July 2025 Volume 14 No. 2

Journal of Ophthalmology of Eastern Central and Southern Africa

(Formerly East African Journal of Ophthalmology)

www.coecsa.org ISSN 2308-6327

Published by The College of Ophthalmology of Eastern, Central and Southern African Region

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Editorial message

Dear colleagues,

Welcome to your July 2025 edition of the *Journal of Ophthalmology of Eastern Central, & Southern Africa* (JOECSA), your go to source for the latest updates and resource to enhance and fuel your professional knowledge.

As an ophthalmologist and eye care professional, you are playing key role in advancing eye care globally. And that is why we are committed to providing you with scientific updates, practical tips, tools, and the best practices you need. We trust that the information in this edition of JOECSA equips you with valuable knowledge, insights, updates and resources to support your continuous growth and strengthen your impact in the field of ophthalmology.

In this edition we are excited to share a few highlights of rate of Second Eye Cataract Surgery (SECS); Evaluation of viral keratoconjunctivitis; The effect of a scorpion sting on the eye; Changes in endothelial cell density after phacoemulsification, Cat-scratch disease; Corneal topographic patterns and keratoconus with ocular allergy. We invite you to read on and explore these interesting topics.

We extend our heartfelt thanks to our esteemed authors, Dr.Bolutife Olusanya, Dr.Tarimo Anorld, Dr.Maarten B. Jalink, Dr.Nyamori J , Msopole Benjamin Tenson, Dr.Muna EJ. and their co-authors for their contribution on this edition.

We really appreciate the work of our committed reviewers who accomplished their duty timely and tirelessly.

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Corneal topographic patterns and factors associated with keratoconus among patients presenting with ocular allergy at a tertiary hospital in northern Tanzania

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ABSTRACT

Objective: To determine the corneal topographic patterns and factors associated with keratoconus among patients presenting with ocular allergy.
Method: This was a hospital-based cross-sectional study conducted among patients aged 5–30 years with ocular allergy. Data collection included questionnaires, slit-lamp examination, retinoscopy, and corneal topography. Keratoconus was diagnosed using clinical signs and a steep K > 47.2D on topography. Topographic patterns were also recorded. Data were analysed using STATA v17, with descriptive statistics and multivariable analysis; p-values < 0.05 were considered statistically significant.
Results: A total of 270 participants (534 eyes) were enrolled, 61.9% of whom were male. Vernal keratoconjunctivitis was present in 60.7% of participants. Keratoconus prevalence was higher via corneal topography (19.3%) as compared to clinical signs alone (12.2%). Common topographic patterns among those with keratoconus included inferior steepening (26.9%), round (21.2%), symmetric bowtie (13.5%), and asymmetric bowtie with inferior steepening (13.5%). Significantly associated factors were aged >10 years (p = 0.001), allergy duration >5 years (p < 0.001), and chronic allergies: vernal keratoconjunctivitis and atopic keratoconjunctivitis (p < 0.001).
Conclusion: The prevalence of keratoconus is higher when diagnosed using topography compared to relying only on clinical signs. This highlights the need for screening all patients with ocular allergy for keratoconus, especially those with VKC and AKC, older age (>10 years) and longer duration of symptoms.

Key words: Keratoconus, Ocular allergy

INTRODUCTION

Ocular allergy is the inflammation of the conjunctiva due to immediate hypersensitivity reaction to environmental allergens[1]. Keratoconus (KC) in association with ocular allergy is thought to be due to chronic eye rubbing that leads to increase in levels of tear proteolytic enzymes and decreased concentration of protease inhibitors, which results in altered corneal collagen configuration and eventually thinning and protrusion[2,3].

The overall prevalence of keratoconus globally is estimated to be 1.38 per 1000 population[4]. Among patients with ocular allergy the prevalence of KC ranges (1.7-10.6%) in East African countries[5,6].

Complications of KC include progressive myopia, astigmatism, corneal thinning, hydrops and scarring, thus leading to decreased visual acuity and poor quality of life[3].

Corneal topography is a diagnostic tool for keratoconus, even before it is clinically visible[7] ,enabling early diagnosis and timely management. A steep K>47.2 diopters is suggestive of keratoconus[8].

Although keratoconus is also associated with systemic conditions such as Down syndrome and connective tissue disorders[3,9], this study hypothesized a strong association between keratoconus and ocular allergy particularly its chronic forms. Despite the growing incidence of ocular allergy in Tanzania[10], there is limited data on fundamental knowledge of its extent, corneal topographic patterns, and factors that contribute to the development of keratoconus among these patients. This study aimed to address this gap and thus providing data that will help in better management of these patients.

MATERIALS AND METHODS

Study design and population

This was a hospital-based cross -sectional study that was conducted from October 2023 to May 2024 at Kilimanjaro Christian Medical Centre (KCMC) in the Eye Department. KCMC is a tertiary and a teaching hospital found in Northern Tanzania.

The study included patients aged 5 to 30 years who were diagnosed with ocular allergy and attended the eye clinic at KCMC.This age range was chosen because most patients under 5 years old have difficulty cooperating during topography, and keratoconus typically develops during puberty and adolescence, with progression up to the age of 30 years[11]. Consent to collect data was obtained from patients aged 18 years and above, and from parents or guardians for those below 18 years.

Patients who did not meet the eligibility criteria, that is those who had undergone corneal transplant, corneal scar, corneal ulcer, dry eye syndrome were excluded because these conditions can significantly alter corneal curvature and surface regularity, thereby affecting the accuracy of corneal topography[9]. Also patients with other forms of corneal ectasia apart from keratoconus and patients unable to cooperate for corneal topography, other systemic conditions that are associated with keratoconus such as, Down's syndrome, Ehlers-danlos syndrome, osteogenesis imperfecta[3,12] were excluded.

Study procedure

Consecutive sampling technique was applied during this study. Patients of interest were identified at the eye clinic, then demographic characteristics (age, sex, residency) were documented for every patient. Visual acuity testing was then performed using Snellen chart. Structured interviews using a questionnaire with closed-ended questions were conducted.

This helped to attain symptoms that were used to differentiate types of ocular allergy, duration of symptoms, other atopies (asthma, allergic rhinitis and eczema). Ocular examination using slit-lamp biomicroscopy was then performed, during which various signs were identified to differentiate between different types of ocular allergy.

Types of ocular allergy were classified using Leonard classification system[13] and categorized into acute and chronic types. Acute being Perennial Allergic Conjunctivitis (PAC) and Seasonal Allergic Conjunctivitis (SAC) and chronic being Vernal Keratoconjunctivitis (VKC) and Atopic Keratoconjunctivitis (AKC). Also, different signs of keratoconus observed on slit lamp bio microscopy were documented i.e., Munson's sign, apical scarring, Fleischer's ring, Vogt's striae and Rizutti's sign (using a pen torch) were documented. Clinical diagnosis of keratoconus was made by the presence of one or more of these signs.

Refraction using a retinoscopy was done to identify scissoring sign and refractive errors (hyperopia, myopia, astigmatism and myopic astigmatism). Best Corrected Visual Acuity (BCVA) was graded according to WHO grading system that is 6/6-6/12 (normal vision), 6/18-(mild visual impairment), 6/24-6/60 (moderate visual impairment), 5/60-3/60 (severe visual impairment) and <3/60 (blindness).

Corneal topography was then performed using (Zeiss Atlas 9000 Corneal topography system). Steep K, Flat K were documented. Also, corneal topographic patterns were categorized according to Rabinowitz- as Round (R), Oval (O), Symmetric Bowtie (SB), Superior Steepening (SS), Inferior Steepening (IS), Asymmetric Bowtie with Superior Steepening (ABSS), Asymmetric Bowtie with Inferior Steepeining (ABIS) and Irregular(I)[8].

A Steep K > 47.2 D and with at least one clinical sign of keratoconus was considered as clinical keratoconus. A steep K > 47.2D with absence of clinical signs was considered of subclinical keratoconus[8.]

Keratoconus was also graded according to severity using Amsler Krumeich grading system by using a steep K. Grade I- steep K <48D, Grade II- Steep K <53, Grade III- Steep K 53-55D, Grade IV-Steep K>55D[9,14].

Data analysis

Data was analyzed using STATA (Stata Corp LLC, College Station, Texas, USA) version 17. Descriptive statistics were carried out, whereby categorical variables were summarized using frequency and percentages and numeric variables were summarized using mean with Standard Deviation (SD) and median with Interquartile Range (IQR).

A modified poisson was used to assess the factors associated with keratoconus. A univariate analysis was done to obtain the Crude Prevalence Ratio (CPR) while a multivariable analysis was done to obtain Adjusted Prevalence Ratio (APR). Variables with a P-value of < 0.05 were considered statistically associated with keratoconus.

Ethical considerations

Ethical clearance was sought from the Institutional Review Board of Kilimanjaro Christian Medical University College Research and Ethics Review Committee (KCMU-CREC) and granted with No. PG 84/2023.Only file numbers were used to maintain confidentiality when completing the questionnaires.

