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Research Article

PREVALANCE OF KERATOCONUS IN SUBJECTS WITH ASTIGMATISM IN A TERTIARY CARE HOSPITAL IN KASHMIR- A CROSS-SECTIONAL STUDY

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ABSTRACT:

AIM: To determine the prevalence of keratoconus in a tertiary care hospital in Kashmirso as to enable prompt detection and treatment and prevent resultant complications. MATERIALS AND METHODS: 228 eyes of 114 patients with astigmatism >1.5D were included in the study. All subjects underwent a complete ophthalmic examination. Patients were diagnosed as keratoconus using a combination of clinical signs, corneal topography supplemented by pachymetry.RESULTS: Mean age of the patients was 19.3 ± 4.57 years. The Rabinowitz indices among the study population revealed mean keratometric reading of 41.02 ± 9.67 D, mean SimK astigmatism of 2.84 ± 1.59 D, mean I-S difference of 0.81 ± 2.71 D, mean SRAX of 5.61 ± 12.28 D, mean central corneal asymmetry of 2.27 ± 6.36 D, and mean pachymetry to be 491.6 ± 47.74 µm. There were statistically significant differences between keratoconus eyes and astigmatic eyes in videokeratographic parameters (P value <0.05). The prevalence of keratoconus in patients with astigmatism >1.5D was found to be 13.2%,among which 13 patients had bilateral keratoconus (76.5%) while 4 patients had unilateral keratoconus (23.5%). CONCLUSION: Our study concludes that patients with astigmatism >1.5D should be routinely screened for keratoconus which will help in early diagnosis and treatment. This will also give us an idea about the follow up of such patients which will prevent progressive visual blur and acute loss of vision due to hydrops.

KEYWORDS: Keratoconus, astigmatism, Rabinowitz indices.

INTRODUCTION

Keratoconus (KC) is a chronic, bilateral, non-inflammatory disorder characterized by progressive steepening, thinning and apical scarring of the cornea. The annual incidence of KC is 2 per 100,000 with a prevalence of 54.5 per 100,000 (approximately 1 per 2,000).[1-3]

Etiology is unknown and most likely multifactorial.[1,4-7]Multiple reports link vigorous eye rubbing to the development of acute hydrops.[8]A positive family history has been reported in 6-8% of the cases.[9] Clinical diagnostic work up of KC includes patient's

medical history, refraction, keratometry, and slit-lamp examination to evaluate the status of the cornea.[10]

A typical patient with keratoconus presents in the teens or early twenties with complaints of blurring or distortion in vision and having to change glasses frequently. Retinoscopy usually shows irregular myopic astigmatism. A scissoring reflex and an "oil-droplet" reflex (Charleux sign) are highly suggestive of keratoconus. The signs on slit-lamp examination include prominent corneal nerves, corneal ectasia accompanied by thinning (generally greatest at the apex of the cone), subepithelial and anterior stromal scars, Vogt's striae and Fleischer's ring found around the base of the cone. Gross clinical signs in advanced keratoconus include V-shaped distortion of the lower eyelid in down gaze (Munson's sign) and a sharply focused light beam near the nasal limbus produced by lateral corneal illumination (Rizzuti's sign). Acute hydrops is a specific presentation of keratoconus caused by sudden breaks in Descemet's membrane (DM).[1,11,12] As the cornea steepens and thins, the patient experiences a decrease in vision that depends on the amount of corneal distortion produced.[13] Other signs include increased intensity of the corneal endothelial reflex and subepithelial fibrillary lines.

Early in the disease there may be no symptoms, and keratoconus may be noted by the ophthalmologist simply because the patient cannot be refracted to a clear 20/20 corrected vision. In advanced disease there is significant distortion of vision accompanied by profound visual loss.[14,15]Early form of keratoconus may go undetected unless anterior corneal topography is studied.[1]

Four quantitative video keratographic indices have been suggested for screening keratoconic patients. These indices include central corneal power >47.2 D, inferior-superior dioptric asymmetry over 1.2 D, Sim-K astigmatism >1.5 D and skewed radial axes $>21^{0}$.[1] Corneal asymmetry-central corneal curvatures of the two eyes that differ by more than 0.92D suggest that keratoconus may be present.[16]The current study was undertaken with an idea to screen the astigmatic patients for early diagnosis and treatment of keratoconus.

AIM:

To determine the prevalence of keratoconus in a tertiary care hospital in Kashmir. This will aid in: Early diagnosis and treatment of keratoconus and preventing progressive visual blur and acute loss of vision due to hydrops.

MATERIALS AND METHODS:

This Cross-Sectional study was carried out in the Postgraduate Department of Ophthalmology, Government Medical College Srinagar for a period of one and a half year with effect from May 2016 to November 2017. **Inclusion Criteria**: Patients aged 10-35 years of age with cylindrical error of >1.5D.

