Pterygium in Uganda: A hospital-based study

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Abstract: To determine the prevalence of pterygium and its associated factors in patients attending Mulago National Referral Hospital Eye Clinic. This was a prospective hospital-based cross-sectional study conducted between January 2019 and March 2019. We selected 516 patients from Mulago Hospital eye clinic(s) using a multistage stratified probability sampling technique. A thorough history and clinical examination were conducted; a pre-tested questionnaire was filled out. Data were entered into a computer using EpiData 3.1 and analysed using STATA 11. A total of 516 patients were recruited of whom 60.3% were female and 39.7% were male. Out of the 516 patients, 70 (13.6%) had pterygium. Pterygium occurrence was associated with Age above 40 years (OR 13.59, 95% CI: 1.78–103.95, p = 0.012), Family history (OR 3.56, 95% CI: 1.72–7.35, p = 0.001), Alcohol intake (OR 2.21, 95% CI: 1.13–3.97, p = 0.02) and Dust exposure (OR 1.81, 95% CI: 1.03–3.19, p = 0.04). The prevalence of pterygium was high in our study and found to be positively associated with increasing age, positive family history, alcohol intake and dust exposure.

Subjects: Climatology; Risk, Science & Technology; Aging; Ophthalmology

Keywords: pterygium; prevalence; Uganda; Mulago; associated factors; hospital

ABOUT THE AUTHOR

Erima Denis has recently completed his residency in Ophthalmology at Makerere University College of Health Sciences Kampala and currently works at Lubaga Hospital in Uganda. He and his colleagues conducted this study as a dissertation in part fulfillment of the requirements to complete the academic program.

The Author also participated in the recently completed Gambia National Eye Health Survey 2019 along with several other colleagues who made the project successful. He is currently working on write-ups from that study: particularly a population based review of pterygium in the Gambian population. As such, the research reported in this paper provides a good foundation for understanding and reporting on the subject matter at a population level.

PUBLIC INTEREST STATEMENT

THE SUN AND YOUR EYES

Pterygium is a triangular-shaped growth on the surface of the eye caused by exposure to sunshine. It is common in places with hot and dusty climate and has been shown to occur more frequently in people who spend more time outdoors. We studied the occurrence of this condition amongst patients attending our eye clinic, in order to establish the magnitude of the disease in our community and determine factors associated with its presence. We found the highest so far recorded magnitude of this condition. Interestingly, however, there was no difference in how often the condition occurred amongst people who either spent less or more time outdoors. Some theories have indicated that: provided the region is sunny enough, the damage caused by sunshine to your eyes occurs much earlier in childhood making it nearly impossible to prevent the manifestation of this condition later on in life.
1. Introduction

Pterygium is an ocular surface disorder that was first described and studied before 1000BC by Susrata (William Rosenthal, 1953). It is a wing-shaped fibro-vascular growth of the conjunctiva that invades the cornea and has a diversely variable prevalence: being as low as 2.83% in some regions and as high as 39.0% in others (McCarty, 2000; Zhong et al., 2012). The global pooled prevalence has been estimated at 10.2% (Liu, Wu, Geng, Yuan, & Huang, 2013).

While pterygium is generally considered to be a non-blinding disease, it can cause refractive errors and is cosmetically unappealing (Gumus, Erkilic, Topaktas, & Colin, 2011). Globally, uncorrected refractive errors are a major cause of blindness and low vision: it is estimated that 145 million people have impaired vision due to lack of adequate refractive correction and this leads to a potential loss of productivity (Resnikoff, Pascolini, Mariotti, & Pokharel, 2008; Smith, Fricke, Holden, Fricke, & Naidoo, 2009). Since cataract is the leading cause of blindness, many national eye care programs and policies focus on cataracts and seem to neglect or underestimate the impact of ocular surface disorders such as pterygium.

Furthermore, the hazardous effect of Ultra Violet (UV) radiation to humanity has been well documented (Lucas, McMicheal, Smith, Armstrong, & Prüss-Ustün, 2006). Particularly in the eye, it has been associated with such conditions as pterygium, pingueculum, photokeratoconjunctivitis and squamous cell carcinoma. This necessitates a move towards raising awareness of such disease processes and appropriate behavioural modification to reduce exposure.

Pterygium tends to be more prevalent in tropical and equatorial regions and has been strongly associated with exposure to sunshine.

Uganda is in the equatorial region and over 72% of the population is predominantly dependent on agriculture (Statistics UBO, 2013) which translates into multiple outdoor hours and thus exposure to UV radiation. Its capital city, Kampala has a population estimate of 1,570,080 people (Statistics UBO, 2013) most of whom are casual labourers: they get exposed to dust and wind which are both implicated in the development of pterygia. Other factors such as age and socio-economic status, sex have been found to be positively associated with the occurrence of pterygium. But yet, no data exist on the overall prevalence of pterygium and factors associated with its development in our region.