RESULTS

This study included 270 individuals (534 eyes). Median age among study participants was 11 years IQR (8,15), 61.9% were male. The largest subgroup consisted of those with VKC, accounting for 60.7% (Table 1).

Table 1: Social-demographic and clinical characteristics of study participants (N=270)

Variable	Frequency (n)	(%)
Age of the participant in years		
≤ 10	122	45.2
11-30	148	54.8
Median (IQR)	11 (8,15)	
Sex		
Female	103	38.1
Male	167	61.9
Residence		
Rural	110	40.7
Urban	160	59.3
Duration of ocular allergy		
≤ 5	183	67.8
6-10	59	21.9
> 10	28	10.4
Type of ocular allergy		
SAC	77	28.5
PAC	17	6.3
AKC	12	4.4
VKC	164	60.7
Other atopies		
None	223	82.6
Asthma	4	1.5
Allergic rhinitis	28	10.4
Eczema	13	4.8
Either atopies	2	0.7
Refractive error status		
Emmetropia	169	62.6
Myopia	16	5.9
Hyperopia	1	0.4
Astigmatism	35	13
Myopic astigmatism	49	18.1

Figure 1, shows proportion of those with keratoconus, out of 270 study participants, the proportion of keratoconus by clinical diagnosis alone was 12.2% (33/270) and this increased by topography to 19.3% (52/270). Among the 52 participants with keratoconus, 44 had bilateral and 8 unilateral making a total of 96 eyes with keratoconus. In regards to Best Corrected Visual Acuity (BCVA) of eyes with keratoconus, those with BCVA between 6/6-6/12 were 45.8% (44/96) and those with BCVA of <3/60 were 12.5%(12/96) as shown in figure 2.

Figure 1: Proportion of keratoconus among patients with ocular allergy by clinical diagnosis and topography

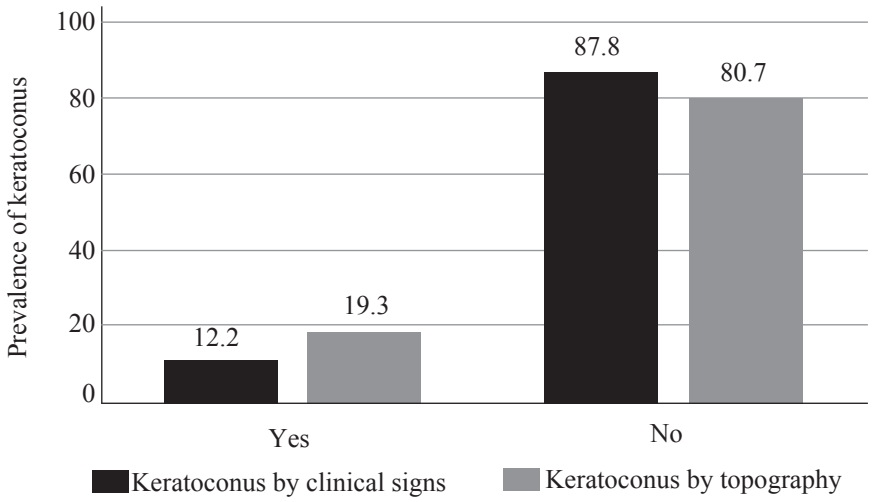


Figure 2: Best corrected Visual Acuity (BCVA) among the study participants' eyes with keratoconus (N=96)

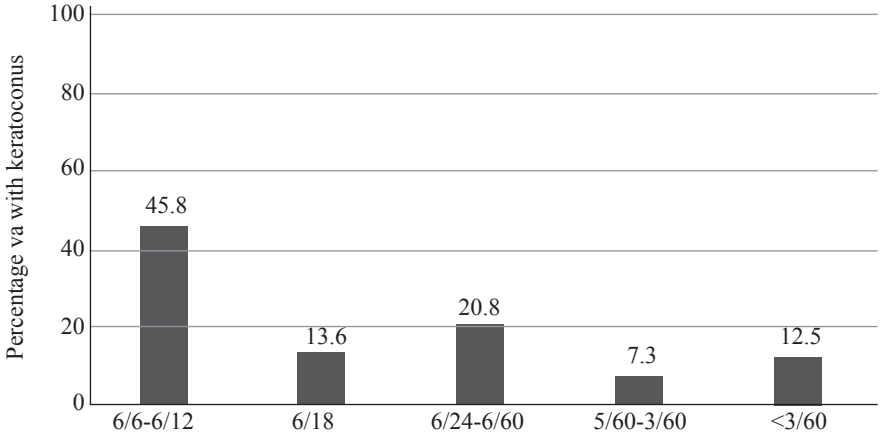


Figure 3 shows the distribution of keratoconus severity according to the Amsler Krumeich grading system. The highest proportion was observed in grade 4, with 44% (42/96).

Figure 3: Distribution of grades of keratoconus by severity (N=96 eyes)

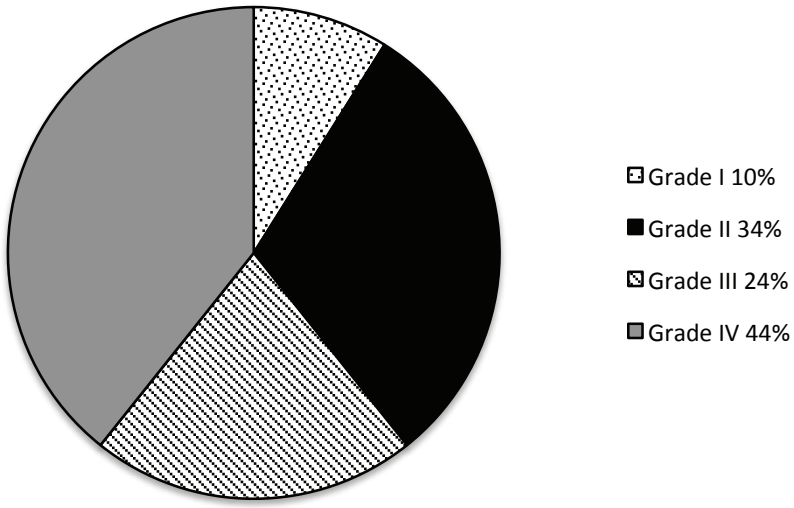
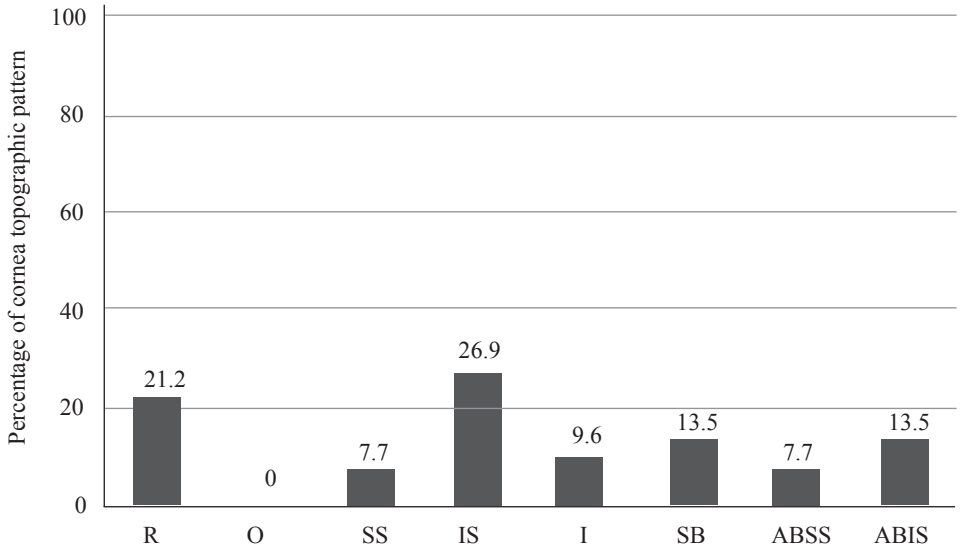


Figure 4, shows the distribution of different corneal topographic patterns in Keratoconus patients. the most prevalent corneal topographic patterns were Inferior Steepening (IS) by 26.9% (14/52), Round by 21.2% (11/52), Symmetric Bowtie (SB) by 13.5% (7/52) and Asymmetric Bowtie with Inferior Steepening (ABIS) also by 13.5% (7/52).

Figure 4: Corneal topographic patterns among the study participants with keratoconus (N=52)



R-*Round, **O**-Oval, **SS**-Superior steepening, **IS**-inferior steepening, **I**-Irregular, **SB**-Symmetric Bowtie, **ABSS**-Asymmetric Bowtie with Superior Steepening, **ABIS**- Asymmetric Bowtie with Inferior Steepening

Table 2 summarizes the factors associated with keratoconus among participants with ocular allergy. In the adjusted analysis, age of the participant, duration of ocular allergy, and type of ocular allergy were statistically significant factors.

