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# A CLINICAL EVALUATION OF LESIONS AT LIMBUS

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**ABSTRACT** **Background-** The present study aimed to determine the prevalence of limbal lesions in a hospital-based population at a tertiary eye care center in India to identify the risk factors associated with lesions at the limbus. **Methodology-**This study was conducted as a cross-sectional observational study on 180 patients with limbal lesions, attending the OPD at a tertiary eye care center from March 2023 to August 2024. A detailed history and ocular examination were done along with Ultrasound biomicroscopy. Histopathology was done in selected cases. **Results-** Prevalence of limbal lesions was 3.45%Pterygium was the most common limbal lesion (31.2% eyes), followed by pinguecula (22.9%), phlycten (15.6%), limbal VKC (10.4%), nodular episcleritis (3.00%) and naevus (2.2%). We found advancing age, outdoor work, rural residence and summer season to be significantly associated with a high risk of pterygium ($p<0.05$). Pingecula was significantly associated with female gender ($p<0.05$). Significantly higher proportions of patients with phlycten belonged to younger age (<40 years), were engaged in indoor or household chores, and were unilateral ($p<0.05$). Limbal VKC was associated with younger age, male gender, indoor work, and significantly higher proportions of cases with limbal VKC had bilateral VKC ($p<0.05$). **Conclusions-** This study provides valuable insights into the prevalence and risk factors of limbal lesions in a hospital-based population. The findings underscore the importance of considering demographic, occupational, and environmental factors in the management and prevention of these lesions. UBM proves to be a valuable tool in the assessment of solid limbal lesions, aiding in accurate diagnosis and treatment planning.

**KEYWORDS :** limbal lesions, Pterygium, Pingecula, Phlycten, risk factors, UBM

## INTRODUCTION

The limbus, located at the junction of the cornea and sclera, plays a vital role in both the structure and function of the eye. As a narrow

transitional zone, it not only ensures the anatomical continuity between the transparent cornea and the opaque sclera but also contains limbal stem cells.

These stem cells are essential for the ongoing regeneration of the corneal epithelium, thus maintaining corneal clarity and vision.[1]

Limbal lesions are one of the most frequent presenting complaints in the ophthalmic outpatient department because the limbus is readily seen, and patients notice any change in their ocular appearance. Limbal lesions encompass a broad spectrum of conditions, ranging from non-cancerous growths such as pinguecula and pterygium to pre-cancerous and malignant tumors, including conjunctival intraepithelial neoplasia (CIN), squamous cell carcinoma (SCC), and melanoma. Additionally, some of these lesions may represent localized signs of systemic conditions, such as conjunctival lymphoma or amyloidosis. Clinically, these conditions often present as elevated, pigmented, or vascular lesions, making accurate diagnosis challenging. For this reason, detailed clinical assessments combined with histopathological confirmation are often required to differentiate between them. Also, lesions arising in this area are particularly challenging to manage due to their diverse origins, the potential for malignancy, and the anatomical importance of their location near vision-critical ocular structures.[2]

The limbus is also crucial for preserving visual function. Visual morbidity may result from the encroachment of limbal lesions into the visual axis; this may lead to astigmatism. It also causes diplopia due to the limitation of ocular movements. In the case of a limbal dermoid along with encroachment into the visual axis, there is lipid infiltration of the cornea. Staphyloma formation adjacent to the dermoid has also been reported and may be associated with spontaneous perforation of the cornea or the sclera. Damage or loss of the limbal stem cells, a condition known as limbal stem cell deficiency (LSCD), can lead to serious consequences such as conjunctivalization of the cornea, neovascularization, chronic inflammation, and progressive vision loss. Recurrent or extensive limbal lesions, such as multiple pterygia, can either cause or worsen LSCD, further complicating both diagnosis and treatment. [3-5]

Ultrasound biomicroscopy (UBM) is a recent technique to visualize the anterior segment with the help of a high-frequency ultrasound transducer.[6] The first practical UBM system for imaging of the eye was developed by Foster and Pavlin in the early 1990s.[7] The anterior segment has a depth of 4-5 mm, and the structures are close to each other, so we require a higher frequency probe.UBM (anterior segment ultrasonography) is performed with a 50 MHz probe. The resolution of the 50 MHz probe is 40 microns and the depth is 4mm2.

