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Research Article

Study of Goblet Cell Morphology by Impression Cytology in Various Types of Pterygium

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- Pterygium
- Impression cytology
- Goblet cells
- Ocular surface
- Grades of pterygium
- Types of pterygium

Abstract

Purpose: To evaluate ocular surface damage caused by pterygium by studying goblet cell morphology with the help of impression cytology and also to observe correlation of various grades and types of pterygium to changes in goblet cell morphology.

Material: 50 eyes with pterygium were classified according to site (nasal, temporal and double), morphology (corneal involvement) and nature (fleshy and other minor groups which included atrophic, cystic and recurrent) of pterygium. These eyes were studied for changes in goblet cell morphology by impression cytology and its correlation with different types and grades of pterygium.

Result: Interpretation of impression cytology was done by Saine et al., criteria. Incidence of grade 2 nasal fleshy (68.2%) ptyergium was commonest which showed grade 2 and 3 changes in goblet cell morphology. In minor group, atrophic pterygium was 12% out of which 75% had grade 2 impression cytology changes and recurrent pterygium showed grade 2 impression cytology changes.

Conclusion: Corneal involvement and nature of pterygium was directly proportional to changes in goblet cell morphology by impression cytology.

ABBREVIATIONS

IC: Impression Cytology; F: Fleshy pterygium; A: Atrophic pterygium; C: Cystic pterygium; R: Recurrent pterygium

INTRODUCTION

Pterygium is a triangular fibrovascular sub epithelial in growth of degenerative bulbar conjunctival tissue over the limbus into the cornea [1].

Most commonly it leads to cosmetic disfigurement and may cause diminution of vision due to astigmatic refractive error and involvement of pupillary area.

Etiology is associated with prolonged working in hot climate and exposure to UV rays leading to limbal stem cells damage causing fibrovascular proliferation. This proliferation causes alteration in goblet cells present in epithelium of conjunctiva [1]. Goblet cells secrete mucous and thus protects ocular surface. Abnormality in goblet cells causes poor tear film stability and thus damaging ocular surface. Damaged ocular surface leads to various ocular surface disorders and pterygium is one of them.

The amount of changes occurring in ocular surface can be examined by conjunctival goblet cell morphology [2], which can be documented by impression cytology of goblet cells. It is simple non invasive technique which is widely used to diagnose various ocular surface disorders. Application include etiological diagnosis of various pre clinical and established ocular surface disorders, documenting sequential changes in the conjunctival and corneal surface over time, staging of squamous metaplasia and monitoring effects of treatment [3].

The severity of ocular surface changes caused by pterygium can be demonstrated by impression cytology of goblet cells. Therefore this study was conducted to evaluate goblet cell morphology by impression cytology to observe ocular surface damage caused by various grades, sites and types of pterygium.

MATERIALS AND METHODS

This is a prospective, comparative and cohort study of 50 eyes of various types and grades of pterygium causing changes in goblet cell morphology.

Statistical analysis used

Descriptive statistical analysis was used to calculate the percentage frequency of the variables.

Cases were selected from patients attending outdoor clinics, eye camps and multi-specialty camps. Inclusion criteria included various grades, types and sites of primary pterygium and recurrent pterygium. Exclusion criteria was history of using any topical drugs, Intraocular surgery other than pterygium surgery, systemic diseases (diabetes mellitus, rheumatic arthritis), Contact lens users and associated ocular pathology.

Selected patients were enrolled for the study with detailed ocular complaints was recorded including visual acuity and best corrected visual acuity. Ocular examination in detail was done on slit lamp to rule out any other associated ocular disease. Pterygium was examined for site (nasal, temporal, double), grade (grade 1,2,3 and 4) [1] and nature (progressive, fleshyatrophic and recurrent) through slit lamp examination. Various parameters of pterygium, including height, width and corneal involvement of pterygium were recorded. Anterior segment was examined for corneal, anterior chamber, iris and pupil pathology. Dilated fundus examination was done using 90D lens to know the status of retina. Intraocular pressure was noted by using applanation tonometer to rule out glaucoma.