Participants aged 10 years or younger were 0.35 times as likely to have keratoconus compared to those older than 10 years (APR = 0.35; 95% CI: 0.17–0.71; p = 0.001). Those with acute forms of ocular allergy were 0.26 times as likely to have keratoconus compared to participants with chronic forms (APR = 0.26; 95% CI: 0.14–0.49; p < 0.001). Participants with a duration of ocular allergy of 5 years or less were also 0.26 times as likely to have keratoconus compared to those with allergy lasting more than 5 years, after adjusting for age and type of ocular allergy (APR = 0.26; 95% CI: 0.14–0.49; p < 0.001).

Table 2: Factors associated with keratoconus among participants with ocular allergy

Variable	CPR (95%CI)	P-value	APR (95%CI)	P-value
Age of the participant in years				
≤10	0.25 (0.12-0.50)	<0.001	0.35 (0.17-0.71)	0.001
>10	Ref		Ref	
Sex				
Female	0.72 (0.42-1.23)	0.231		
Male	Ref			
Duration ocular allergy in years				
≤5	0.18 (0.10-0.31)	<0.001	0.26 (0.14-0.49)	<0.001
>5	Ref		Ref	
Type of ocular allergy				
Acute	0.28 (0.14-0.57)	<0.001	0.26 (0.13-0.50)	<0.001
Chronic	Ref		Ref	
Atopies				
No	Ref			
Yes	0.86 (0.43-1.71)	0.673		

DISCUSSION

In this study the proportion of keratoconus among patients with ocular allergy was 12.2% by clinical diagnosis and raised to 19.3% by corneal topography. Clinical diagnosis relies on observable symptoms and signs that are mostly observed in advanced cases of keratoconus. On the other hand, corneal topography can identify subtle changes in corneal shape that may not be apparent during a routine clinical examination.

Similarly, other studies showed that the prevalence of keratoconus (KC) increased when diagnosed by topography. A study done in Malaysia showed that the prevalence of KC increased from 10.3% to 11.5% among patients with VKC[15]. Another study done in India among patients with VKC:11.2% had KC by corneal topography, none clinically[16].

Studies done in Kenya and Egypt differed dramatically from clinical to topography diagnosis that is; (10.6% to 30.9%) and (7% to 27%) respectively as compared to our study[16,17]. This difference could be explained by different diagnostic criteria of keratoconus by topography; for instance, a study done in Egypt used two criteria, which are steep K > 47.2 and I-S asymmetry >1.2D. Also, the results could have been overestimated due to variances in the expertise of healthcare providers interpreting clinical signs on topography.

A study conducted in Italy demonstrated a significantly lower prevalence of KC among VKC patients (0.77%) compared to our own findings[18]. This low prevalence might be attributed to the inclusion criteria, which required a minimum follow-up period of 12 months and the use of cyclosporine eye drops by all participants during this period. Additionally, racial and geographic disparities could contribute to the observed differences, as it has been shown in different studies that higher rates of keratoconus are typically reported in tropical regions as compared to European countries .

Of note, in our study, the majority of participants' eyes, 44%, with keratoconus were in grade 4. This could be due to the absence of effective screening programmes for early detection of keratoconus among patients with ocular allergies which result in a higher proportion of advanced cases by the time patients are diagnosed. Many of which in this category require corneal transplant. These findings were similar to the study done in Kenya whereby the majority of the participants, 58.8%, had severe keratoconus[6].

Among patients with ocular allergy diagnosed with keratoconus, inferior steepening was most prevalent (26.9%), followed by round, symmetric bowtie, asymmetric bowtie with inferior steepening (21.2%,13.5% and 13.5%) respectively. It has been speculated that the most pattern found in early forms of keratoconus are inferior steepening[8]. Round pattern is found in more severe forms of keratoconus[9]. A similar study conducted in India showed the frequencies of various corneal topographic patterns were as follows: round (R) 17.11%, Asymmetric Bowtie with Inferior Steepening (AS-IS) 17.11%, and Symmetric Bowtie (SB) 38.16%. The discrepancy primarily lies in the slightly higher percentage of symmetric bowtie patterns. And this could be due to the fact that the patients included in their study had early stages of KC, as all the participants with KC were diagnosed by topography, none clinically[16].

Another study done in Israel showed the most prevalent patterns were asymmetric bowtie with superior steepening (36.25%), asymmetric bowtie with inferior steepening (31.25%), and symmetric bowtie (18.75%)[19]. The difference in these studies can be explained by the fact that the study only enrolled patients with VKC; other types of ocular allergy were not studied.

In our study, age was an independent risk factor for the development of keratoconus; those aged <10 years were less likely to have keratoconus ((P-value < 0.001) compared to those aged 10 years. This can be explained by the fact that studies have shown most of the patients develop keratoconus at puberty. This is due to hormonal changes during puberty and adolescence that influence corneal remodeling and may contribute to the onset of keratoconus in susceptible individuals. This study is similar to a study done in Kenya, where most of the patients diagnosed with keratoconus were aged 10-14 years (42.1%), followed by those aged 15-19 years (23.7%); the mean age of the patients diagnosed with keratoconus was 14.9 SD 5.9[6]. It is also similar to another study done in Egypt, a case-control study where the mean age of patients with KC was 11.2 ± 3.7 years for the cases[17].

Participants with a duration of ocular allergy of <5 years were less likely to have keratoconus compared to those with duration of ocular allergy >5 years (P-value < 0.001). This could be due to individuals with shorter durations of ocular allergy having experienced less cumulative inflammatory damage to the cornea compared to those with longer durations, thereby reducing their risk of developing keratoconus. A study done in India[16] revealed similar results, whereby the odds of having keratoconus increased significantly in those with allergy duration of more than 6 months, and this was statistically significant (p < 0.0001). In another study done by Salam Wani *et al*[20] the mean duration of illness in eyes with a KC pattern was 6.7 years, and in eyes with severe KC and astigmatism was 8.5 years and 5.7 years, which is more compared to eyes with non-KC pattern. It was also similar to a study done in Kenya where the mean duration of allergy symptoms in patients with keratoconus was 5.8 years[6]. However, it is important to note that these two studies did not show association by univariate and multivariate analysis.

In this study, those with acute forms of ocular allergy were less likely to have keratoconus compared to those with chronic forms (P-value < 0.001); this is probably due to the fact that chronic inflammation is believed to play a role in the pathogenesis of keratoconus. The more severe the allergic response, the higher the levels of inflammatory mediators released in the eye. These mediators can potentially contribute to the thinning of the cornea over time, which is a characteristic feature of keratoconus. This study was comparable to a study done in Kenya where those with severe forms of ocular allergy had 13.3 odds of developing keratoconus compared to those with mild-moderate forms of ocular allergy (p < 0.001). It is also similar to a study done in Egypt whereby 65.9% of VKC had KC[17]. Comparing our study to others was challenging because most previous studies focused exclusively on patients with VKC rather than encompassing all types of ocular allergies. Therefore, there is a need for further research that includes all forms of ocular allergy.

Study limitation

This study employed a cross-sectional design, which limits the ability to establish temporal relationships, highlighting the need for further evidence from prospective research. Additionally, as a hospital-based study, the findings may not be fully representative of the general population.

CONCLUSION

In this study, we found there was an increase in the proportion of keratoconus in patients with ocular allergy when diagnosed by topography as compared to when we rely only on clinical signs. Also, corneal topographic patterns that were mostly found in KC patients included inferior steepening, round, symmetric bowtie and asymmetric bowtie with inferior steepening. Factors that were significantly associated with the development of keratoconus were age >10 years, long duration of allergy and chronic forms of ocular allergy. This highlights that, while clinical examination remains important, it may miss mild or subclinical cases. This may lead to delays in diagnosis and timely management of such patients, increasing the risk of complications.

RECOMMENDATIONS

To incorporate early corneal topography screening for patients with ocular allergy, particularly those over 10 years of age, with a long duration of allergy, and those experiencing chronic forms such as VKC and AKC.

This will help in early diagnosis, timely management such as corneal collagen crosslinking to arrest progression of the disease, thus reducing the number of complications and need for corneal transplant.

Authors contributions

I Ndyanabo L. (lead author) conceptualized the study, designed the methodology, and conducted data collection. I also performed the statistical analysis, drafted and revised the manuscript. Muna. EJ and Mndeme FG contributed in supervising the clinical aspects of data collection and provided critical insights during data interpretation and contributed to manuscript editing. All authors read and approved the final version of the manuscript.

Disclosure

This research was supported by a grant from Light for the World. The funding organization had no role in the study design, data collection and analysis, interpretation of results, decision to publish, or preparation of the manuscript. The authors declare no competing financial interests related to this work.

