsinki for research involving human subjects.

### 2.2. Assessment

Unaided and corrected distance visual acuity of each eye was assessed with the Log MAR chart at three meter distance in normal illumination for school going children. For preschool children and uncooperative children, VA testing was performed using the Kay Pictorial test.

Detailed anterior segment examination was carried out with the help of a Slit lamp biomicroscopy (Haag–Streit 900 Ag., Switzerland). The diagnosis of VKC was made on the basis of the typical clinical history of severe itching with characteristic signs, including giant papillae on the upper palpebral conjunctiva, limbal infiltrates, and eosinophilic concretions (Horner–Trantas' dots). Slit-lamp biomicroscopic sign of i.e., Vogt's striae, Fleischer's ring, stromal thinning, and stromal scarring and keratometric findings of irregular mires consistent with diagnosis of keratoconus were recorded for each subject.

Fundus evaluation was performed using the Heine Beta 200 direct ophthalmoscope, slit lamp funduscopy using +90 D 'Volk' lens (U.S.A) and Indirect Ophthalmoscopy (Welch Allyn model: AA107) using +20 D 'Volk' lens (U.S.A) after pupil dilatation with 0.5% cyclopentolate.

Cycloplegic refraction was performed with the help of Heine streak retinoscope in each child 45 min after instilling three 0.5% cyclopentolate drops at 5 min intervals. Any scissor reflex in retinoscopy was also noted.

Videokeratography was performed with Nidek Advanced Vision Information System (NAVIS) ophthalmic operating system (Nidek Magellan Mapper SN MM 2062 2004/5). Magellan Mapper features a streamlined 30-ring projector, dual-edge ring finder, 21,600 data points, and a high resolution camera. The Magellan Mapper accurately tracks without "ring lock" so highly irregular corneas provide meaningful data. Innovative software includes wide range of application, advanced graphical interface and corneal navigator.

Before initiation of corneal topography, a drop of artificial tears (carboxymethylcellulose 0.5%) was instilled into the inferior fornix to ensure an adequate tear film. Three keratographs were taken of each eye by ensuring proper fixation at the central green light of the cone of the machine. One keratograph of each eye was chosen for analysis based on the criteria: the least eyelid shadow to allow proper centration, proper focusing with thin regular continuous rings that covered the cornea from limbus to limbus, and absence of any dry spots (discontinuous rings) or excess pooling of tears along the inferior lid margin. Keratoconus-like topography was determined based on the Expert Classifier System. The expert classifier system determines the presence or absence of keratoconus based on the analysis of eight topographic indexes derived from corneal topographic analysis. They were SimKl, SimK2, surface asymmetry index (SAI), differential sector index (DSI), opposite sector index (OSI), center/surround index (CSI), analyzed Area (AA) and irregular astigmatism index (IAI) [17,18]. Discrimination between keratoconus and nonkeratoconus is made by a linear discriminant function of the multiple independent variables. The linear discriminant function yields a single composite discriminant value for each map, which was designated the keratoconus prediction index (KPI). The division between keratoconus and non-keratoconus-like topography is the cutoff value. Maps that had a KPI value greater than the optimum cutoff value were classified as keratoconus. In addition to KPI, four indices (DSI, OSI, CSI, and SimK2) were used in the binary decision tree. Maps were first classified as either keratoconus, borderline, or non-keratoconus using KPI and SimK2 values. The border line maps were then divided into keratoconus or non-keratoconus by DSI, OSI, and CSI [17].

Central corneal thickness was measured with Axis II PR (Quantal medical, SN 5537, 21, rue Newton, Z.I. du, BREZET, France) two minutes after instilling one drop of 2% Lidnocaine eye drop. Intraocular pressure (IOP) was measured by Goldmann Applanation Tonometer attached to the Slit lamp Biomicroscope (Haag–Streit 900 Ag., Liebefeld, Switzerland).

## 3. Statistical analysis

All data were recorded in proforma and entered in computer database for statistical analysis with the help of the computer software SPSS 17. Variation in distribution of subjects with age and best spectacle corrected visual acuity (BSCVA) were analysed using

**Table 1**
Characteristics of subjects with vernal keratoconjunctivitis.

| | Total VKC ($n=115$) | Mixed ($n=65$) | Palpebral ($n=33$) | Limbal ($n=17$) | $p$-value |
|---|---|---|---|---|---|
| Age (years) | $10.9 \pm 4.9$ | $10.5 \pm 4.5$ | $13.4 \pm 5.0$ | $8.4 \pm 4.3$ | 0.001* |
| Sex (%) | | | | | |
| Males | 86 (74.8) | 48 (73.8) | 26 (78.9) | 12 (70.6) | 0.76# |
| Females | 29 (25.2) | 17 (26.2) | 7 (21.1) | 5 (29.4) | |
| BSCVA (Log MAR) | $0.05 \pm 0.18$ | $0.06 \pm 0.23$ | $0.02 \pm 0.07$ | $0.03 \pm 0.07$ | 0.55* |
| Keratoconus | 13 (11.3%) | 10 (15.4%) | 2 (6.1%) | 1 (5.9%) | 0.14# |

VKC = Vernal keratoconjunctivitis, BSCVA = Best spectacle corrected visual acuity,
* Significant at the level of $p \leq 0.05$ by ANOVA.
# Significant at the level of $p \leq 0.05$ by the Chi-square test.

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