Impression cytology was performed based on following method.

Acetate cellulose filter paper strips of pore size 0.20 µm size, 13 mm diameter by Sartorius stedim biotech was used for conjunctival impression cytology. The filter paper was cut into 2x2mm square size. Impression of conjunctival goblet cell was taken on dull surface of the paper and other surface was mark to identify the stained surface. In the present study, cut pieces of filter paper were placed 2mm away from limbus in all four quadrants of conjunctiva (superior, nasal, temporal and inferior) (Figure 2).

The paper was allowed to remain in contact for 5-10 seconds. This strip was peeled off with forceps. These filter paper were transferred to marked glass slide and placed in fixative solution, containing 70% ethyl alcohol, 37% formaldehyde and glacial acetic acid in a recommended standard volume ratio of 20:1:1, slides were fixed for 10 minutes and stained with PAS and haematoxylin stain. Slides are cleared with xylene and viewed and photographed under a light microscope having in built camera. Type and nature of pterygium were not disclosed to the pathologist to avoid any biased opinion.

Grading

The all slides were examined to determine the nature of the conjunctival epithelial metaplasia causing cytological changes occurring in goblet cell morphology (Figure 3-6).

Staging of changes in conjunctival goblet cells was based on Saini et al., criteria.

Grade 1: Small round epithelial cells with a cytoplasm to nuclear ratio of 1:2. Large numbers of deeply positive goblet cell present.

Grade 2: A good cell sheet consisting of larger polygonal epithelial cells with a decreased cytoplasmic nuclear ratio of 1:3. Goblet cells were reduced in number, but still deeply PAS-positive.

Grade 3: Larger polygonal cells with a further decrease in cytoplasmic to nuclear ratio. Reduced number of goblet cells, with reduced staining.

Grade 4: Larger polygonal basophilic cells with pyknotic nuclei.

Intracellular keratin often demonstrable. Absent goblet cells. Only a few loose clumps were obtainable.

Grading of impression cytology reflecting the health goblet cell morphology was correlated with the grade and nature of pterygium to evaluate extent of ocular surface changes caused by pterygium.

RESULTS

50 eyes of 31 patients were included in the study with 37 (74%) female and 13 (26%) male patients. The age ranging between 25 years – 75 years. Incidence of pterygium was more common in age group in 56-65 years with 8% (4) in males and 20% (10) females respectively (Table 1).

Bilateral involvement was seen in 19 (61.2%) patients and rest 12 (38%) were unilateral (Table 2).

In our study pterygium was classified in 3 ways, according to site, corneal involvement and nature of pterygium.

1) According to site - It was divided into nasal 90% (45), temporal and double pterygium 10% (5) (nasal and temporal both). None of the cases had temporal pterygium. Site of pterygium was compared with corneal involvement of pterygium. Of all 45 eyes of nasal pterygium grade 1 was seen in 1 case (2%), grade 2 observed in 32 (64%), grade 3 was 10 (20%) and 2 (4%) patients had grade 4 pterygium. Total of 5 bilateral pterygium, 6% (3) cases had grade 2 pterygium and 4% (2) had grade 3 pterygium (Table2).

2) Classification according to corneal involvement- According to corneal involvement, pterygium was classified into four grades.

Grade 1 (just touching limbus) pterygium was observed in 1 (2%), grade 2 (less then 2mm of corneal involvement) in 35 (70%), grades 3 (2-4 mm of corneal involvement) in 12 (24%) and grade 4(more than 4mm involvement, encroaching pupillary area) in 2 (4%) eyes (Figure 7-9).