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Evaluation of demographic, clinical characteristics, severity, and clinical evolution of viral conjunctivitis at Eye Department of KCMC from January to May 2024

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ABSTRACT

Background: Viral conjunctivitis is a highly contagious eye infection affecting the cornea and conjunctiva, causing significant discomfort and visual impairment.
Objective: This study aims to evaluate the demographic and clinical characteristics, severity, and clinical evolution of viral conjunctivitis.
Method: A retrospective cross-sectional study conducted at the Kilimanjaro Christian Medical Centre (KCMC) Eye Department. Data collected from patient medical records, focusing on demographics, clinical presentations, diagnoses, and initial treatments over a five-month period. The study included all patients with hyperemic conjunctiva, while excluding those with a history of ocular trauma or features of bacterial/allergic conjunctivitis.
Results: A total of 57 participants were included, with a notable predominance of females (66.7%) and a significant representation of individuals aged between 50 and 64 years (29.82%). The overall mean age of participants was 39.72 years (SD = 16.17). Most patients were from the Kilimanjaro region (84.2%), particularly the Longuo ward (19.3%). Clinically, all participants exhibited redness of the eye, with other prevalent symptoms including excess tearing (94.7%), foreign body sensation (93%), and eye pain/irritation (91.2%). Severity classification indicated that 54.39% of cases were mild, with no statistically significant associations found between the severity of VC and age or gender. A comprehensive treatment approach was observed, with all patients receiving antibiotics, while 80.7% were treated with steroids.
Conclusion: These findings provide valuable insights into the epidemiological patterns and clinical manifestations of viral conjunctivitis in the Kilimanjaro region. Moreover, the observed seasonal variations in incidence highlight the importance of timely awareness campaigns to enhance diagnosis and management strategies.

Key words: Viral conjunctivitis, Conjunctivitis, Adenovirus

INTRODUCTION

Viral conjunctivitis is an eye infection characterized by inflammation of conjunctiva, primarily caused by adenoviruses (80% of cases). Other pathogens include herpes simplex and varicella-zoster viruses. Transmission occurs via direct contact with infected secretions or surfaces, making it highly contagious. It affects all age groups and outbreaks are common in crowded environments like schools and workplaces. Its management focuses on symptomatic relief and infection prevention. In Tanzania, especially around the Kilimanjaro Christian Medical Centre, outbreaks significantly impact public health. There is limited data on treatment protocols, highlighting the need for improved public education and research[1-8]. Though it affects all ages, it is particularly common among children and young adults[3]. In a case report done in North America, 125 cases were involved, a large proportion of patients (101) came from a single shipyard in San Francisco. The rest were townspeople and a few hospital employees, who had not been in contact with the eye clinic. They conclude that disease is contagious but not to an exceptional degree[9].

In a study done in China, the average age of the patients was 39.3 ± 14.6 years. There was no significant difference among the four different age groups (children- 3–12 years, adolescents- 12–18 years, adults- 18–60 years, and the aged- over 60 years), in terms of the proportion of mild, moderate, and severe cases. The majority of patients (30.2%) presented in winter followed by 29.9% during summer[3]. Also, a retrospective single-center case series study in Sydney Australia found that viral conjunctivitis patients mostly presented within a week. In this study, 368 eyes of 224 patients were diagnosed with viral conjunctivitis at the Sydney Eye Hospital from 1st January to 31st March 2017. The median age of patients

was 35.3 (range 7–82), and 59.8% of patients were males[10]. A cross-sectional study was conducted in Jinja-Hospital Uganda, 100 randomly selected respondents were involved, viral conjunctivitis was more prevalent in the age group of 25-40 years 50% (50), more in females 52% (52) than in males 48% (48) and it was associated with URTI 29% (29), more in urban places 71% (71), and was also associated with systemic conditions mostly in DM 20% (20)[11]. There is limited data on the demographic characteristics of viral conjunctivitis in Tanzania.

Viral conjunctivitis presents with redness, tearing, eye pain, and photophobia. It often includes swelling of the conjunctiva and eyelids, watery discharge, and blurred vision. Subepithelial corneal infiltrates may occur, leading to reduced visual acuity. Symptoms typically worsen over 1-2 weeks and gradually resolve over several weeks. In a case report done in North America, 125 cases were involved, it was described that viral conjunctivitis is primarily a conjunctival disease in most cases, the corneal involvement being secondary, and many patients with the typical conjunctival picture fail to develop keratitis but, in a few cases, punctate corneal changes can occur, the lesions are more likely to be from 0.5 to 1.5mm or more in diameter[9]. In a cross-sectional descriptive study conducted in Iran, 153 patients were involved, the most common clinical findings in patients were conjunctival injection (90.8%), eye discharge (86.6%), conjunctival haemorrhage (85%), tearing (80.4%), follicular reaction (75.8%), and foreign body sensation (67.3%). Also, there was a relationship between some clinical findings and a positive adenovirus genome test[12]. According to the standard treatment guidelines and national essential medicines list for Tanzania mainland, VC may be unilateral but usually bilateral. Its clinical presentation may include respiratory tract infection, watery eye discharge, burning, sandy or gritty feeling in the eyes, Diffuse pink or red conjunctiva due to subconjunctival haemorrhages, photophobia if the cornea is involved, normal visual acuity and preauricular lymphadenopathy. It appears in epidemics so there will be a history of contact with patients with a similar eye condition[13].

The severity of viral conjunctivitis can range from mild discomfort to severe visual impairment. Initial symptoms tend to worsen over 1-2 weeks, with the potential for subepithelial corneal infiltrates that can cause blurred vision. In most cases, symptoms resolve within 2-4 weeks, but in severe cases, symptoms may persist longer, necessitating medical intervention to prevent complications. In a retrospective single-center case series study done in Australia, 368 eyes of 224 patients diagnosed with viral conjunctivitis at the Sydney Eye Hospital from 1st January to 31st March 2017. Severity was defined as mild, moderate, or severe according to the documentation of clinical signs in the patient records, for hyperemia (mild-47% moderate-42%, or severe-11%), conjunctival follicles (mild-36.5% moderate-38.8%, or severe-24.7%), conjunctival papillae (mild-16.7%, moderate-58.3%, or severe-25.0%)[10]. While in a prospective cohort study conducted in Japan, out of the 32 cases, with a mean age of 38.4 years, 23 (72%) developed conjunctivitis in the contralateral eye, the severity of the disease varied widely after HAdV exposure, typically taking 5–12 days to incubate. The range of symptoms can vary from mild or subclinical ocular surface inflammation to severe conjunctivitis, characterized by significant sensitivity to light, excessive tearing, swelling of the eyelids, and chemosis[14]. According to the standard treatment guidelines and national essential medicines list for Tanzania mainland, viral conjunctivitis is usually self-limiting, but the irritation and discharge get worse in 3 – 5 days before getting better and symptoms can persist for 2–3 weeks[13].

Viral Conjunctivitis (VC) is a highly contagious eye infection that can cause severe discomfort, visual impairment, and complications like corneal scarring (when there is corneal involvement), this study can bridge knowledge gaps, fostering a holistic approach to managing viral conjunctivitis at KCMC and beyond.

Objective: Evaluation of demographic, clinical characteristics, severity, and clinical evolution of viral conjunctivitis at KCMC Eye Department from January 2024 to May 2024.

MATERIALS AND METHODS

This hospital-based retrospective cross-sectional study was conducted from January to May 2024 at the Eye Department of Kilimanjaro Christian Medical Centre (KCMC). It included all patients presenting with hyperemic conjunctiva during the study period, excluding those with ocular injury, trauma, or clinical features suggestive of bacterial or allergic conjunctivitis. The case definition of viral conjunctivitis was based on clinical presentation such as redness, tearing, photophobia, and itching confirmed through slit-lamp examination performed on all patients. Key examination findings included conjunctival injection although there was no any corneal involvement. Patient medical records were reviewed to extract demographic information (age, gender, occupation, socioeconomic status, and residential location) and clinical characteristics, including presenting symptoms and treatments received. Disease severity was classified as mild, moderate, or severe based on

the number of days since symptom onset. Treatments documented included the use of artificial tears, topical antibiotics, corticosteroids, and anti-allergic medications.