Exclusion Criteria: Patients with past history of eye trauma with corneal scars, patients with past history of refractive eye surgeries, patients with high cylinders over 35 years of age or diseases like pellucid marginal degenerations and patients with corneal scars due to inflammatory diseases.

Detailed ocular and relevant medical/surgical history was recorded. General physical and systemic examination was conducted on all the cases. All the patients entering into the

study underwent a complete eye examination vis Visual acuity testing using snellens chart, Refraction/ Retinoscopy to note scissoring of reflex, Intra ocular pressure measurements, Fundus examination using direct and indirect opthalmoscope, Slit lamp examination of anterior segment, Corneal topography-using ATLAS (Ziess) videokeratography and Pachymetry-using multiple point non-contact pachymetry.
Patients were diagnosed as keratoconus using a combination of clinical signs, corneal topography supplemented by pachymetry.
Statistical Methods: The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar and pie diagrams. Student's t-test was employed to compare Rabinowitz indicies among Kerataconus and Astigmatism eyes. A P-value of less than 0.05 was considered statistically significant.

RESULTS:

In our study, 228 eyes of 114 patients, with astigmatism >1.5 dioptres were included. Table 1 and 2 show the demography of the patients. As shown in table 1, mean age of the patients was 19.3 ± 4.57 years and majority of the patients (52.6%) were clustered in the age group 15-19 years, followed by 20-24 years (26%).Among the 114 patients, 70 were male while 44 were female.Table 3 depicts the visual acuity on presentation varied according to the severity of disease. 35.5% of eyes had a visual acuity of 6/18 while only 2 eyes had visual acuity of 6/60 to FC. The presenting visual acuity was found to improve with spectacles as 43.4% eyes achieved visual acuity of 6/6 while only 0.9% had visual acuity of 6/60 to FC as shown in table 4. Table 5 depicts the important corneal signs which included inferior steepening (4.8%), limbal thickening (6.2%), inferior steepening with apical thinning (1.3%) and Vogt's Striae, Fleischer ring (0.9%). Table 6 and 7demontrate the Rabinowitz indices among the study population which revealed mean keratometric reading of 41.02 ± 9.67 D, mean SimK astigmatism of 2.84 ± 1.59 D, mean I-S difference of 0.81 ± 2.71 D, mean SRAX of 5.61 ± 12.28 D.The mean central corneal asymmetry was 2.27 ± 6.36 D and the mean pachymetry was found to be 491.6 ± 47.74 µm.There were statistically significant differences between keratoconus eyes and astigmatic eyes in videokeratographic parameters (P value <0.05).The prevalence of keratoconus in patients with astigmatism >1.5D was found to be 13.2% as shown in table 8. Among these keratoconus patients, 13 patients had bilateral keratoconus (76.5%) while 4 patients had unilateral keratoconus (23.5%) as depicted in table 9. Table 10 shows that in our study, there was a statistically significant difference in the degree of astigmatism as per corneal topograpgy findings, which indicated that higher prevalence rates for keratoconus will be found as cylindrical power increases.

Table 1: Age distribution of study patients		
Age (years)	**Frequency**	**Percentage**
10-14	11	9.7
15-19	60	52.6
20-24	26	22.8
25-29	14	12.3
≥30	3	2.6
Total	114	100
Mean±SD (Range)=19.3±4.57 (11-35) Years		

Table 2: Gender distribution of study patients		
Gender	**Frequency**	**Percentage**
Male	70	61.4
Female	44	38.6
Total	114	100

Table 3: Distribution of study eyes as per visual acuity		
Visual Acuity	**No.**	**%age**
6/6	15	6.6
6/9	18	7.9
6/12	25	11.0
6/18	81	35.5
6/24	65	28.5
6/36	22	9.6
6/60 to FC	2	0.9
Total	228	100

Table 4: Distribution of study eyes as per best corrected visual acuity (BCVA)		
BCVA	**Frequency**	**Percentage**
6/6	99	43.4
6/9	52	22.8
6/12	32	14.0
6/18	13	5.7
6/24	5	2.2
6/36	15	6.6
6/60	10	4.4
6/60-FC	2	0.9
Total	228	100

Table 5: Distribution of study eyes as per corneal findings		
Cornea Findings	**Frequency**	**Percentage**
Inferior steepening	11	4.8
Limbal thickening	14	6.2
Inferior steepening with apical thinning	3	1.3
Vogt's striae, fleischer ring	2	0.9
Clear	198	86.8
Total	228	100