3) According to nature of pterygium- It was divided into fleshy 41 (82%), and other minor groups which included atrophic 6 (12%), recurrent 2 (4%) and cystic 1 (2%). Nature of pterygium was compared with corneal involvement. Out of total 41 (82%) eyes with fleshy pterygium, maximum patients had grade 3 pterygium Out of total 9 in minor group, there were 6 atrophic pterygium, in which 5 (10%) were grade 2. Two recurrent pterygium showed grade 2 and grade 4 pterygium respectively. Cystic degeneration pterygium (Figure 15) had grade 2 degree of corneal involvement (Table 3).

Associated ocular findings which do not affect ocular surface was senile immature cataract in 10 (20%) eyes, rest of the eyes (80%) were within normal limits on slit lamp examination IOP recorded by applanation tonometer was normal in all the cases. Dilated fundus examination done in all with 90D lens was unremarkable.

All 50 eyes underwent impression cytology to note the changes in goblet cell morphology occurring due to nature and extent of corneal involvement of pterygium. Grade 1 goblet cell changes were noted in 4 (8%) eyes, grade 2 in 12 (24%) grade 3 in16 (32%) and grade 4 changes in 12 (24%). In 6 (12%) eyes sample was inadequate sample.

Goblet cell changes were compared with the nature of pterygium.

1) Fleshy Pterygium- Out of total 41 fleshy pterygium, 3 had grade 1 (6%) goblet cell changes, 11 eyes with grade 2 pterygium showed grade 2 (22%) changes, grade 3 (22%) goblet cell changes were seen in 11 eyes of grade 3 pterygium and 12 eyes had grade 4 (24%) goblet cell changes. 4 (8%)eyes had unsatisfactory sample.

2) Minor group – Minor group included atrophic, recurrent and cystic pterygium

a. Atrophic pterygium – Total of 6 atrophic pterygium included in the study, grade 2 and grade 3 changes goblet cell changes were documented in 2 (4%) eyes in each group. 2 (4%) eyes had inadequate sample.

b. Cystic changes – One cystic pterygium had grade 2 goblet cell changes.

c. Recurrent pterygium- Both the recurrent pterygium included had grade 2 goblet cell changes (Table 4).

According to corneal involvement of pterygium, grades of goblet cell changes were,

1) Grade 1 pterygium- One grade 1 pteryigum had grade 1 goblet cell changes.

2) Grade 2-Total of 29 grade 2 pterygium were found in the study, 2 (4%) fall into category of grade 1 goblet cell changes, 11 (22%) shown grade 2, 10 (20%) were grade 3 and 6 (12%) had grade 4 goblet cell changes.

3) Grade 3 -With 12 eyes, 1 (2%) eye observed grade 2, 5 (10%) grade 3 and 6 (12%) grade 4 goblet cell changes.

4) Grade 4 -Out of 2 included 1 (2%) had grade 2 and other had grade 3 (2%) goblet cell changes (Table 5).

Goblet cell changes depend upon both nature and corneal encroachment of the pterygium.

1) Grade 1 goblet cell changes – Grade 1 goblet cell changes was found only one grade 1 fleshy pterygium (2.27%).

2) Grade 2 goblet cell changes – There were total 31.8% (14) grade 2 goblet changes were observed in the study. Out of which maximum 18.8% (8) belongs to grade 2 fleshy pterygiumfollowed by 4.54% (2) grade 2 atrophic pterygium, 2.27% (1) grade 2 cystic pterygium, 2.27% (1) grade 3 fleshy pterygium 2.27% (1) grade 3 atrophic pterygium and 2.27% (1) in grade 4 fleshy pterygium.

3) Grade 3 goblet cell changes – Out of 17 eyes with grade 3 goblet cell changes. In grade 2 pterygium, 8 (18.8%) belongs to fleshy pterygium and 1 (2.27%) recurrent pterygium. In grade 3 pterygium 6 (13.6%) were of fleshy pterygium and 1 (2.27%) was atrophic. Only one case (2.27%) had grade 4 recurrent pterygium.