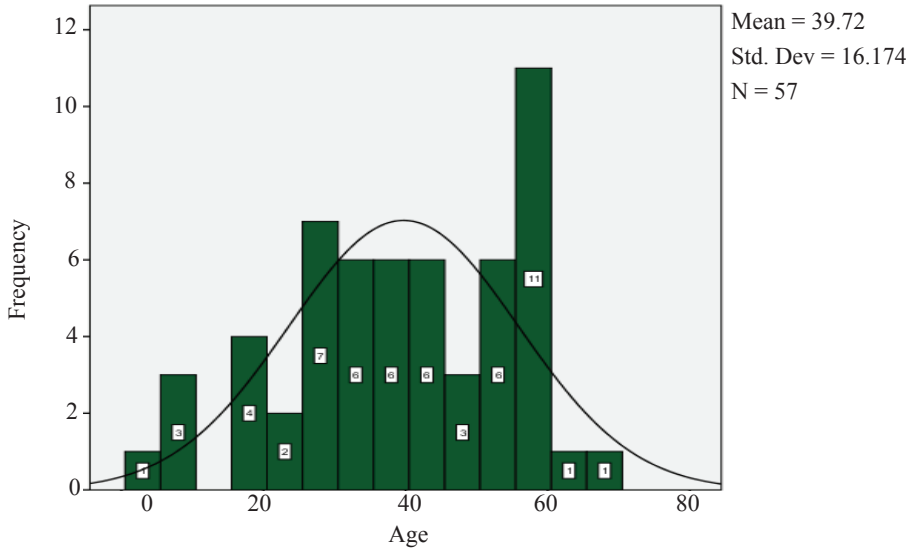
Analysis: Data were coded, cleaned, and analyzed using SPSS version 25. Descriptive statistics summarized demographic and clinical characteristics using frequencies, percentages, means, and standard deviations. Fisher's exact test assessed associations between categorical variables, while ANOVA compared the mean number of clinical characteristics across age groups. A p-value of <0.05 was considered statistically significant. Data quality was ensured through thorough cleaning, and findings were compared with previous studies to provide context and interpret relevance.

RESULTS

Demographics

A total of fifty-seven participants were involved in the study. Among these participants, 66.7% were female. Additionally, 29.82% of the participants were aged between 50 and 64 years. The ages of the participants ranged from 3 to 68 years (Figure 1), with a mean age of 39.72 years (SD = 16.17). The majority of participants came from the Kilimanjaro region, accounting for 84.2%, with a specific concentration in the Longuo ward, which comprised 19.3% of the participants.

Figure 1: Age of participants



Clinical characteristics

On clinical presentation, the following symptoms were observed in the participants: 57 (100%) reported redness of the eye, 54 (94.7%) reported excess tear production, 53 (93%) reported a foreign body sensation, 52 (91.2%) reported eye pain/irritation, 51 (89.5%) reported sensitivity to light, 49 (86%) reported eye itching, 47 (82.5%) reported eye discharge, and 22 (38.6%) reported having sticky eyelids in the morning. Additionally, 6 (10.5%) had periauricular lymphadenopathy, and 6 (10.5%) reported signs of upper respiratory tract infections. All patients presented with at least four clinical characteristics, with the majority, 36.8%, exhibiting seven clinical characteristics (Table 1), and there was no corneal involvement.

Table 1: Number of clinical presentations.

No. of clinical presentations	Frequency	(%)
4	2	3.5
5	7	12.3
6	6	10.5
7	21	36.8
8	16	28.1
9	5	8.8
Total	57	100.0

Table 2: Severity of viral Conjunctivitis vs number of clinical presentations Crosstabulation

		Number of clinical presentations						Total
		4	5	6	7	8	9	
Severity of viral conjunctivitis	Mild	1	5	5	9	7	4	31
	Moderate	1	2	1	8	6	1	19
	Severe	0	0	0	4	3	0	7
Total		2	7	6	21	16	5	57

Table 3: Eye itching vs severity of viral conjunctivitis crosstabulation

Mild Moderate			Severity of viral conjunctivitis			Total
			Mild	Moderate	Severe	
Itchy eyes	Present	Count	29	15	5	49
		% within severity of viral conjunctivitis	93.5%	78.9%	71.4%	86.0%
	Absent	Count	2	4	2	8
		% within severity of viral conjunctivitis	6.5%	21.1%	28.6%	14.0%
Total		Count	31	19	7	57
% within severity of viral conjunctivitis		100.0%	100.0%	100.0%	100.0%	

Table 4: Correlations among variables

		1	2	3	4	5	6	7	8
1	Number of clinical presentations								
2	Itchy eyes	-.2							
3	Excess tear production	-.04	-.1						
4	Eye pain/irritation	-.45**	-.13	.2					
5	Sensitivity to light	-.51**	.03	-.08	.50**				
6	Eye discharge	-.52**	.21	.30*	.02	.14			
7	Sticky eyelid in the morning	-.64**	-.09	.19	-.01	.15	.27*		
8	Foreign body sensation	-.39**	-.11	.24	.40**	.35**	.05	.08	

*Note = 57, **P<0.01, *P<0.05*

Severity and clinical evolution

The severity of viral conjunctivitis was classified as mild if symptom onset occurs within 2 to 3 days, moderate if it occurs within 4 to 6 days, and severe if symptoms appear after 7 days. Most participants (54.39%) had mild viral conjunctivitis (Figure 2). Most participants were aged between 20 and 34 years (Figure 3), and there were more females than males in the study (Figure 4). When evaluating the relationship between the severity of viral conjunctivitis and different age groups using Fisher's exact test, the P-value was 0.13. This indicates that there is no statistically significant association between the severity of the condition and the age groups within the study population. Similarly, when examining the association between the severity of viral conjunctivitis and gender, the Fisher's exact test yielded a P-value of 0.62. This result also suggests that there is no statistically significant association between the severity of the condition and gender among the participants. There was no statistically significant association between the severity of viral conjunctivitis and various clinical characteristics. The P-values for the characteristics were as follows: eye itching (0.14), persistent redness (not applicable as it was constant), excessive tearing (1.00), eye pain (1.00), sensitivity to light (0.09), eye discharge (0.69), sticky eyelids (0.59), foreign body sensation (0.69), periauricular lymphadenopathy (1.00), and upper respiratory tract infection (1.00). All 57 patients (100%) received antibiotic treatment, while 46 patients (80.7%)

were treated with steroids**.** Additionally, 12 (21.1%) patients received artificial tears, and 5 (8.8%) were administered anti-allergic medications. When assessing the relationship between the severity of viral conjunctivitis and the type of medication administered, the p-values were 0.89 for steroids, 0.35 for artificial tears, and 0.24 for anti-allergic medications, indicating no statistically significant association. A one-way ANOVA was conducted to compare the number of clinical characteristics among six age groups. The results indicated no significant differences between the groups ($p>0.05$).

