



Corneal Topographic Changes In Allergic Conjunctivitis

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Abstract:

Aim of the work demonstrate the affection of the allergic conjunctivitis on the corneal surface and topography. Study has been undertaken to determine corneal topographic characteristics of patients with allergic conjunctivitis and compare the change in corneal topographic indices in allergic conjunctivitis subjects with normal subjects. Case – control study was carried out in Bani Suif Ophthalmic hospital among 204 eyes divided into two groups 102 diseased eyes with allergic conjunctivitis and 102 normal eyes age and gender matched normal subjects from July 01, 2018 to November 30, 2019. Patients with disease other than allergic conjunctivitis, previous history of corneal scars, dry eye, eye infections ,uveitis , history of surgery and unwilling to participate in the study were excluded. Age and gender matched subject with normal ocular finding were considered as a normal comparable group. The purpose and procedure of study were clearly explained to verbal consent was received from all subjects. Uncorrected and corrected distance visual acuity of each eye was assessed. Detailed anterior segment examination was carried out with the help of a Slit lamp biomicroscopy. Diagnosis of allergic conjunctivitis was made on the basis of the typical clinical history of severe itching and burning sensation with characteristic signs, including giant papillae on the upper palpebral conjunctiva, limbal infiltrates, and eosinophilic concretions (Horner–Trantas' dots).

Keywords: allergic conjunctivitis ; cornea ; pentacam

1. Introduction:

In early 17th century Shimmer used reflection of marbles from cornea as perhaps the earliest corneal topography. Placido's disc was a major advancement in the late 19th century. Placido disc has stood of time and current Placido based topographers work on the same principle of assessing the reflection of a concentric set of white rings from the convex anterior surface of cornea. Recent advances in the technology use scanning slit methods for assessment of elevation data and incorporation of distortion free Scheimpflug photography technique [1].

Corneal topography uses three principles Placido disc reflection, scanning slit and Scheimpflug topography. Corneal topography is most commonly used in refractive surgery to screen candidates for normal corneal shape, patterns, and ruling out suspicious or keratoconic patterns. Also used in early screening of keratoconus suspects, post-surgery astigmatism and in ocular surface disorders as pterygium, limbal dermoid and cases of corneal scars[1]

Allergic conjunctivitis is an actually group of diseases affecting ocular surface and is usually associated with type1 hypersensitivity reactions. Divided into two types acute and chronic. Acute types are

seasonal allergic conjunctivitis and perennial allergic conjunctivitis. Chronic types are vernal keratoconjunctivitis (VKC), atopic keratoconjunctivitis (AKC) and giant papillary conjunctivitis. The ocular surface inflammations (usually mast cell driven) result in tearing, itching, lid with conjunctival edema, redness and photophobia. And can lead to a classic late response (associated with eosinophilia and neutrophilia) in subset individuals as in cases of allergic diseases. Chronic allergic can also develops accompanied by remodeling of the ocular surface tissue . In severe cases the patient experience extreme discomfort and sustain damage of the ocular surface. Keratopathy is more frequent in vernal keratoconjunctivitis which affect young age and atopic keratoconjunctivitis which affect older ages[2]

Vernal keratoconjunctivitis (VKC) is chronic allergic type of disease with seasonal periods of exacerbations, more observed in children and youngsters. In people whom live in hot and dry climates such as Middle East, north Africa and parts of south America. Being rare in North America and Europe where it seems to be milder presentation[2]

Vernal keratoconjunctivitis (VKC) and atopic keratoconjunctivitis (AKC) have potential to induce serious visual changes not only as result of the disease itself but also due to the complications associated with its evolution and management. Long standing diseases and disabling lesion such as corneal ectasia have been reported descriptively as complication of sever prolonged VKC and AKC[3].

Chronic ocular trauma could be the environmental factor(trigger) associated with keratoconus development in genetically predisposed individuals due to prolonged and slow release of small amounts of degenerative enzymes induced by chronic epithelial trauma could cause tissue damage [4].

In December2015, report from Kathmandu, Nepal. To detect topographic changes in children with vernal keratoconjunctivitis show 11.3% of children developed keratoconus like topography was present in 13 subjects among 115 subjects with VKC .