Figure 1 Method of impression cytology -Cellulose acetate filter paper on the temporal side of conjunctiva.

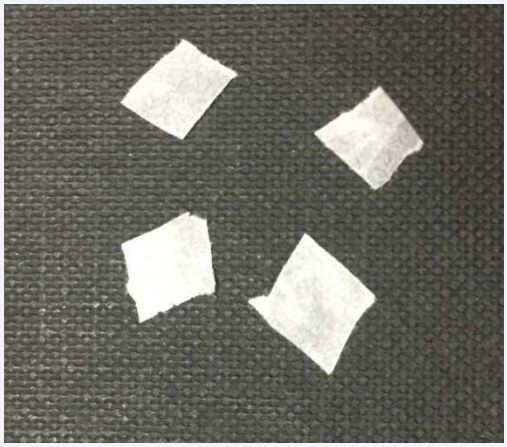

Figure 2 Acetate cellulose filter paper strips of pore size 0.20 µm size, 13 mm diameter by Sartorius stedim biotech.

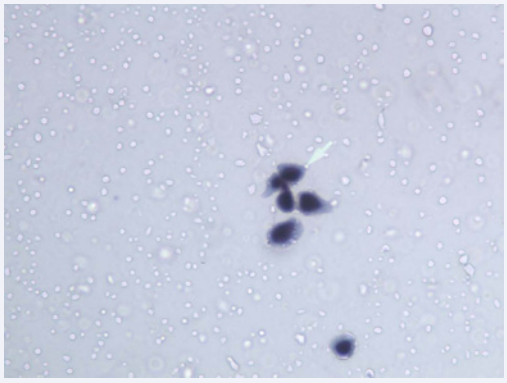

Figure 3 Grade 1: Small round epithelial cells with a nucleus to cytoplasm ratio of 1:2. Large numbers of deeply positive goblet cell present.

4) Grade 4 goblet cell changes – Grade 4 goblet cell changes were observed in 12(27.2%) eyes of fleshy pterygium out of which 13.6% (6) grade 2 and grade 3 each (Table 7).

DISCUSSION

This is prospective study of 50 eyes in 31 patients with various grades and nature of pterygium.

Age incidence

Pterygium is a well known entity above 50 years. Various studies conducted by Asnani KK (1983) [4] and Shriniwas K Rao

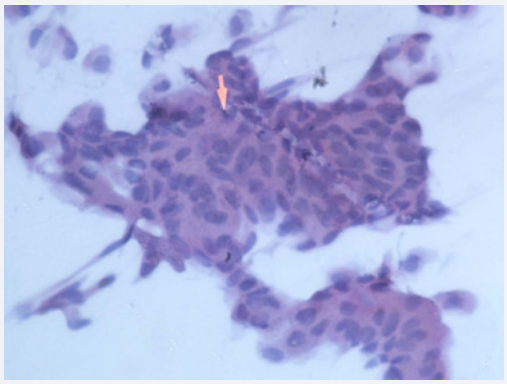

Figure 4 Grade 2 GC changes: A good cell sheet consisting of larger polygonal epithelial cells with a decreased nucleocytoplasmic ratio of 1:3. Goblet cells were reduced in number, but still deeply PAS-positive.

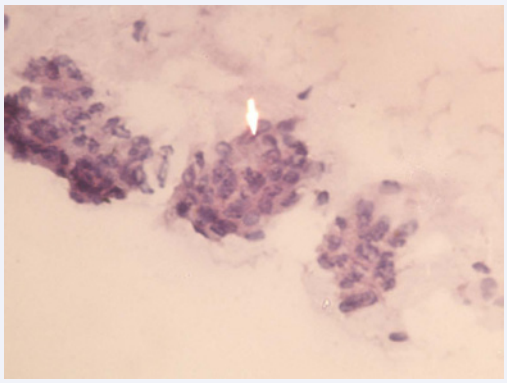

Figure 5 Grade 3 GCchanges: Larger polygonal cells with a further decrease in nucleus to cytoplasm ratio. Reduced number of goblet cells, with reduced staining.