UBM helps in the differentiation of scleritis from episcleritis and helps in the early detection of sclera necrosis. UBM allows precise measurement and visualization of subsurface features of small lesions and differentiates easily between solid and cystic lesions.[6]

Despite the clinical importance of lesions at the limbus, there is a lack of comprehensive research focusing solely on this anatomical region. Existing literature primarily includes case reports or condition-specific studies, without providing a broader understanding of the full spectrum of limbal pathologies. This absence of large-scale, focused research makes it difficult to develop standardized diagnostic and treatment protocols. Given the potential severity and risk of malignant transformation or local invasion, timely diagnosis and intervention are imperative. While having a holistic approach to treat the disease, the ophthalmologist must be well adapted at recognizing lesions at the limbus from the history and ophthalmic examination that warrant management.

The present study aimed to determine the prevalence of limbal lesions in a hospital-based population at a tertiary eye care center of India to find out the risk factors associated with lesions at the limbus.

## METHODOLOGY

The present study was conducted as a cross-sectional observational study on 180 patients with limbal lesions, attending the OPD at a tertiary eye care center from March 2023 to August 2024. All consecutive patients who presented with lesions at the limbus in the outpatient department, irrespective of age and sex and giving consent for the study were included, whereas patients with Globe perforation with iris tissue prolapsed at the limbus and those not willing to participate in the study were excluded.

After obtaining ethical clearance from the Institute's ethical committee, all the patients satisfying the inclusion and exclusion

criteria were enrolled, and a detailed history was obtained regarding sociodemographic variables, clinical history, family history, etc.,and was documented in a proforma. An ocular examination was done in detail. Visual Acuity (VA) was assessed using the Snellen chart. A thorough external examination of the anterior segment was done using a slit lamp, and the location, depth, the penetration on cornea, sclera and AC (anterior chamber) were observed.

**Table 1 Distribution Of Patients According To Baseline Variables**

| Baseline Variables | | Frequency (n=180) | Percentage |
|---|---|---|---|
| Age (years) | ≤20 | 54 | 30.0 |
| | 21 to 40 | 66 | 36.7 |
| | 41 to 60 | 46 | 25.6 |
| | >60 | 14 | 7.8 |
| Gender | Male | 91 | 50.6 |
| | Female | 89 | 49.4 |
| Occupation | Business | 15 | 8.3 |
| | Carpenter | 1 | 0.6 |
| | Farmer | 25 | 13.9 |
| | Govt. Servant | 2 | 1.1 |
| | Teacher | 2 | 1.1 |
| | Labourer | 24 | 13.3 |
| | Preschool age | 2 | 1.1 |
| | Student | 50 | 27.8 |
| | Homemaker | 59 | 32.8 |
| Locality | Rural | 99 | 55.0 |
| | Urban | 81 | 45.0 |
| Laterality | Bilateral | 51 | 28.3 |
| | Unilateral | 129 | 71.7 |
| Season | Summer (Mar-Jun) | 94 | 52.2 |
| | Rainy (Jul-Oct) | 45 | 25.0 |
| | Winter (Nov-Feb) | 41 | 22.8 |

Intraocular pressure was assessed using the applanation tonometer. Fundus Examination was done using a Direct/ Indirect Ophthalmoscope. Apart from this, Keratometry and Autorefractometry were also done and the findings were documented.

The UBM (Ultrasound biomicroscopy) procedure to be done was explained to the patients, and informed written consent was taken for UBM under a guarded prognosis. All examinations of this study were performed with the UBM Model Reflex, Reichert Technologies, with a 50 MHz transducer probe. The image has a lateral and axial physical resolution of approximately 50 μ and 25 μ respectively, and a penetration depth of 4-5mm.

After instilling 4% lignocaine drops in the eye, a plastic eyecup was used to gently part the lids and retain a layer of distilled water, which is required as a media and also avoids injury to the globe. Scanning was performed under standard lighting conditions for position, and the probe was manually moved perpendicular to the structure to be scanned. The patient was then instructed to move the eyeball upwards, downwards, nasally, and temporally to delineate a better anatomy of the limbal lesions.