Data management and statistic analysis

Data were collected, coded, revised and entered to the Statistical Package for Social

Science (IBM SPSS) version 20. The data were presented as number and percentages for the qualitative data, mean, standard deviations and ranges for the quantitative data with parametric distribution and median with inter quartile range (IQR) for the quantitative data with non parametric distribution.

Chi-square test was used in the comparison between two groups with qualitative data and *Fisher exact test* was used instead of the Chi-square test when the expected count in any cell found less than 5

Independent t-test was used in the comparison between two groups with quantitative data and parametric distribution and *Mann-Whitney test* was used in the comparison between two groups with quantitative data and non parametric distribution.

The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:

$P > 0.05$: Non significant (NS)

$P < 0.05$: Significant (S)

$P < 0.01$: Highly significant (HS)

2. Results:

Study among 204 eyes. (Table 1) among 102 eyes 51 patients with allergic conjunctivitis, males comprised of 62 eyes 31 patients (60.80%) and females comprised of 40 eyes 20 (39.20%) patients with mean

age of presentation of 18.45 ± 8.26 years (ranging from 6 to 36 years). Majority of patients (28) 56 eyes (54.90%) comprised of SAC and PAC followed by VKC and AKC in 23 subjects (45.10%).

Table (1): Age and Sex Distribution of the allergic conjunctivitis Patients; (N= 102):

| AC Patients | |
|---------------------|-------------------|
| Age; (years) | |
| Mean \pm SD | 18.450 \pm 8.26 |
| Minimum | 6 |
| Maximum | 36 |
| Sex; N (%) | |
| Male | 62 (60.80) |
| Female | 40 (39.20) |

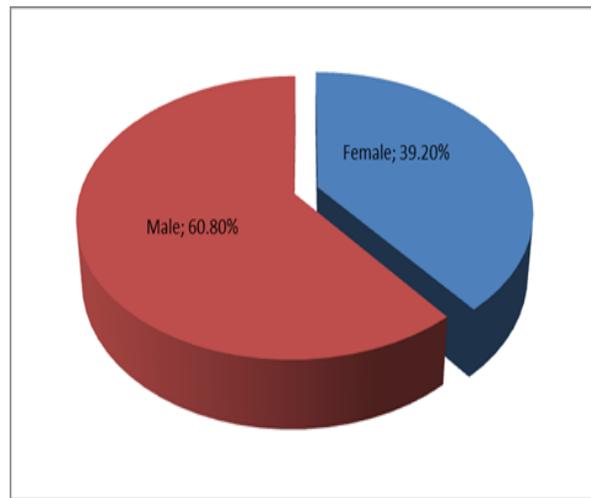


Figure (1): Sex in allergic group

Table (2): Comparison between allergic group and normal group as regards (BCVA) best corrected visual acuity

| | Allergic group (No.=102) | | Normal group (No.=102) | | Independent t test | |
|------|-----------------------------|------|---------------------------|------|--------------------|---------|
| | Mean | SD | Mean | SD | t | P value |
| BCVA | 0.83 | 0.23 | 0.95 | 0.11 | -4.540 | 0.001 |

SD: Stander deviation

This table shows that there was statistically significant decrease BCVA allergic group in comparison with normal group

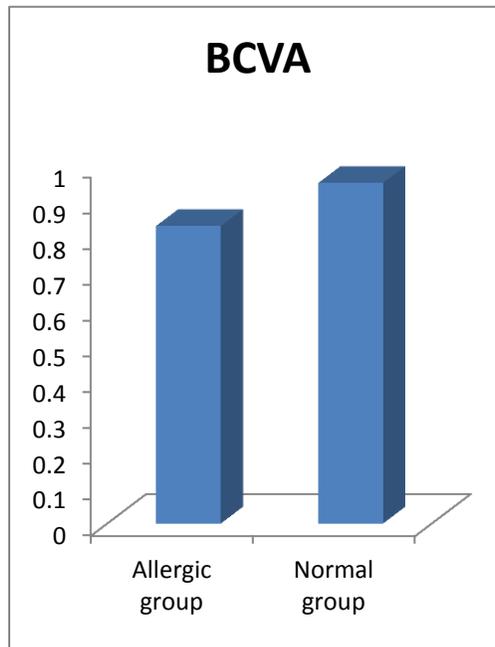


Figure (2): BCVA in allergic group and normal group

Table (3): Comparison between allergic group and normal group as regards spherical and cylinder spectacles