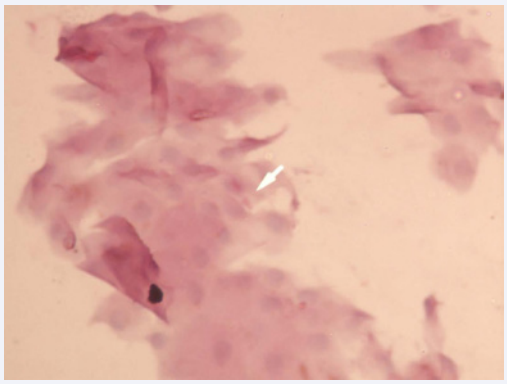

Figure 6 Grade 4 GC changes: Larger polygonal basophilic cells with pyknotic nuclei. Intracellular keratin often demonstrable. Absent goblet cells. Only a few loose clumps were obtainable.

[5] et al., (1998) found mean incidence of pterygium in age group of 30-40 years, Parthavasarthi N.R (1967) [6] High R and Taylors noticed an increase of prevalence of pterygium after age of 25 years

In our study, higher incidence of pterygium was found between 56 -65 years of age group which was 28% (Table 1) among all the age group ranging between 25 years to 75 years. Above mentioned studies, observed incidence of pterygium in age group under 40 years whereas in our study higher incidence was seen in age group above 50 years. In our study, late presentation of cases could be due to lack of ocular complaints, lack of awareness and low socio economic status which enables them to reach our institute.

Unilateral/Bilateral involvement of eye

Pterygium is a bilateral condition, one eye may follow other eye by months to years Incidence of bilateral pterygium (38%) were more than (12%) of unilateral cases (Table 2). Most of the cases had pinguecula, in due course of time develop into pterygium. In our study none of unilateral cases become bilateral in 6 months follow up, none of pinguecula got eventually develop into pterygium.

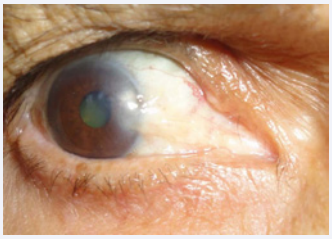

Figure 7 Grade 2 Pterygium.

Figure 8 Grade 3 Pterygium.

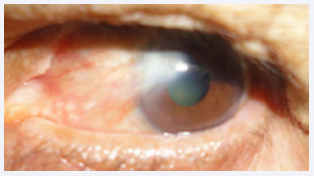

Figure 9 Grade 4 Pterygium.

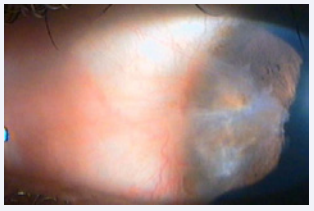

Figure 10 Grade 2 atrophic pterygium.

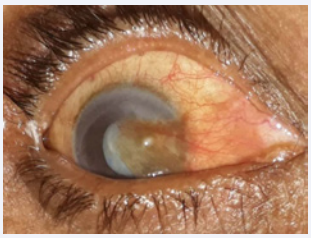

Figure 11 Recurrent pterygium Grade 4.

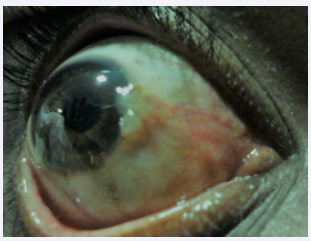

Figure 12 Grade 2 cystic degeneration pterygium.

Fuchs (1966) Parson Duke Elder [7] and many other advocated that pinguecula is a precursor of pterygium a further step in the same primary degenerative pathological process. It was provided by the constant finding in all cases of pinguecula and pterygium examined histo-pathologically showed early sign of hyaline and elastotic degenerative changes in the deeper part of the tissue.