The longitudinal and transverse scan was performed at the level of the lesion. The cornea and sclera can be readily differentiated on the UBM, owing to their different echogenic properties.

Any lesion detected was evaluated for location, depth, and penetration on cornea, sclera, and AC.

Histopathology was done on the patients in which a diagnosis was not made clinically or by SLE. The procedure to be done was explained to the patients. Informed written consent was taken by the patients for histopathology.

**Statistical Analysis-**

All statistical analysis was performed on Microsoft Office Excel. Data was analyzed using IBM SPSS (Statistical Package for Social Science) software version 20 (IBM Corp. Illinois Chicago). Values were recorded as frequency and mean ± standard deviation (2SD).

## RESULTS

In present study 180 out of 5210 OPD patients were diagnosed with limbal lesions, making prevalence 3.45% of limbal lesions in hospital based population in a period of 1.5 yr duration.This study was thus conducted on 231 eyes of 180 patients presenting with limbal lesions at our study area during the study period.

The mean age of patients was 33.4±18.9 years and majority of patients belonged to 21 to 40 years of age (36.7%). Male attributed to 50.6% of the study population. About 32.8% patients were homemaker and 27.8% were students. About 55% patients were resident of rural area. About 27.8% patients had bilateral limbal lesions whereas 72.2% patients had unilateral limbal lesions.Majority of the patients presented in summer season (52.2%) followed by rainy (25%) and winter (22.8%) seasons. (Table 1).

As observed from the above table, pterygium was the most common limbal lesion, observed in 31.2% eyes, of them, 93.1% eyes had nasal pterygium. This was followed by pinguecula (22.9%), phlycten (15.6%), limbal VKC (10.4%), nodular episcleritis (3.00%) and naevus (2.2%). Other limbal lesions are depicted in table 2.

**Table 2- Distribution Of Eyes According To Limbal Lesions**

| Limbal lesions | Nasal | | Temporal | | Other | | Total (n=231) | |
|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % |
| Pterygium | 67 | 93.1 | 1 | 1.4 | 4 | 5.6 | 72 | 31.2 |
| Pinguecula | 49 | 92.5 | 0 | 0.0 | 4 | 7.5 | 53 | 22.9 |
| Phlycten | 4 | 11.1 | 11 | 30.6 | 21 | 58.3 | 36 | 15.6 |
| Limbal VKC | 0 | 0.0 | 24 | 100.0 | 0 | 0.0 | 24 | 10.4 |
| Nodular Episcleritis | 0 | 0.0 | 1 | 14.3 | 6 | 85.7 | 7 | 3 |
| Naevi | 1 | 20.0 | 0 | 0.0 | 4 | 80.0 | 5 | 2.2 |
| Melanosis | 0 | 0.0 | 4 | 100.0 | 0 | 0.0 | 4 | 1.7 |
| Nodular scleritis | 1 | 25.0 | 1 | 25.0 | 2 | 50.0 | 4 | 1.7 |
| Foreign body | 0 | 0.0 | 1 | 33.3 | 2 | 66.7 | 3 | 1.3 |
| Limbal Dermoid | 0 | 0.0 | 1 | 33.3 | 2 | 66.7 | 3 | 1.3 |
| Squamous dysplasia | 2 | 66.7 | 0 | 0.0 | 1 | 33.3 | 3 | 1.3 |
| Adherent leucoma | 0 | 0.0 | 1 | 50.0 | 1 | 50.0 | 2 | 0.9 |
| Bitot's spot | 0 | 0.0 | 0 | 0.0 | 2 | 100.0 | 2 | 0.9 |
| Conjunctival Cyst | 2 | 100.0 | 0 | 0.0 | 0 | 0.0 | 2 | 0.9 |
| Lipoma | 0 | 0.0 | 2 | 100.0 | 0 | 0.0 | 2 | 0.9 |
| Filtering bleb | 0 | 0.0 | 1 | 100.0 | 0 | 0.0 | 1 | 0.4 |
| Granuloma | 1 | 100.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.4 |
| Intercalary Staphyloma | 0 | 0.0 | 1 | 100.0 | 0 | 0.0 | 1 | 0.4 |
| Leprotic granuloma | 0 | 0.0 | 0 | 0.0 | 1 | 100.0 | 1 | 0.4 |
| CB tumour | 0 | 0.0 | 0 | 0.0 | 1 | 100.0 | 1 | 0.4 |
| Papilloma | 1 | 100.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.4 |
| Pigmented nodule melanoma | 0 | 0.0 | 0 | 0.0 | 1 | 100.0 | 1 | 0.4 |
| Pseudopterygium | 0 | 0.0 | 1 | 100.0 | 0 | 0.0 | 1 | 0.4 |
| Squamous neoplasia | 0 | 0.0 | 1 | 100.0 | 0 | 0.0 | 1 | 0.4 |