Table 6: Descriptive statistics of Rabinowitz indicies among study eyes				
Rabinowitz Indicies	**Mean**	**SD**	**Min**	**Max**
Kmax	41.02	9.67	41.02	91.94
I-S Difference	0.81	2.71	-3.79	10.98
Simk Astigmatism	2.84	1.59	0.4	10.76
SRAX	5.61	12.28	0	60
Central Corneal Asymmetry	2.27	6.36	0	31.26
Pachymetry	491.6	47.74	352	572

Table 7: Rabinowitz indicies among Kerataconus and Astigmatic eyes					
Rabinowitz Indicies	Kerataconus [n= 30]		Astigmatism [n=198]		P-value
	Mean	SD	Mean	SD	
Kmax	66.32	15.87	43.83	1.81	0.003*
I-S Difference	6.43	2.47	-0.04	1.41	<0.001*
Simk Astigmatism	5.64	2.45	2.42	0.81	<0.001*
SRAX	34.13	10.05	2.71	8.02	<0.001*
Central Corneal Asymmetry	12.28	11.85	0.38	0.34	<0.001*
Pachymetry	384.8	31.67	507.91	21.27	<0.001*

Statistically Significant Difference (P-value<0.05)

Table 8: Prevalence of keratoconus among study eyes		
Keratoconous	**Frequency**	**Percentage**
Present	30	13.2
Absent	198	86.8
Total	228	100

Table 9: Laterality of keratoconus patients		
Laterality	**Frequency**	**Percentage**
Bilateral	13	76.5
Unilateral	4	23.5
Total	17	100

Table 10: Degree of astigmatism as per corneal topography findings in study eyes					
	Mean	**SD**	**Max**	**Min**	**p-value**
WTR Astigmatism	-2.39	0.63	-4.5	-1	<0.001*
ATR Astigmatism	-3.01	1.08	-5.5	-0.5	
Keratoconus	-5.72	2.51	-11	-1.75	

Statistically Significant Difference (P-value<0.05)

DISCUSSION:

This study was conducted on 228 eyes of 114 patients with astigmatism>1.5D, attending our tertiary care centre. The mean age of the patients was 19.3 ± 4.57 years with an age range of 11 to 35 years. Majority (52.6%) were clustered between 15-19 years of age. In a study conducted by **Mahadevan R et al**[16], majority (90%) of the patients were clustered between 10-30 years of age and the mean age of the patients was 21.3 ± 6.96, which is comparable to our study and indicates the presence of keratoconus in this age group.

Among the study population, out of total 114 patients, 70 were male (61.4%) and 44 were female (38.6%). In a study conducted by **Shafqat R et al**[17] 63% of patients were male while 37% were female, in a total sample of 100 patients which was comparable to our study. Again in a study conducted by **Mohd-Ali B et al**[18]on clinical characteristics of kerataconus patients, 71% of the study population was male, while 29% were female. However, in a study conducted by **Valdez-Garcia Jorge E.et al**[19] on the prevalence of kerataconus in an adolescent population, 66.6% were female and 33.3% were male which

was not comparable to our study, thus revealing that there is no gender prelidection in kerataconus patients.

Visual acuity among the study patients revealed that majority of patients i.e., 35.5% had visual acuity of 6/18 at the time of presentation, while only 0.9% had visual acuity of 6/60 to counting fingers, 6.6% had visual acuity of 6/6, 7.9% had 6/9, 11.8% had 6/12, 28.5% had 6/24 and 9.6% had 6/36, which indicated that visual acuity decreases as corneal curvature and astigmatism increase and visual acuity depends on amount, regularity and obliqueness of astigmatism. Visual acuity was found to improve with spectacles and 43.4% eyes achieved visual acuity of 6/6, 22.8% eyes achieved 6/9, 14% achieved 6/12 while 2 eyes with uncorrected visual acuity of counting fingers could not improve further with spectacles. **Assiri AA et al**[20] in their study on incidence and severity of keratoconus, found that with spectacles 33% of the eyes achieved a corrected visual acuity of 6/6. The authors stated that visual acuity values were variable even for patients at the same disease stage as their data showed that overall steepening of cornea produces a greater change in visual acuity than does any increase in astigmatism.

In the 228 eyes that were included in the study population, 198 eyes (86.8%) had clear corneas, while 11 eyes (4.8%) had inferior steepening of cornea, 14 eyes (6.1%) had limbal thickening, 3 eyes (1.3%) presented with inferior steepening and apical thinning of cornea and 2 eyes (0.9%) had Vogt's striae and fleischer's ring. In a study conducted by **AlShammariZet al**[21] on prevalence, clinical features and associated factors of keratoconus patients, out of 44 eyes, 4.9% of eyes had apical scarring while 9.7% had Vogt's Striae. This was higher as compared to our study which can be explained by the fact that their study was a retrospective study with the study group including already diagnosed cases of keratoconus, while ours was a prospective study including astigmatic patients and not already diagnosed kerataoconus cases.