| | Allergic group (No.=102) | | Normal group (No.=102) | | Independent t test | |
|-----------|-----------------------------|------|---------------------------|------|--------------------|---------|
| | Mean | SD | Mean | SD | t | P value |
| Spherical | -0.42 | 0.99 | -0.26 | 1.00 | -1.126 | 0.261 |
| Cylinder | -1.53 | 1.68 | -0.32 | 0.50 | -6.909 | 0.001 |

This table shows there were no significance difference in spherical equivalent of subjects with and without allergic conjunctivitis but there was statistically significant increase cylinder (Astigmatism) in allergic group in comparison with normal group.

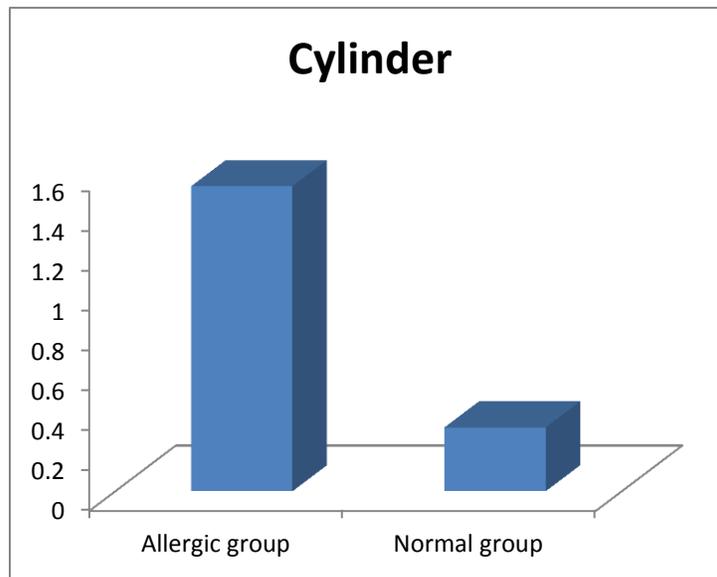


Figure (3): Astigmatism in allergic group and normal group

Table (4): Comparison between allergic group and normal group as regards suspected keratoconus topography

| | | Allergic group (No.=102) | | Normal group (No.=102) | | Chi square test | |
|-----------------------|-----|-----------------------------|-------|---------------------------|--------|-----------------|---------|
| | | No | % | No | % | X ² | P value |
| Suspected keratoconus | KC | 18 | 17.6% | 0 | 0.0% | 19.724 | 0.001 |
| | NON | 84 | 82.4% | 102 | 100.0% | | |

This table shows that there was statistically significant increase suspected keratoconus topography 17.6 % in allergic group in comparison with normal group 0.0%

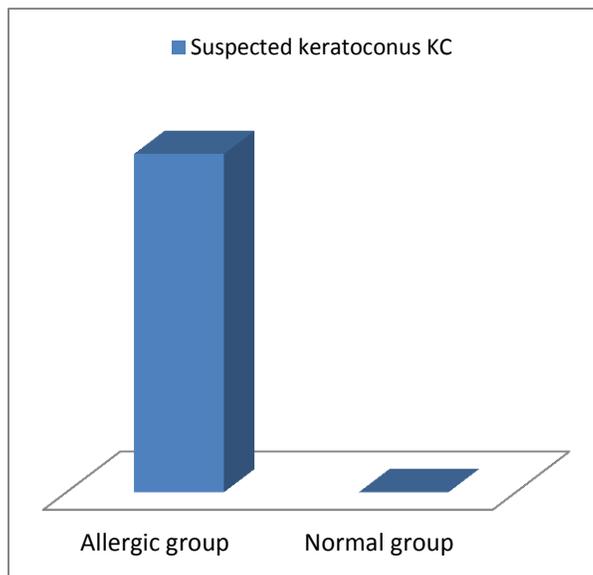


Figure (4): Suspected keratoconus in allergic group and normal group

Table (5): Comparison between allergic group and normal group as regards central corneal thickness

| | Allergic group (No.=102) | | Normal group (No.=102) | | Independent t test | |
|-------------------|-----------------------------|-------|---------------------------|-------|--------------------|---------|
| | Mean | SD | Mean | SD | t | P value |
| Corneal thickness | 509.90 | 52.65 | 540.28 | 33.42 | -4.920 | 0.001 |