Site of pterygium

Pterygium tissue is more commonly found on the nasal side of limbus due to more damage of nasal limbal stem cells by UV rays. The incidence of pterygium on nasal side was highest i.e. 90% as compared to 10% of bilateral pterygium. There was no temporal pterygium in the study (Table 3).

Elliot (1962) [8], Dr. Sabir Kamal [9] (1970), Corane MT [10] (1993), Thatte (2016) [11] found that in 60%cases of pterygium, nasal part of bulbar conjunctiva is more affected than temporal part as a result of sun rays passing unobstructed from the lateral side of the eye, focusing on the medial limbus after passing through cornea and damaging nasal limbal stem cells

Incidence of corneal involvement

Pterygium was classified into four grades according to corneal involvement [1].

Grade 1 –- Just at the limbus,

Grade2- less than 2mm involvement of cornea,

Grade 3- 2 to 4 mm involvement of cornea

Grade 4 - more than 4mm involvement, encroaching pupillary area.

We found that majority of cases corneal involvement was between 2-4mm (grade 2) i.e 70%, these findings were similar to findings of Khanna Nirankari et al. [12], (1971) and Shrinivas K Rao et al. [5], (1998).

Table 1: Age and sex ratio.

Age in years	Male	Female	Total
25-35	4(8%)	7(14%)	11(22%)
36-45	-	9(18%)	9(18%)
46-55	4(8%)	4(8%)	8(16%)
56-65	4(8%)	10(20%)	14(28%)
66-75	1(2%)	7(14%)	8(16%)
Total	13(26%)	37(74%)	50

Table 2: Grades of pterygium and site co-relation.

PTERYGIUM	Nasal	Double	Total
Grade 1	1(2%)		1(2%)
Grade 2	32(64%)	3(6%)	35(70%)
Grade 3	10(20%)	2(4%)	12(24%)
Grade 4	2(4%)		2(4%)
Total	45(90%)	5(10%)	50

Clinical type of pterygium

According to clinical types pterygium can be divided into fleshy, atrophic associated changes (cystic) and recurrent types. Maximum cases belonged to progressive (fleshy) type 82% while 12% were atrophic, 2% cystic and 4% recurrent pterygium. Similar to Khanna et al., study [12,13] (1971). No other studies evaluated incidence of nature of pterygium.

Comparison of grade and nature of pterygium

Goblet cell changes depends on the corneal encroachment (grade) and nature of pterygium. We have compared grade as well as nature of pterygium. Out of total 41 (82%) eyes with fleshy pterygium, 1 (2%) eye showed grade 1 pterygium, 28 (56%) grade 2, 11 (22%) grade 3 and 1 (2%) grade 4 pterygium.

Amongst minorgroup, 6 atrophic pterygium, 5 (10%) were grade 2 pterygium andremaining 1 (2%) was grade 3 pterygium. Out of 2 recurrent pterygium, one was with grade 2 and other with grade 4 pterygium. Cystic pterygium had grade 2 degree of corneal involvement (Table 4). In our very best of knowledge on reviewing literature, no other study recorded this comparison of grade and nature of pterygium with ocular surface damage demonstrated by impression cytology.

Grade of impression cytology

Pterygium is one of the commonest causes of goblet cell changes leading to ocular surface disorder. Goblet cell changes found in all types and nature of pterygium.

Grade 1 goblet cell changes were noted in 4 (8%) eyes, grade 2 in 12 (24%), grade 3 in 16 (32%), and grade 4 changes in 12 (24%). In 6 (12%) eyes sample was inadequate sample as they were taken in initial period of study.

Chan Cordelia ML. 2002 stated that ocular surface changes exist throughout the bulbar conjunctiva in eyes with pterygium.