The Rabinowitz indices among the study population revealed mean maximum keratometric reading of 41.02±9.67 dioptres, mean SimK astigmatism of 2.84±1.59 dioptres, mean I-S difference 0.81±2.71 dioptres, mean SRAX 5.61±12.28 degrees. The mean central corneal asymmetry was 2.27±6.36 dioptres while mean pachymetry was 491.6±47.74 µm. The study conducted by **Serdarogullari Het al**[22] on Prevalence of Kerataconus and subclinical keratoconus in subjects with astigmatism found mean maximum keratometric reading of 46.3±2.6 dioptres and mean pachymetry reading of 536±47 µm which was compatible with our study.

In our study, there were statistically significant differences between kerataconus eyes and astigmatic eyes in videokeratagraphic parameters (p. value < 0.05). Mean maximum keratometric value was 66.32±15.87 D in keratoconic eyes and 43.83±1.81 in astigmatic eyes. Mean I-S difference was 6.43±2.47 in keratoconic eyes while -0.04±1.41 in astigmatic eyes. Mean SimK astigmatism was 5.64±2.45 D in keratoconic eyes while 2.42±0.81 D in astigmatic eyes. Mean SRAX was 34.13±10.05 degrees in keratoconic eyes while 2.71±8.02 degrees in astigmatic eyes. Mean pachymetric reading was 384.8±31.67 µm in kerataconic eyes while 507.91±21.27 µm in astigmatic eyes. In the study conducted by **Serdarogullari H et al**[22] on prevalence of kerataconus and sub-clinical kerataconus in subjects with astigmatism, statistically significant differences between kerataconic and astigmatic eyes were observed in all Pentacamparameters.They found that mean pachymetry readings were 463±5.2 µm in kerataconic eyes, while it was 544±42 µm in astigmatic eyes. These findings were comparable to our study and indicate

that the pachymetry readings are much thinner in keratoconic eyes as compared to astigmatic eyes and the difference is statistically significant. In our study, mean central corneal asymmetry in the eyes of keratoconus patients was found to be 12.28±11.85 dioptres whereas in astigmatic patients it was found to be 0.38±0.34 dioptres which indicate statistically significant differences between the two. **Gupta N**[15]mentioned that a central corneal asymmetry >0.92 between the two eyes was suggestive of keratoconus. **Rabinowitz YS et al**[23]suggested that three quantitative parameters were statistically significant when comparing normal eyes with keratoconic eyes, these were- central corneal power, difference in corneal power between fellow eyes in the same patient and steepening of the inferior cornea compared with the superior cornea. These findings are comparable to the results seen in our study.

In our study, 13.2% of patients with astigmatism >1.5D had keratoconus. In comparison, **Serdarlogullari Het al**[22] in their study found that 14.1% of the patients having astigmatism >2D had keratoconus. **Valdez Garcia Jorge E et al**[19], in the study conducted on prevalence of keratoconus in an adolescent population found a prevalence rate of 1.8% in 500 patients, which is much smaller as compared to our study. Also, **Mohd-Ali Bet al**[18] in their study on clinical characteristics of keratoconus patients, found a prevalence of 1.2% among the study population of 13,000. The prevalence of keratoconus among refractive surgery candidates has been reported to vary from 0.9 to 8.1%.[25,26]

When we compare this prevalence with other studies, it is obvious that higher prevalence rates for keratoconus will be found as cylindrical power increases. Some investigators state that over diagnosis was related to sagittal based curvature measurements by placido-based topography systems.[60,61]Since this study is limited by sample size, our results may not reflect the actual prevalence of keratoconus in the population >1.5D astigmatism.

In our study population 13 patients had bilateral keratoconus (76.5%), while 4 had unilateral keratocnus (23.5%). **Abdu Met al**[26]in their study on clinical profile of keratoconus patients found 78% of subjects had bilateral keratoconus which is comparable to our study. **Lim L. et al**[27]found that more than one third of subjects with unilateral keratoconus developed manifest keratoconus in other eye over 8 years and these authors reported that mean value of irregularity was significantly higher in keratoconus eyes than control eyes.

In our study, there was a statistically significant difference in the degree of astigmatism as per the corneal topography findings. While the patients depicting with the rule astigmatism had a mean cylindrical error of -2.39±0.63 dioptres, against the rule astigmatic patients had a mean cylindrical error of -3.01±1.08, the keratoconus patients had a mean cylindrical error of -5.72±2.51 dioptres. This indicated that there was a statistically significant difference between the degree of astigmatism and its correlation with the corneal topography findings. It is obvious that higher prevalence rates for keratoconus will be found as cylindrical power increases. Thus, screening of astigmatic patients for keratoconus becomes essential in order to pick up keratoconus early and initiate treatment.

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