2. Materials and methods

This was a prospective hospital-based cross-sectional study conducted at Mulago National Referral Hospital, which is a tertiary hospital located in the capital city of Uganda (Kampala). Ethical approval was obtained from the Makerere University School of Medicine Institutional Review Board. A modification of Leslie’s Kish sample size estimation formula was used to calculate a maximum total sample size of 516 patients. Eligible patients were recruited using systematic probability sampling until the required number was obtained. Since the eye clinic was divided into 2 sub-clinics, 258 patients were recruited from each clinic. The first patient to be enrolled in the study for each clinic was randomly selected on the first day of the study using a computer-generated random number between one and five. Exclusivity between clinics was maintained.

2.1. Inclusion criteria

- All patients who attended Mulago National Referral Hospital Eye Clinic(s) between January and March 2019.
- All patients in the above category who gave informed consent/Assent.
2.2. Exclusion criteria

- Patients who were very sick.

Patients who agreed to participate in the study were educated sufficiently by a research assistant on the intentions and scope of the study and then made to sign consent forms. The research assistants then administered a semi-structured questionnaire to collect demographic data and relevant clinical history/dependable variable data. A detailed ocular examination was performed for every study participant by the Principle Investigator and supervising ophthalmologists at the clinic.

Visual acuity (V/A) was measured using a Snellen chart at 6 m or illiterate E chart; those with V/A less than 6/6 were reassessed with a pinhole. Refraction for distance vision and possible astigmatism was done using an Auto-refractor (Canon RK-5) at the eye clinic and validated using Subjective refraction to give the final spectacle correction.

Pterygium, when found, was categorized and graded using clinical classification module Table 1:

| Stage 1 | The head of the pterygium did not reach the midline between the limbus and pupillary margin. |
| Stage 2 | The head of the pterygium passes the midline but did not reach the pupil. |
| Stage 3 | The head of the pterygium passed the pupillary margin. |

2.3. Data analysis

Bivariable analysis was performed to assess the association between each independent variable and the occurrence of pterygium using simple logistic regression. The strength of the association was assessed using the odds ratios and 95% confidence intervals of the odds ratio. Multiple logistic regression model was run to determine the simultaneous associations between the independent variables and the outcome. Variables with a p-value of <0.20 at bivariate analysis were considered for the multivariable model. Collinearity was assessed using $r = 0.4$ as a threshold.

3. Results

A total of 516 patients were selected using the predetermined sampling method. There were 205 males (39.7%) and 311 females (60.3%) in this study. Out of the 516 patients, 70 patients (13.6%) had pterygium in at least one eye (95% CI: 11.0%-17.0%). There were more females with pterygium (62.9%) than males (37.1%).

Pterygium was exclusively present in the Right eye for 28 (40%) patients and in the Left eye for 37 (53%) patients whereas 5 (7.1%) patients had the condition in both eyes. Figure 1 is a Venn diagram representing this, whereas Figure 2 shows the Age and Sex distribution amongst patients with pterygium:

When the factors associated with pterygium occurrence were analysed using both bivariate and multivariate models. Only the association between pterygium and: Age, Level of Education, Dust exposure, Alcohol use and Family history remained statistically significant (p-value less than 0.20).
after multivariate analysis. Most of these factors were positively associated with Age having the highest Odds Ratio (OR) followed by Positive family history. A side by side comparison of the results of the analysis is shown in Table 2.

4. Discussion
The prevalence of pterygium among patients attending Mulago Eye Clinic was found to be 13.6% was much higher than that found in other hospital-based studies. In a study conducted by Pooja Shrestha et al. (Shrestha & Kaiti, 2016) the prevalence was found to be 2.4% in Nepal whereas Alqohtani et al. (Alqohtani, 2013) found a prevalence of only 0.074% in Saudi Arabia.
In Nepal, the authors believed that the low prevalence was due to a referral bias and therefore not a true representation of the target population much as the environmental conditions favoured a higher prevalence. Additionally, they argued that Kathmandu (Nepal) is at a lower altitude of 1,400 m and perhaps this reduced the impact of UV radiation. Kampala is at an altitude of 1,190 m and the selection criteria for patients were similar to that in the Nepal study, perhaps the only significant environmental difference is that Kampala lies closer to the equator (72 km) and therefore still has higher levels of UV radiation. The average UV index of Kampala is 12, whereas that of Kathmandu only reaches this high during four summer months in a year. (Weather Atlas, 2019) There are also significant ethnic and cultural differences between these two regions that could explain the difference in prevalence since the aetiology of pterygium is multifactorial.