This table shows that there was statistically significant decrease corneal thickness 509.90um in allergic group in comparison with normal group 540.28um.

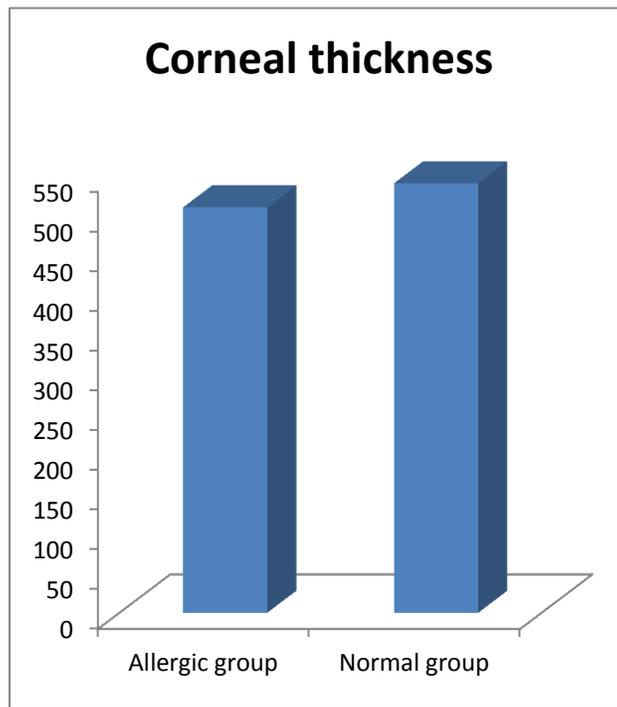


Figure (5): Corneal thickness in allergic group and normal group

Table (6): Comparison between allergic group and normal group as regards IOP

| | Allergic group (No.=102) | | Normal group (No.=102) | | Independent t test | |
|-----|-----------------------------|------|---------------------------|------|--------------------|---------|
| | Mean | SD | Mean | SD | t | P value |
| IOP | 14.22 | 1.89 | 14.66 | 1.74 | 0.000 | 1.000 |

This table shows that there was no statistically significant difference in IOP between allergic group and normal group

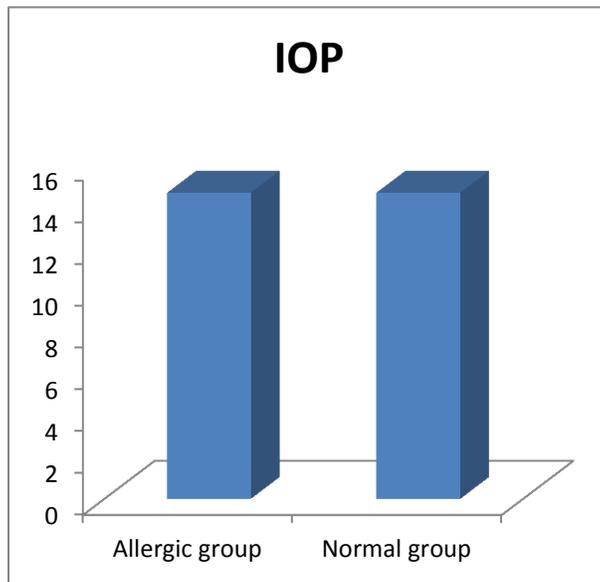


Figure (6): IOP in allergic group and normal group

Table (7): Comparison between allergic group and normal group as regards corneal topographic indices