**Table 3- Risk Factors Of Pterygium**

| Baseline variables | | Pterygium | | | | P value |
|---|---|---|---|---|---|---|
| | | Absent (n=159) | | Present (n=72) | | |
| | | n | % | n | % | |
| Age (years) | ≤40 | 124 | 78 | 26 | 36.1 | **0.001** |
| | >40 | 35 | 22 | 46 | 63.9 | |
| Gender | Male | 79 | 49.7 | 39 | 54.2 | 0.53 |
| | Female | 80 | 50.3 | 33 | 45.8 | |
| Occupation | Indoor workers (Homemaker, students, preschool children, Business, teacher) | 133 | 83.6 | 23 | 31.9 | **0.001** |
| | Outdoor workers (carpenter, farmer, labourer, Govt. servant, Business) | 26 | 16.4 | 49 | 68.1 | |
| Locality | Rural | 83 | 52.2 | 51 | 70.8 | **0.008** |
| | Urban | 76 | 47.8 | 21 | 29.2 | |
| Laterality | Bilateral | 61 | 38.4 | 41 | 56.9 | **0.008** |
| | Unilateral | 98 | 61.6 | 31 | 43.1 | |
| Season | Summer (Mar-Jun) | 85 | 53.5 | 34 | 47.2 | **0.002** |
| | Rainy (Jul-Oct) | 48 | 30.2 | 12 | 16.7 | |
| | Winter (Nov-Feb) | 26 | 16.4 | 26 | 36.1 | |

In our study, we found advancing age, outdoor work, rural residence and summer season to be significantly associated with high risk of pterygium ($p<0.05$). Also, significantly higher proportions of pterygium were bilateral ($p<0.05$) (Table 3).

We observed pingecula to be significantly associated with female gender ($p<0.05$) (Table 4).

**Table 4- Risk Factors Of Pingecula**

| Baseline variables | | Pingecula | | | | P value |
|---|---|---|---|---|---|---|
| | | Absent (n=178) | | Present (n=53) | | |
| | | n | % | n | % | |
| Age (years) | ≤40 | 113 | 63.5 | 37 | 69.8 | 0.397 |
| | >40 | 65 | 36.5 | 16 | 30.2 | |
| Gender | Male | 103 | 57.9 | 15 | 28.3 | **0.001** |
| | Female | 75 | 42.1 | 38 | 71.7 | |
| Occupation | Indoor workers | 119 | 66.9 | 37 | 69.8 | 0.686 |
| | Outdoor workers | 59 | 33.1 | 16 | 30.2 | |
| Locality | Rural | 102 | 57.3 | 32 | 60.4 | 0.691 |
| | Urban | 76 | 42.7 | 21 | 39.6 | |
| Laterality | Bilateral | 77 | 43.3 | 25 | 47.2 | 0.62 |
| | Unilateral | 101 | 56.7 | 28 | 52.8 | |
| Season | Summer | 93 | 52.2 | 26 | 49.1 | 0.48 |
| | Rainy | 43 | 24.2 | 17 | 32.1 | |
| | Winter | 42 | 23.6 | 10 | 18.9 | |