Dr. İhsan, Dr. Kaan (2005) detected degenerative changes on impression cytology in all parts of conjunctiva but much more in pterygium tissue and superior bulbar conjunctiva.

Table 3: Co-relation between grade and types of Pterygium.

PTERYGIUM GRADE	Fleshy	Atrophic	MINOR Cystic	Recurrent	Total
Grade 1	1(2%)	-	-	-	1(2%)
Grade 2	28(56%)	5(10%)	1(2%)	1(2%)	35(70%)
Grade 3	11(22%)	1(2%)	-	-	12(24%)
Grade 4	1(2%)	-	-	1(2%)	2(4%)
Total	41(82%)	6(12%)	1(2%)	2(4%)	50

Table 4: Co-relation of Impression cytology in various types of pterygium.

Impression cytology	Fleshy	Atrophic	MINORCystic	Recurrent	Total
Grade 1	3(6%)				3(6%)
Grade 2	11(22%)	2(4%)	1(2%)		14(28%)
Grade 3	11(22%)	2(4%)		2(4%)	15(30%)
Grade 4	12(24%)				12(24%)
Inadequate	4(8%)	2(4%)			6(12%)
	41(82%)	6(12%)	1(2%)	2(4%)	50

Table 5: Co-relation of impressive cytology in various grades of pterygium.

Impression cytology	Grade 1 pterygium	Grade 2 pterygium	Grade 3 pterygium	Grade 4 pterygium	Total
Grade 1	1(2%)	2(4%)	-	-	3(6%)
Grade 2	-	11(22%)	1(2%)	1(2%)	13
Grade 3	-	10(20%)	5(10%)	1(2%)	15
Grade 4	-	6(12%)	6(12%)	-	12(24%)
Total		3(6%)	3(6%)		6(12%)
	1(2%)	32(64%)	15(30%)	2(4%)	50

Table 6: Co-relation between grades of impression cytology to various grades and types of pterygium.

	Grade 1				**Grade 2**				**Grade 3**				**Grade 4**				**total**
	F	A	C	R	F	A	C	R	F	A	C	R	F	A	C	R	
Grade 1(IC)	1																1
Grade 2(IC)					8	2	1		1	1			1				14(31.8%)
Grade 3(IC)					8(18.18%)			1	6	1						1	17(38.6%)
Grade 4(IC)					6(13.63%)				6								12(27.2%)
	1(2.27%)				26(59.09%)				15(34.09%)				2(4.54.%)				44

Bandyopadhyay R (2010) concluded aqueous tear film deficiency leads to ocular surface disorder which brings about a change at the cytological level, and ocular surface disorders found in pterygium. These changes can be studied by impression cytology.

In our study we have seen that, there is a variable amount of ocular surface disorder caused by pterygium. The amount of goblet cell changes were seen all over the conjunctiva which could be correlated to grade and nature of pterygium.

Comparison of grades of impression cytology with the corneal encroachment

To evaluate relation between extent of goblet cell damage and corneal encroachment an observation was done amongst the four grades of pterygium (Table 6).

1. Grade 1 Pterygium- We found that grade 1 pterygium had grade 1 goblet cell changes.

2. Grade 2 Pterygium - There were total of 29 eyes with grade 2 pterygium in the study. 2 (4%) eyes showed grade 1 goblet cell changes, 11 (22%) grade 2, 10 (20%) grade 3 and 6 (12%) eyes documented grade 4 goblet cell changes.

3. Grade 3 Pterygium - In 12 eyes of grade 3 pterygium, 1 (2%) had grade 2 goblet cell changes, 5 (10%) grade 3 and 6 (12%) grade 4 goblet cell changes.

4. Grade 4 Pterygium -Out of 2 grade 4 pterygium, grade 2 goblet cell changes were observed in 1 (2%) eye and grade 3 (2%) goblet cell changes were observed in the other eye (Table 6). This shows larger involvement of conjunctiva and ocular surface by pterygium is directly related to conjunctival goblet cell changes.