Alqahtani and colleagues clearly pointed out that their hospital-based study in Alkhobar Saudi Arabia generated such a low prevalence of 0.074% because of its strict selection criteria. In the author’s own words:

This low rate is due to the inclusion of only the advanced pterygia (pterygium amenable to surgical treatment) in the study. (Alqahtani, 2013)

Global meta-analysis estimates the prevalence of pterygium at 10.2% (95% CI: 6.3%-16.1%) but the authors admit that this is highly variable from one region to another. (Liu et al., 2013) Our prevalence of 13.6% is slightly higher than this average but cannot be fairly compared due to the difference in the design of the studies. Hospital-based studies do not have the statistical power to infer upon the general population, but they offer a window for hypothesis development and a foundation for community-based studies. The prevalence of pterygium from our study is the highest so far found in any published Hospital-based study of similar design.

Our study found a positive association between age and pterygium occurrence: especially age above 40 years (OR 13.59, 95% CI: 1.78-103.95, p = 0.012). This is backed by scientific theories of cumulative UV propagated damage and similar findings were reported in other studies. (Liu et al., 2013; Saw, Banerjee, & Tan, 2000; Shrestha & Kaiti, 2016) Many population-based studies target the age group above 40 years, but as our study revealed, there was a high enough occurrence of pterygium within the age group 18-40 years (OR 8.39, 95% CI: 1.08, 65.33, p = 0.042).

We as well found a positive association between pterygium and positive family history (OR 5.16, 95% CI: 2.63–10.13, p < 0.001). Some studies have managed to test and prove genetic influence in the pathophysiology of pterygium (Islam & Wagoner, 2001; Kau, Tsai, Hsu, Liu, & Wei, 2004; Tan, Lim, Goh, & Smith, 1997; Tsai et al., 2007) while others have disputed such theories (Dos Reis et al., 2015). Apart from the clustered case series (Romano, Steger, Kovacova, Kaye, & Willoughby, 2016), few other
studies have tried to capture this relationship. (Anguria, Ntuli, Interewicz, & Carmichael, 2012; Booth, 1985) More research is warranted in this area.

Our study found that dust exposure had a positive association with the development of pterygium (OR 1.81, 95% CI: 1.03, 3.19, p = 0.04). This is consistent with several other studies (Achigbu & Ezepue, 2014; Mackenzie, Hirst, Battistutta, & Green, 1992; Nakaishi, Yamamoto, Ishida, Someya, & Yamada, 1997). The scientific theory of micro-trauma supports this finding. (Nakaishi et al., 1997)

Studies done by Marmamula et al. (Marmamula, Khanna, & Rao, 2013) found people who drank alcohol to have a two times likelihood of developing pterygium. Our study found pterygium to be positively associated with drinking alcohol (OR 2.12, 95% CI: 1.13–3.97, p < 0.001). There is as yet no clear scientific explanation for this observation. A case–control study done in Singapore found Alcohol intake was positively associated with pterygium occurrence; however, the authors only performed a logistical regression model for the risk factor of Sunlight exposure: neglecting other confounders, and it is unclear as to how they arrived at a conclusion about alcohol. No odds ratio was given. (Saw et al., 2000)

While UV radiation has been suggested as the strongest risk factor for pterygium development in any population: our study did not find any statistically significant positive association between environmental elements that enhance UV exposure (Out-door occupation, Hours Spent outdoors)
and the occurrence of pterygium. This is in contrast to several studies. (Al-Bdour and Al-Latayfeh, 2004; Coroneo, 1993; Durkin et al., 2008; Lu et al., 2009; Panchapakesan, Hourihan, & Mitchell, 1998)

This may be due to the limitation of a cross-sectional study. Another reason could be because Uganda is an equatorial country and as such already has a high Ultraviolet Index and this can cumulatively lead to the occurrence of pterygium regardless of the personal degree of exposure.

The impact of UV radiation on the limbus and conjunctiva that consequently leads to development of pterygium is cumulative and WHO estimates that approximately 80% of a person’s lifetime exposure occurs before the age of 18 years. (Lucas et al., 2006) Ooi et al. added evidence to this by identifying ocular Fluorescein photographic changes in children suggestive of solar keratosis and early stages of pingueculum development. (Ooi et al., 2006) Typically, these are periods when many potentially protective behavioural mechanisms are nearly impossible to implement or sustain.

Our study found a high prevalence of pterygium in patients attending Mulago National Referral Hospital. However, this was a hospital-based study and therefore, findings cannot be used to accurately infer upon the general population. But it provides a useful insight into the burden of the disease. Another limitation was that the study design was cross-sectional; therefore, the relative risk of developing pterygium cannot be determined for any of the exposures measured.

We, therefore, recommend the following:

A population study should be carried out to determine the exact prevalence of pterygium and its determinants in our population.

More investigation into the lifetime impact UV radiation, and methods to reduce exposure especially during earlier years.

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None of the authors have any proprietary interests or conflicts of interest related to this submission.

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