**Table 5-Risk factors of phlycten**

| Baseline variables | | Phlycten | | | | P value |
|---|---|---|---|---|---|---|
| | | Absent (n=195) | | Present (n=36) | | |
| | | n | % | n | % | |
| Age (years) | ≤40 | 114 | 58.5 | 36 | 100 | **0.001** |
| | >40 | 81 | 41.5 | 0 | 0 | |
| Gender | Male | 97 | 49.7 | 21 | 58.3 | 0.344 |
| | Female | 98 | 50.3 | 15 | 41.7 | |
| Occupation | Indoor workers (Homemaker, students, preschool children, Business, teacher) | 120 | 61.5 | 36 | 100 | **0.001** |
| | Outdoor workers (carpenter, farmer, labourer, Govt. servant, Business) | 75 | 38.5 | 0 | 0 | |
| Locality | Rural | 118 | 60.5 | 16 | 44.4 | 0.073 |
| | Urban | 77 | 39.5 | 20 | 55.6 | |
| Laterality | Bilateral | 96 | 49.2 | 6 | 16.7 | **0.001** |
| | Unilateral | 99 | 50.8 | 30 | 83.3 | |
| Season | Summer (Mar-Jun) | 102 | 52.3 | 17 | 47.2 | 0.85 |
| | Rainy (Jul-Oct) | 50 | 25.6 | 10 | 27.8 | |
| | Winter (Nov-Feb) | 43 | 22.1 | 9 | 25 | |

Significantly higher proportions of patients with phlycten belonged to younger age (<40 years), were engaged in indoor or household chores and were unilateral ($p<0.05$) (table 5).

**Table 6- Risk Factors Of Limbal VKC**

| Baseline variables | | Limbal VKC | | | | P value |
|---|---|---|---|---|---|---|
| | | Absent (n=207) | | Present (n=24) | | |
| | | n | % | n | % | |
| Age (years) | ≤40 | 126 | 60.9 | 24 | 100 | **0.001** |
| | >40 | 81 | 39.1 | 0 | 0 | |
| Gender | Male | 100 | 48.3 | 18 | 75 | **0.013** |
| | Female | 107 | 51.7 | 6 | 25 | |
| Occupation | Indoor workers (Homemaker, students, preschool children, Business, teacher) | 133 | 64.3 | 23 | 95.8 | **0.002** |
| | Outdoor workers (carpenter, farmer, labourer, Govt. servant, Business) | 74 | 35.7 | 1 | 4.2 | |
| Locality | Rural | 119 | 57.5 | 15 | 62.5 | 0.64 |
| | Urban | 88 | 42.5 | 9 | 37.5 | |
| Laterality | Bilateral | 82 | 39.6 | 20 | 83.3 | **0.001** |
| | Unilateral | 125 | 60.4 | 4 | 16.7 | |
| Season | Summer (Mar-Jun) | 102 | 49.3 | 17 | 70.8 | 0.134 |
| | Rainy (Jul-Oct) | 56 | 23.7 | 3 | 12.5 | |
| | Winter (Nov-Feb) | 49 | 23.7 | 3 | 12.5 | |

The present study found a significant association of limbal VKC with younger age, male gender, indoor work, and significantly higher proportions of cases with limbal VKC had bilateral VKC ($p<0.05$) (table 6).

**Table 7-Risk Factors Of Other Limbal Lesions**

| Baseline variables | | Other limbal lesions | | | | P value |
|---|---|---|---|---|---|---|
| | | Absent (n=185) | | Present (n=46) | | |
| | | n | % | n | % | |
| Age (years) | ≤40 | 123 | 66.5 | 27 | 58.7 | 0.32 |
| | >40 | 62 | 33.5 | 19 | 41.3 | |
| Gender | Male | 93 | 50.3 | 25 | 54.3 | 0.62 |
| | Female | 92 | 49.7 | 21 | 45.7 | |
| Occupation | Indoor workers (Homemaker, students, preschool children, Business, teacher) | 119 | 64.3 | 37 | 80.4 | **0.04** |
| | Outdoor workers (carpenter, farmer, labourer, Govt. servant, Business) | 66 | 35.7 | 9 | 19.6 | |
| Locality | Rural | 114 | 61.6 | 20 | 43.5 | **0.03** |
| | Urban | 71 | 38.4 | 26 | 56.5 | |
| Laterality | Bilateral | 92 | 49.7 | 10 | 21.7 | **0.001** |
| | Unilateral | 93 | 50.3 | 36 | 78.3 | |
| Season | Summer (Mar-Jun) | 94 | 50.8 | 25 | 54.3 | **0.02** |
| | Rainy (Jul-Oct) | 43 | 23.2 | 17 | 37 | |
| | Winter (Nov-Feb) | 48 | 25.9 | 4 | 8.7 | |