Figure 2: Severity of viral conjunctivitis

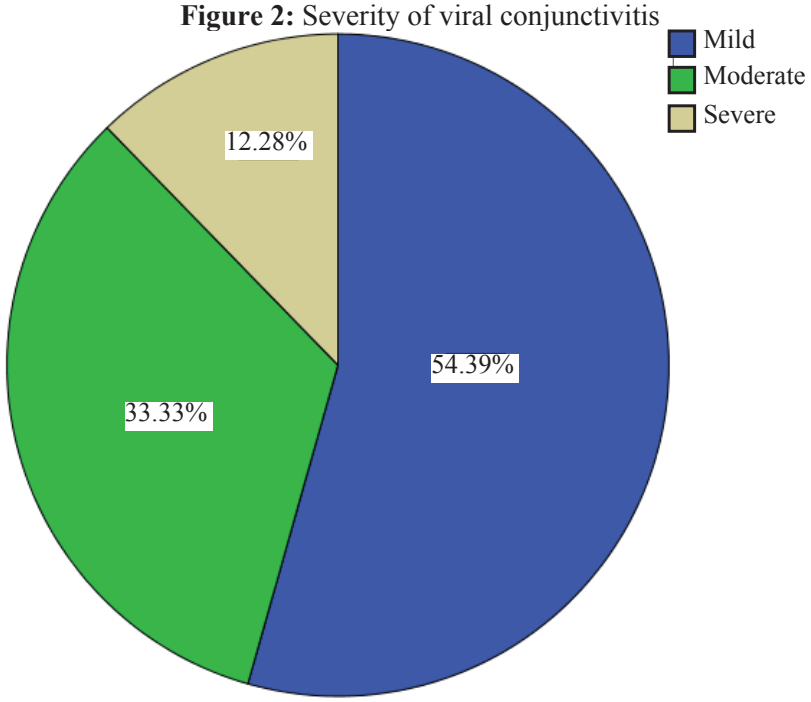


Figure 3: Severity of viral conjunctivitis by age group

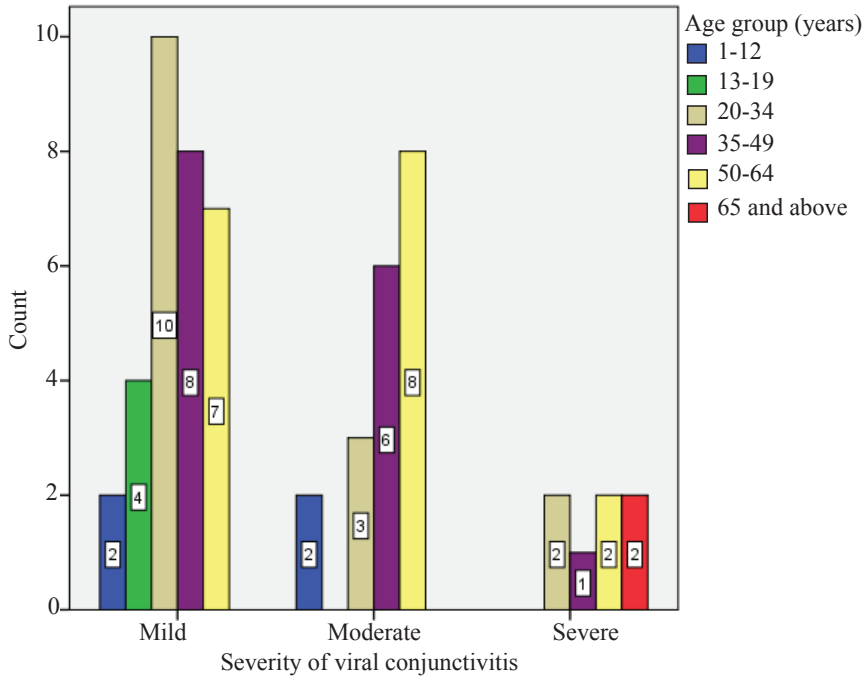
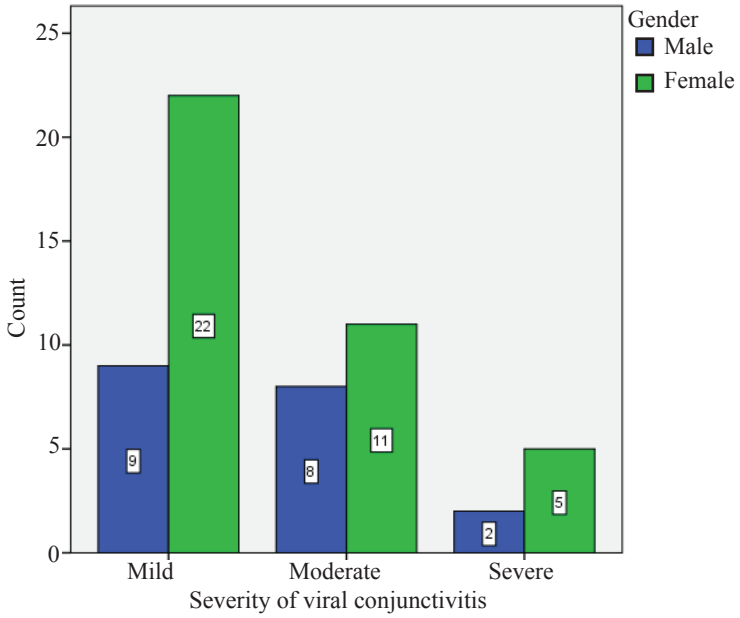


Figure 4: The severity of viral conjunctivitis by gender



DISCUSSION

This research enhances the understanding of viral conjunctivitis epidemiology in the Kilimanjaro region. Findings show a higher prevalence among females (66.7%) and individuals aged 50-64 (29.82%) years, aligning with global trends. The predominance of female cases may indicate gender-related differences in exposure, hygiene, or healthcare-seeking behaviors. The mean age of 39.72 years suggests middle-aged individuals are particularly susceptible, consistent with studies from Iran. These demographic insights are crucial for designing targeted public health interventions and awareness campaigns, ensuring effective prevention and management strategies for vulnerable populations[3,11,12].

The geographic concentration of participants from the Kilimanjaro region, particularly in the Longuo ward (19.3%), raises questions about the local environmental and socio-economic factors that may contribute to the higher incidence of viral conjunctivitis. It is also possible that this higher incidence is related to the proximity of the hospital in that area. Previous studies have indicated that urban areas and densely populated settings increase the risk of viral transmission due to close contact and potentially poorer hygiene conditions[11]. Byaruhanga, *et al*[12] reported similar findings in Uganda, where urban residency was associated with a higher prevalence of viral conjunctivitis. Therefore, it is crucial to investigate the specific environmental and infrastructural conditions in the Kilimanjaro region that may facilitate the spread of VC. Additionally, the reported incidence of VC being higher during certain seasons aligns with the findings from the study in China[3].

Notably, the presence of upper respiratory symptoms in 10.5% of cases reflects the documented association between viral conjunctivitis and respiratory infections[13]. Additionally, the occurrence of periauricular lymphadenopathy, though relatively low, underscores the systemic implications of viral conjunctivitis, corroborating findings from other studies[15].

Our study's data showing that the majority of patients exhibited multiple clinical characteristics further emphasizes the multifaceted nature of VC. The varied symptomatology and high rates of prior antibiotic use among patients suggest a need for enhanced diagnostic clarity to avoid unnecessary treatments, as many cases are viral in origin[10]. Overall, this research underscores the need for targeted public health measures and awareness regarding VC's clinical manifestations.

Furthermore, the prospective cohort study by Kimura *et al*[14] emphasized the potential for contralateral eye involvement post-adenoviral exposure, underscoring the contagious nature of viral conjunctivitis. This highlights the importance of monitoring patients closely, particularly during the incubation period, as the severity can vary significantly.

The analysis of symptom correlations revealed significant negative correlations ($p<0.01$) between the number of clinical presentations and eye pain, sensitivity to light, discharge, sticky eyelids, and foreign body sensation. These findings indicate that as symptom severity increases, the total number of distinct clinical features may decrease. This could be because some key symptoms tend to co-occur, meaning when a few hallmark signs (like pain, photophobia, sticky eyelids) are present, they may dominate the clinical picture, making the total

count of different symptoms appear lower as a patient with severe pain and photophobia might not report minor symptoms like tearing or itching.

In our study, there was no corneal involvement observed, consistent with findings from a North American case report involving 125 patients, where viral conjunctivitis was primarily conjunctival. It was described that corneal lesions may occur in some cases, they are typically mild, secondary, and not present in many patients with classic conjunctival symptoms[9].

The treatment modalities employed primarily antibiotics, steroids, and artificial tears reflected a broad approach to managing symptoms rather than targeting the viral aetiology, which is consistent with the standard treatment guidelines. This finding suggests a need for future studies to explore more targeted therapeutic interventions to improve patient outcomes in viral conjunctivitis.

A key limitation of this study due to its retrospective design, individual symptoms and examination findings were not consistently graded or documented in the patients records. As such, the severity classification was based solely on the duration of symptoms at presentation.

CONCLUSIONS

This study provides valuable insights into the epidemiological patterns, clinical manifestations, and management of viral conjunctivitis in the Kilimanjaro region. The higher prevalence among females and the middle-aged population underscores the need for targeted public health interventions. Our findings also stress the multifaceted nature of VC, with diverse symptoms and varying severity, reinforcing the necessity for accurate diagnosis and appropriate management strategies.

RECOMMENDATIONS

To effectively address VC, public health initiatives should focus on raising awareness about the disease's symptoms and prevention methods, particularly among vulnerable demographics. Further research is recommended to investigate environmental factors contributing to VC incidence in the Kilimanjaro region and to explore targeted therapeutic interventions that may enhance patient outcomes. Regular monitoring and education on hygiene practices can also help mitigate viral transmission during peak seasons.

Authors contributions

The research proposal was conceived and written collaboratively by all four authors: Bwire J, Tarimo A, Makupa W and Muro F. Each author contributed to developing the study design, methodology, data analysis, and manuscript preparation.

Disclosure

This research was conducted without any monetary grants or sponsorship from any organization.

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Rate of second eye cataract surgery (SECS) amongst patients attending University College Hospital, Ibadan, Nigeria

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ABSTRACT

Objective: To determine the rate of Second Eye Cataract Surgery (SECS) amongst patients attending University College Hospital (UCH), Ibadan and the average time interval between first and second eye surgery.
Methods: This was a hospital-based, descriptive cross-sectional study carried out at the outpatient clinic of the Department of Ophthalmology, University College Hospital (UCH), Ibadan. A total of 427 patients diagnosed with bilateral operable age-related cataract, and had undergone cataract surgery in at least one eye two years prior to commencement of study, were studied using a study designed questionnaire to ascertain the proportion of patients that have had second eye cataract surgery done and the average interval between the first and second eye surgeries. Data was analyzed using IBM Statistical Product and Service Solutions (IBM-SPSS) version 25 and summary statistics are presented using frequency tables, means and rates.
Results: Out of the 427 patients studied, only 124 (29%) underwent Second Eye Cataract Surgery (SECS) within two years of the First Eye Cataract Surgery (FECS) at an average interval of 12 ±7.4 months. Type of surgery being Manual Small Incision Cataract Surger**y** (MSICS) for FECS was the only statistically significant variable associated with shorter interval between the FECS and SECS (p = 0.001).
Conclusions: The SECS rate in UCH, Ibadan is still low with a prolonged interval between surgeries.