| | Allergic group (No.=102) | | Normal group (No.=102) | | Independent t test | |
|-----------|-----------------------------|-------|---------------------------|------|--------------------|---------|
| | Mean | SD | Mean | SD | t | P value |
| K1 (D) | 43.75 | 4.07 | 42.76 | 1.36 | 2.317 | 0.021 |
| K2 (D) | 45.65 | 4.94 | 44.17 | 1.26 | 2.923 | 0.004 |
| K max (D) | 47.58 | 7.52 | 45.37 | 1.31 | 2.928 | 0.004 |
| ISV | 32.89 | 32.93 | 21.51 | 5.35 | 3.446 | 0.001 |
| IVA | 0.25 | 0.28 | 0.16 | 0.05 | 3.473 | 0.001 |
| KI | 1.05 | 0.14 | 1.01 | 0.03 | 3.257 | 0.001 |
| CKI | 1.01 | 0.04 | 1.00 | 0.01 | 3.039 | 0.003 |
| IHD | 0.02 | 0.03 | 0.01 | 0.01 | 4.190 | 0.001 |
| IHA | 11.01 | 12.75 | 6.98 | 5.13 | 2.965 | 0.003 |
| Mean I-S | 1.96 | 3.00 | 0.89 | 0.41 | 3.581 | 0.001 |

This table shows that there was a statistically significant increase corneal topographic indices in allergic group in comparison with normal group.

P-value less than 0.05 is considered significant.

K1: flat meridian.

K2: steep meridian.

Kmax : steepest meridian.

ISV: index of surface meridian.

CKI: central keratoconus index.

IVA: index of vertical asymmetry.

KI: keratoconus index.

IHD: index of height decentration.

IHA: index of height decentration.

Mean I-S: inferior and superior keratometric difference.