The present study found a significant association of other limbal lesions with indoor work, urban locality, unilateral disease and summer season ($p<0.05$) (table 7).

## DISCUSSIONS

The present study observed a 3.45% prevalence of limbal lesions among 5210 outpatient department (OPD) patients over a 1.5-year period, with 231 eyes of 180 patients included in the analysis. The study also identified pterygium as the most common limbal lesion, accounting for 31.2% of cases, followed by pinguecula (22.9%) and phlycten (15.6%). This rate is notably higher than the global prevalence of pterygium, which ranges from 12% to 13.2% in various populations.[8]

The study found a significant association between pterygium and advancing age, outdoor occupations, rural residence, and summer season. These findings align with the findings of Rezvan et al, indicating that pterygium prevalence increases with age and is more common in individuals with outdoor occupations and those residing in rural areas.[8]Similarly, a study in Korea reported a 6.7% prevalence among individuals aged 30 and older, with male gender, lower education, rural habitation, and sun exposure identified as risk factors.[9]These findings are corroborated by the Tehran Geriatric Eye Study, which found a higher prevalence of pterygium in men and an association with lower socioeconomic status and education level.[10] Additionally, a study in Saudi Arabia reported increased pterygium prevalence with age, outdoor occupations, and sunlight exposure.[11] Pinguecula was predominantly observed in females, with a significant gender association noted in the study. This contrasts with the findings of Fotouhi et al, where pinguecula was more prevalent in males. The study did not find significant associations with age, occupation, or seasonality for pinguecula.[10]

Phlycten was significantly associated with younger age, indoor occupations, and unilateral involvement. These findings are consistent with previous studies highlighting that phlycten is more common in younger individuals and those with indoor occupations.[12-14]

Limbal VKC was significantly associated with younger age, male gender, indoor occupations, and bilateral involvement. These associations are corroborated by the EPIC VKC study, which reported a higher prevalence of VKC in males and younger age groups,

particularly in rural areas. Other limbal lesions were significantly associated with indoor occupations, urban locality, unilateral involvement, and summer season. These findings suggest that environmental and occupational factors play a role in the development of these lesions.[15]

UBM was instrumental in assessing the depth of solid lesions like dermoid, papilloma, lipoma, and squamous neoplasia, and in differentiating between cystic and solid lesions. It also helped in detecting pterygium encroachment into the corneal layers and distinguishing between pterygium and pseudopterygium. However, UBM had no role in diagnosing flat lesions such as melanosis, bitot's spot, and naevus.UBM proved valuable in differentiating between solid and cystic limbal lesions and assessing their depth of penetration. A study on scleritis and episcleritis highlighted UBM's utility in detecting scleral necrosis and differentiating between scleritis subtypes. Furthermore, UBM aided in distinguishing pterygium from pseudopterygium by visualizing the lesion's depth and scleral involvement.[16,17]

## CONCLUSIONS

Our study showed that most common limbal lesions in decreasing order of frequency were pterygium, pinguecula, phlycten, limbal VKC, nodular episcleritis, naevus, foreign body, nodular scleritis, melanosis, limbal dermoid, squamous dysplasia. Outdoor occupation was associated with pterygium but not with pinguecula. This study provides valuable insights into the prevalence and risk factors of limbal lesions in a hospital-based population. The findings underscore the importance of considering demographic, occupational, and environmental factors in the management and prevention of these lesions. UBM proves to be a valuable tool in the assessment of solid limbal lesions, aiding in accurate diagnosis and treatment planning.

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