In our study amongst all grades of pterygium, incidence of grade 2 pterygium was highest. In total grade 2 pterygium, grade 2 goblet cell changes were seen in highest number (22%) which is similar to study conducted by Xing Ming EN et al. [1].

He stated that extent of ocular surface damage caused by pterygium is related to nature and corneal encroachment of pterygium.

Correlation of nature of pterygium and grades of impression cytology

We observed that goblet cell damage is proportional to various types of pterygium according to nature of pterygium. (fleshy, progressive, associated changes (cystic) and recurrent).

1. Fleshy Pterygium- Grade 2 (22%), grade 3 (22%) and grade 4 (24%) goblet cell changes were most frequently seen in changes among all the fleshy pterygium.

2. Minor group –

a) Atrophic Pterygium - Out of 6 atrophic pterygium grade 2 and gardec 3 changes were observed in 2 eyes (4%) in each category and 2 (4%) eyes had inadequate sample.

b) Cystic Pterygium –One cystic pterygium included in the study showed grade 2 goblet cell changes.

c) Recurrent Pterygium –There were two recurrent pterygium included in the study which showed grade 2 goblet cell changes (Table 5).

Correlation of goblet cell changes with the nature of pterygium was similar to study conducted by Xing Ming EN et al. [1]. He stated that extent of ocular surface damage caused by pterygium is related to nature and corneal encroachment of pterygium.

This was also observed in our study that ocular surface involvement by pterygium was directly related to goblet cell changes, as fleshy pterygium involves more ocular surface observed more goblet cell changes, though recurrent pterygium had previously damaged ocular surface but goblet cell damage was proportionate to grade of pterygium in recurrent pterygium also.

Correlation of goblet cell changes with corneal encroachment and nature of pterygium

Pterygium causes changes in goblet cell morphology is a well-known factor. We compared goblet cell changes with the nature and corneal encroachment (grades)

1) Grade 1 goblet cell changes –It was seen only in one case of grade 1 fleshy pterygium (2.27%).

2) Grade 2 goblet cell changes – There were total 31.8% (14) grade 2 goblet changes seen in the study. Out of which Grade 2 pterygium were observed in 18.8% (8) fleshy pterygium, 4.54% (2) atrophic pterygium, 2.27% (1) cystic pterygium. In grade 3 pterygium, 2.27% (1) fleshy pterygium, 2.27% (1) atrophic pterygium and grade 4 pterygium included 2.27% (1) fleshy pterygium.

3) Grade 3 goblet cell changes -17 eyes had grade 3 goblet cell changes. Out of which grade 2 pterygium were seen in 8 (18.8%) fleshy pterygium, 1 (2.27%) recurrent pterygium and grade 3 pterygium were seen in 6 (13.6%) fleshy pterygium and 1(2.27%) atrophic. Only one case had grade 4 recurrent pterygium 1 (2.27%).

4) Grade 4 goblet cell changes – Grade 4 goblet cell changes were observed in 12 (27.2%) eyes. All were fleshy pterygium with 13.6% (6) grade 2 and 13.6% (6) grade 3 (Table 7).

We observed that goblet cell changes depends on both nature i.e. fleshy and grade 3 and 4 of pterygium had more goblet cell changes. So we conclude from the present study that amount of goblet cell changes caused by pterygium are in proportional with the nature and corneal encroachment of pterygium which is similar to study conducted by Xing Ming EN et al. [1].

CONCLUSION

Pterygium is one the common cause of ocular surface disorder which can be evaluated by studying goblet cell morphology. These changes vary with grade and nature of pterygium. It was observed that fleshy pterygium with 2-4 mm of corneal involvement had maximum alteration in goblet cell morphology. Amount of ocular surface damage caused by pterygium varies according to nature and corneal encroachment of pterygium.

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