Key words: Cataract, First Eye Cataract Surgery (FECS), Second Eye Cataract Surgery (SECS), Manual Small Incision Cataract Surgery (MSICS)

INTRODUCTION

Cataract has remained a major cause of blindness worldwide accounting for about 51% of blindness, affecting almost 20 million people[1], with the developing countries accounting for 75% of this blindness[2]. There is an increasing prevalence of cataract blindness in developing countries, which has been attributed to inadequate human resource, poor cataract management, poor disease awareness, poverty, lack of basic infrastructure and dedicated cataract surgery programs.

Although cataracts are frequently bilateral, cataract surgery is usually performed on one eye at a time[3], mainly due to fear of devastating complications such as endophthalmitis[4]. First eye cataract surgery results in significant improvement in visual acuity and contrast sensitivity[3,5,6]. However, cataract patients still report vision-related problems while waiting for Second Eye Cataract Surgery (SECS), as a result of differences in vision between the operated and un-operated eyes[3,5,7,8]. These problems are largely corrected by SECS[3,9].

In the last few decades, western countries have witnessed an increase in the uptake of second eye cataract surgery and consequently cataract surgery rates. Data from an audit of cataract surgeries performed in the UK between the period of November 2001 to July 2006 indicated that 41.5% were SECS[10] while a rate of 41% was obtained between November 2006 and July 2010 with a median interval between surgery of 3.7 months[11]1073 patients had ISBCS and 248,341 DSCS from 73 centres. A higher proportion of ISBCS patients were unable to lie flat (11.3% vs. 1.8%; p < 0.001). Although there are limited data on rates of second eye cataract surgery in other parts of the world, available data suggests lower rates. Malik *et al*[12] in India, found that only 20% of the patients who had undergone cataract surgery in one eye reported back for the second eye cataract surgery within one year. They further noted that patients who were yet to have SECS had more attitudinal barriers, as well as barriers related to service delivery, cost and affordability. Also, Katibeh *et al*[13] in Iran found a second eye cataract surgery rate of 28.1% within a four-year period (2006 -

2009) while Fasina *et al*[14] in Nigeria reported that the rate of bilateral non simultaneous surgery was 0.9% within a three-year period (2012 -2014). This extremely low rate of SECS implies that only few patients achieve their optimum visual potential. This study therefore aims to determine the current trend in SECS rate and the average interval between FECS and SECS.

MATERIALS AND METHODS

This was a hospital-based, descriptive cross-sectional study which was carried out at the outpatient clinic of the Department of Ophthalmology, University College Hospital, Ibadan (UCH). Patients aged 50 years and above, attending the eye clinic of University College Hospital Ibadan were selected based on the following criteria:

Inclusion criteria

- All consecutive patients with bilateral age-related cataract, with best corrected visual acuity worse than or equal to 6/18 in both eyes at diagnosis and had undergone first eye surgery not more than 2 years prior to recruitment.

Exclusion criteria

- Patients who had visual impairment from other ocular co-morbidities such as glaucoma, diabetic retinopathy, age related macular degeneration.
- Patients who had a history of uveitis or ocular trauma.

The list of eligible patients was compiled from the clinic and surgery registers of the Ophthalmology Department of University College Hospital, Ibadan and patients were contacted on phone and clinic appointment was scheduled.

Ethical approval and clearance were obtained from the ethical committee of the University College Hospital, Ibadan and the study adhered to the Tenets of the Helsinki Declaration. Informed consent was obtained from all participants prior to recruitment and the study duration was 7 months (September 2021 – March 2022) which was prolonged due to a decline in clinic attendance as a result of COVID-19 pandemic**.**

Data collection

Brief explanation of the survey was given to the participants. Data of interest obtained from both case notes and participants via the interviewer administered questionnaire included sociodemographic data, information about time of surgery (first and second eye), pre- and post-operative best corrected visual acuity, type of surgery as well as surgical complications.

Data analysis

Data entry, cleaning and analysis were done using IBM-SPSS version 25. Descriptive statistics such as means, medians, ranges and standard deviations were used to present quantitative variables while categorical variables were presented in the form of proportions and percentages. One-way Anova test was used to find the difference between means of some variables for the SECS group in order to identify the factors associated with shorter interval between FECS and SECS. Analyses were carried out at 5% level of statistical significance.

RESULTS

Descriptive characteristics of participants: A total of 480 participants were enrolled in the study, out of which 427 (89%) participants who completed the study were analyzed. There were 212 (49.6%) males and 215 (50.4%) females with a male to female ratio of 1:1.01. The mean age was 70 ± 8.8 years with a range of 52 to 108 years. The sociodemographic characteristics of all participants are represented in Table 1.

Table 1: Sociodemographic characteristics of all participants

Variable	Frequency (n=427)	(%)
Mean age ± Standard deviation (years)	70.1 ± 8.8	
Age in category(years)		
<65	109	25.6
65-74	196	46.0
≥74	122	28.4
Gender		
Male	212	49.6
Female	215	50.4
Marital status		
Married	344	80.6
Widowed	76	17.8
Divorced	3	0.6
Single	2	0.5
Separated	2	0.5
Occupation		
Employed	287	67.4
Unemployed	125	29.3
Retiree	15	3.3
Average monthly income*		
< 30,000 naira/month	308	72.2
30,000 – 60,000 naira/month	95	22.2
>60,000 naira/month	24	5.6
Distance from the hospital by road (hours)	1.4 ± 1.32	
Living alone		
Yes	41	9.6
No	386	90.4

*1 US Dollar = 403.12 Nigerian Naira

Proportion of participants that had Second Eye Cataract Surgery (SECS): A total of 124 (29%) participants had Second Eye Cataract Surgery (SECS) done within two years of First Eye Cataract Surgery (FECS) while 303 (71%) were yet to have SECS. Of the 303 participants yet to have SECS, 220 (72.6%) expressed interest in having their SECS done. However, only 79 (26.1%) expressed readiness for surgery, all of whom were promptly booked.

Interval between First Eye Cataract Surgery and Second Eye Cataract Surgery: Average interval between FECS and SECS: The average interval between FECS and SECS was 12 ± 7.4 months. Table 2 shows the breakdown of the interval between surgeries.

Table 2: Breakdown of interval between FECS and SECS

Interval (Months)	Frequency (n=124)	(%)	Cumulative percentage (n=124)
≤6	34	27.4	27.4
7-12	30	24.2	51.6
13-18	30	24.2	75.8
>18	30	24.2	100.0

Only 34 (8%) of all the participants had SECS within 6 months of FECS while 64 (15%) had it within year.

Factors associated with shorter interval between FECS and SECS: One-way Anova test was used to find the difference between means of some variables for the SECS group in order to identify the factors associated with shorter interval between FECS and SECS as shown in Table 3.

Table 3: Factors associated with shorter interval between FECS and SECS

Parameter	Number of participants (n=124)	Average interval ± SD (months)	P-value
Age in category (years)			
<65	32	10.13 ± 6.36	0.121
65-74	56	12.15 ± 6.98	
>74	36	13.82 ± 8.53	
Type of surgery (First eye)			
ECCE + PCIOL	21	13.91 ± 8.43	0.001*
SICS + PCIOL	94	11.67 ± 7.33	
SICS Only	9	12.56 ± 5.10	
Portal of clinic entry			
Walk-in	93	11.85 ± 7.52	0.735
Clinic referral	24	12.63 ± 7.00	
Outreach	7	13.86 ± 7.63	
Level of education			
No formal Education	22	10.39 ± 7.73	0.366
Formal education	102	12.49 ± 7.30	
Who paid for first eye surgery			
Self	46	13.43 ± 7.32	0.964
Family	67	10.79 ± 7.54	
Sponsorship	4	15.25 ± 5.44	
Insurance	7	14.86 ± 5.79	
FECS (BCVA* in other eye)			
≥ 6/18	34	13.33 ± 7.55	0.282
>6/60-6/24	41	12.49 ± 7.09	

≥HM- 6/60	39	10.66 ± 7.46	
LP	6	9.83 ± 8.61	
FECS (BCVA* in operated Eye)			
≥ 6/12	51	11.26 ±7.17	0.457
>6/60 – 6/18	60	12.79 ± 7.66	
≥ HM-6/60	12	12.25 ± 7.09	
LP	1	3.00	
Gender			
Male	69	12.99 ± 7.05	0.424
Female	55	11.01 ± 7.71	
Average monthly income#			
<30000 Naira/month	84	11.83 ± 7.20	0.682
30000- 60000 Naira/month	28	12.22 ± 7.74	
Occupation			
Employed	84	11.69 ± 6.97	0.289
Retiree	36	13.50 ± 8.23	
Unemployed	4	12.11 ± 7.39	

*BCVA: Best Corrected Visual Acuity
1 US Dollar = 403.12 Nigerian Naira

Type of surgery being MSICS for FECS was the only statistically significant variable associated with shorter interval between the two FECS and SECS (p = 0.001).