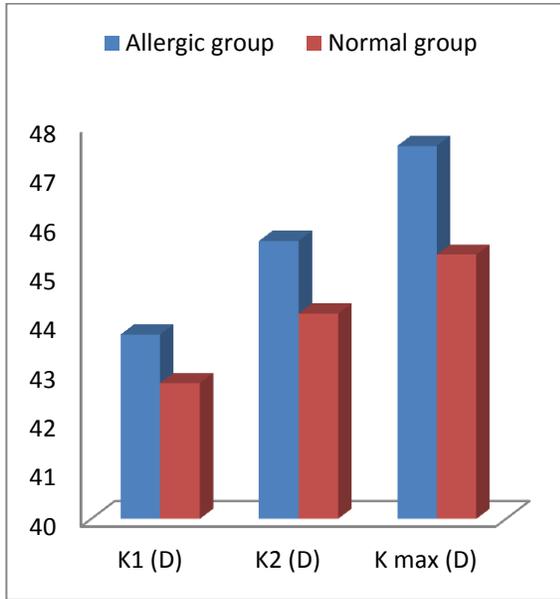


Figure (7): K1, K2 and K max in allergic group and normal group

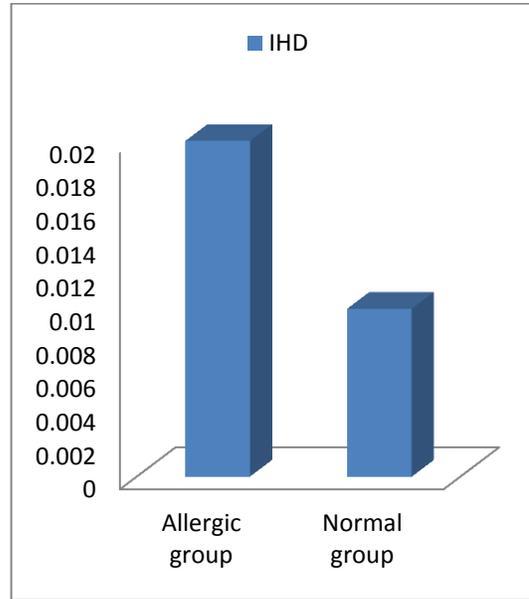


Figure (9): IHD in allergic group and normal group

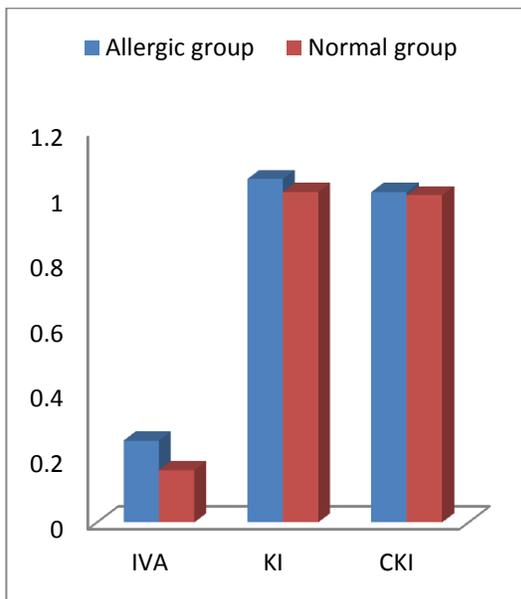


Figure (8): IVA, KI and CKI in allergic group and normal group

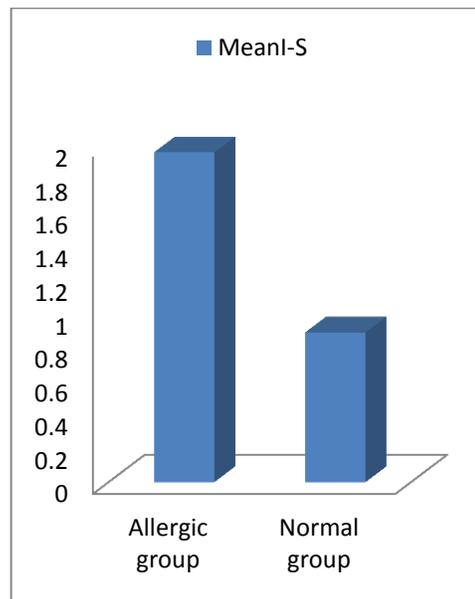


Figure (10): MeanI-S in allergic group and normal group

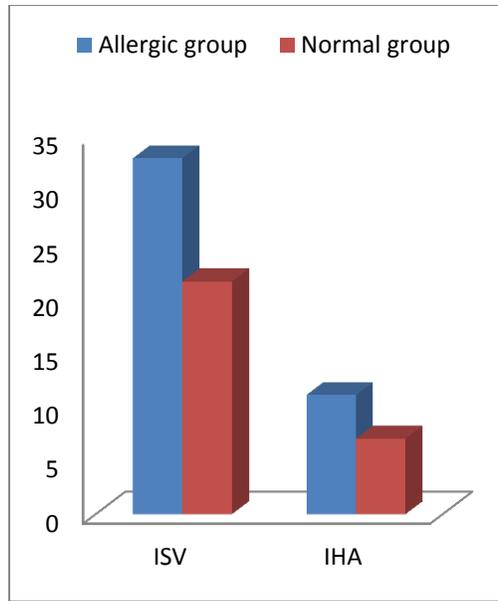


Figure (11): ISV and IHA in allergic group and normal group

3. Discussion:

This study compares the pentacam patterns in patients with allergic conjunctivitis as compared to age and sex matched normal group. Studies have shown association of allergic conjunctivitis with corneal affection and constant eye rubbing has been implicated as a causation factor.

Corneal pentacam is very important investigative tool in detecting any abnormalities of the cornea including keratoconus and helps in diagnosis of early or subclinical forms of keratoconus. Various corneal topographical indices were found to be altered in allergic conjunctivitis patients in this study.

The first reported association between ocular allergy and KC was described by Hilgartner in 1937. The association was controversial with few studies reporting an association ranging from 7 to 35% while others did not show any relationship[5]

However, more recent studies have proved that there is a definite association between allergy and KC. Bawazeer *et al.* did a case control study and found a positive correlation between atopy, eye rubbing, and KC. study supports the hypothesis that the most significant cause of keratoconus is eye rubbing. Atopy may contribute to keratoconus but most probably via eye rubbing associated with the itch of atopy. No other variable measured was significantly

associated with the etiology of keratoconus[6] The Dundee University Scottish Keratoconus study was a prospective observational study of 200 consecutive patients presenting with KC. They found atopic diseases including asthma in 23%, eczema in 14%, and hay fever in 30% of the KC patients[7]

A study from India by Agrawal *et al*, evaluated 274 patients of KC and revealed a higher prevalence of allergy in these patients History of skin allergy, symptomatic ocular allergy, and asthma was seen in 26.6, 24.4, and 11.3% of patient's, respectively[8]

Study by Lapid-Gortzak *et al.*, evaluated the pentacam findings in children with VKC ($n = 40$) versus those of healthy children ($n = 36$) and found that VKC patients have more abnormal corneal topographic patterns than non-VKC controls. Videokeratography allowed defining a subgroup of patients with infraclinical keratoconus. A trend of superior corneal steepening ('superior keratoconus') was also found.

Study by Sharma *et al*, risk factors for keratoplasty and development of acute corneal hydrops in 120 consecutive KC patients were evaluated. It was found that

the patients of KC who had VKC required corneal transplant surgery earlier as compared to primary KC cases. In addition patients with younger age at onset, history of eye rubbing, and atopy had higher risk for developing corneal hydrops[9]

Study by Vijay Gautam *et al*, Topographic corneal changes in children with vernal keratoconjunctivitis 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%) were found to be significantly associated with VKC subjects having keratoconus-like topography[10]

Study by Totan *et al*, Incidence of keratoconus in subjects with vernal keratoconjunctivitis:: A videokeratographic study twenty-six (31.7%) of 82 subjects had complications with keratopathy such as pseudogerontoxon, punctate keratitis, and shield ulcer. Forty-four eyes (26.8%) were detected as keratoconus by quantitative evaluation of videokeratography maps, 14 eyes (8.5%) by biomicroscopy, and 30 eyes (18.3%) by keratometry. The increased incidence of keratoconus was associated with male gender, long-standing disease,

mixed and palpebral forms, and advanced corneal lesions[11].

Study by Yangho Kim et al, Astigmatism Associated with Allergic Conjunctivitis in Urban School Children There was no significant differences in the age or spherical equivalent of subjects with and without allergic conjunctivitis. However, subjects with allergic conjunctivitis had a marginally greater astigmatism (cylindrical D) than those without allergic conjunctivitis (0.63 ± 0.54 vs. $0.71 \pm 0.63, p=0.05$)[12].

Study by Atul Gupta et al, Out of 100 patients, 77 was males and 33 were females. Majority were in the age group of 5 - 10 years. Majority of patients presented with VKC mixed type, i.e. 62%. Out of 100 patients, astigmatism $< 1D$ which is physiological was seen in 50% (Males- 37, Females- 13) of patients, astigmatism 1-2 D was seen in 29% (Males- 22, Females- 7) of patients, astigmatism $> 2D$ was seen in 14% (Males- 11, Females- 4) of patients and Steep K $> 47.2 D +$ astigmatism $> 1.5 D$ i.e. keratoconus like topography was seen in 7% (Males- 7) of patients. Incidence of astigmatism and keratoconus in VKC patients is more when compared to general population of same age group[13]

Study by Shah Nawaz et al, Among 210 subjects with VKC, males comprised of 173 patients (82.3%) and mean age of presentation was 11.5 ± 4.6 years with mixed VKC in 60%. Keratoconus-like topography was present in 64 patients (30.47%) and corneal thickness in normal group ($n=201$) 510 ± 9.4 , in VKC group ($n=210$) 490 ± 8.7 . [14]

4. Conclusion:

Ocular allergy has an important role in pathogenesis, disease progression, and the treatment outcome in cases of KC. Although a number of studies have proven this over the past decades, yet randomized controlled clinical trials on larger number of cases with longer follow up is required. Control of inflammation and avoidance of eye rubbing may offer the best means to prevent KC in these cases .Long standing symptoms of allergic conjunctivitis were associated with increased risk of keratoconus .This study is a preliminary data of ongoing prevalence studies on allergic conjunctivitis and Keratoconus showing early indication of very high prevalence of Keratoconus in allergic conjunctivitis patients of Egypt population .This study also shows that a very high number of subclinical

keratoconus can be detected by pentacam as compared to clinical examination.

Allergic conjunctivitis may cause rather than keratoconus corneal opacities in upper part of cornea.

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