DISCUSSION

Proportion of participants that underwent SECS within 2 years of FECS

Of the 427 participants, only 124 representing 29% had undergone SECS within the 2-year period. This implies a 29% SECS rate in 2 years while further analysis revealed that only 64 participants had theirs within a year representing 15% SECS rate in 1 year. This suggests a significant improvement as compared with the study by Fasina *et al*[14]. The latter revealed an abysmally low rate of 0.9% in 3 years which however did not include those who had SECS outside UCH. This fact alone does not completely explain the increased rate as only 13% of participants that underwent SECS in this study had it outside UCH meaning almost 90% returned to UCH. A possible contributing factor is the proportion of participants that had MSICS during FECS which had increased significantly from 28% in the study by Fasina *et al*[14] to 71% in this study because of improvement in expertise and proficiency in MSICS. This in turn has been associated with improved uptake of SECS due to better postoperative outcome[15]. This may also have contributed to the high rate of satisfaction with FECS recorded in this study as over 90% of the participants were satisfied with the outcome of their FECS.

The SECS rate of 15% in one year and 29% in 2 years obtained in this study, though higher than that of Katibeh *et al*[13] in Iran which was 28.1% in 4 years, is comparable with that of Malik *et al*[12] in India which was 20% in 1 year. It is, however, much lower than that of Castells *et al*[16] which was 51% in 2 years as well as those of the Western world (over 40% in one year)[10,11]. This could be related to the fact that all participants in the study by Castells *et al*[16] were sponsored compared to the 14% in this study. The availability of sponsorship for cataract surgery eliminates cost as a barrier to SECS hence the provision of sponsorship opportunities may, therefore, help improve the rate of uptake of SECS.

Interval between FECS and SECS

The average time interval between FECS and SECS in this study was 12 ± 7.4 months. This is shorter than that of Malik *et al*[12] which was 2.39 ± 2.19 years but longer than that of Castells *et al*[16] which was 9 months. This average interval is thought to be prolonged considering that about 70% of all participants in this study had vision worse than 6/18 in the second eye as at the time of undergoing

FECS. This implies that these participants still delayed surgery despite having vision lower than the threshold recommended by Agency for Healthcare Research and Quality[17]. Only 8% of the participants had SECS within 6 months while 15% had SECS within the first year after FECS. This is lower than that of Castells *et al*[16] which showed that 22% of their participants had SECS within 6 months of FECS. Undergoing MSICS during FECS was found to be associated with shorter interval in this study (p=0.001). Introduction of phacoemulsification may therefore improve both uptake of SECS and shorten the interval as revealed by the study by Katibeh *et al*[13]. Impact of this on uptake of SECS in our environment is an area of future research.

Other factors associated with shorter interval between FECS and SECS but failed to reach statistical significance include; Age <65 years, portal of clinic entry, walk- in patients, source of funds for FECS, poor vision in second eye as at FECS, having no formal education. An area of future research is to identify the factors associated with the uptake of SECS as well as the barriers to its uptake with a view towards improving the uptake of SECS.

Study limitation

Being a hospital based cross-sectional study with retrospective component, missing records could have affected the outcome of this study.

CONCLUSION

Although, the rate of SECS in UCH, Ibadan has improved over the years, it is still relatively low with a prolonged interval between surgeries. Undergoing MSICS was found to be associated with shorter interval between surgeries. Identifying factors that could be responsible for this low rate with a view towards improving uptake of surgery is desirable.

Declaration

Consent for publication: All authors have consented.

Conflict of interest: None.

Authors' contributions: All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Dr. Nafisat Ijaiya-Olatoke. The first draft of the manuscript was written by Dr. Nafisat Ijaiya-Olatoke. Prof. Bolutife Olusanya and Prof. Charles Bekibele supervised the project and edited previous versions of the manuscript. All authors read and approved the final manuscript.

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Selected pre-operative and intraoperative factors affecting changes in corneal endothelial cell density three months after phacoemulsification at a private eye hospital in Nairobi, Kenya

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ABSTRACT

Objective: To evaluate selected patient factors that affect endothelial cell loss 3 months following phacoemulsification surgery.
Methods: This was a prospective cohort study carried out at a single center, Eagle Eye and Laser Center, Nairobi, Kenya that has a Tomey 3000 specular microscope. All patients undergoing phacoemulsification surgery during the study period were included. The collected data was entered into Microsoft Excel and analyzed using SPSS
Results: Average age was 65±12.327 with a M:F ratio of 1.2:1. Forty-one eyes of 33 patients were studied and showed an overall endothelial cell loss of 7.2%. Diabetes was associated with more endothelial cell loss while longer axial length was associated with less endothelial cell loss.
Conclusion: Phacoemulsification surgery is safe despite inevitable minimal loss in endothelial cells. Care should be taken when operating on diabetic patients due to their susceptibility to more cell loss.

Key words: Phacoemulsification, Endothelial cells, Corneal endothelial cell density, Anterior chamber depth, Axial length

INTRODUCTION

The endothelium is the inner most layer of the cornea and is composed of a single layer of polygonal cells that interdigitate and are of variable shape (polymorphism) and size (polymegathism)[1]. These cells are the anatomical and physiological interface between the aqueous humour and the corneal stroma and through ion channels are responsible for pumping out water from the stroma to maintain corneal clarity and thickness[2]. When there is endothelial injury from trauma or surgery, these cells are thought to migrate and change shape so as to fill the gap. ECD at birth is 5000 cells/mm^2 and declines physiologically to about 200-3000 cells.mm^2 in adults[3,4]. Corneal Endothelial Cell Density (ECD) of 450-800 cells/mm^2 is associated with corneal oedema and loss of corneal clarity hence reduced vision[5].

Globally, it is estimated that 94 million people are blind or visually impaired with the leading cause being cataracts[6]. A systematic review and meta-analysis of population-based eye health surveys between January 1980 to October 2018, found cataracts to be the common cause of blindness in people aged over 50 years old at about 15.2 million cases[7]. The prevalence of cataracts is expected to increase due to increased life expectancy.

Surgery is the mainstay treatment for cataracts and phacoemulsification is one of the current methods used in cataract extraction alongside Extracapsular Cataract Extraction (ECCE), with a comparatively smaller incision and injury area. A systematic review and meta-analysis showed that phacoemulsification has better visual outcomes and reduced complication rates compared to ECCE[8]. Phacoemulsification was first performed in Kenya in 1993, and is now the preferred surgical intervention for cataracts in several high-volume centers across the country[9].

Phacoemulsification utilizes ultrasonic energy, which are mechanical waves of more than 20kHz that causes thermal and mechanical damage to the corneal endothelium[10]. This is mainly due to the small confined space that is the anterior chamber in which the surgery is performed making it inevitable that there will be contact between the corneal endothelium and the instruments and fluid used[11]. Corneal endothelial Cell Loss (ECL) following phacoemulsification has been found to be between 5-19.2%[12,13].

Various patient factors affect the degree of corneal endothelial cell loss, such as age, diabetes status[12,14,15] cataract density, axial length and anterior chamber depth[16].

In Kenya, a study evaluating the effects of phacoemulsification on the cornea had not been carried out, despite its widespread use and increasing uptake, hence this study was carried out with the aim of evaluating these changes.

Broad objective: To assess corneal endothelial cell density changes 3 months after phacoemulsification.

Specific objective: To determine the change in corneal Endothelial Cell Density (ECD) associated with selected factors: age, diabetes status, axial length and anterior chamber depth.

MATERIALS AND METHODS

Study design: This prospective study was conducted at Eagle Eye Laser Center (EELC), a private eye hospital in Nairobi serving a diverse population within the city and beyond. All patients undergoing phacoemulsification between August 2018 to January 2019, and were followed up for three months until April 2020.

The center was chosen because of its availability and use of a specular microscope (Tomey- EM 3000, a non-contact specular microscope) that was used to check the corneal endothelial cell density of all patients about to undergo phacoemulsification. A specular microscope is the instrument used to measure corneal endothelial cell density by taking an image of reflected light from the optical interface between the aqueous humor and corneal endothelium. These images are then analyzed by the machine to give different characteristics such as number, density, shape and variation in size[11]. There are four main techniques used to determine endothelial cell density[17].

- Comparison method, whereby the patient's endothelium is compared to a known set of hexagon patterns.
- Frame method (fixed or variable)- where cells are counted within a rectangular or hexagonal frame.
- Corner to corner method- where cells' corners are counted.
- Center to center method- where the center of the cell is counted.

The Tomey 3000 specular microscope used in our study utilizes the fixed frame method of ECD calculation. A-scan by Alcon© was used to measure Anterior Chamber Depth (ACD) and Axial Length (AL).

During the study period at EELC all phaco surgeries were performed by two surgeons (HG and JN) on the same Alcon Accurus© phacoemulsifier; ECD and biometry recorded by one experienced technician and intraoperative data from the Alcon Accurus© captured by one experienced theatre nurse.

Ethical consideration: The study adhered to the tenets of the Helsinki Declaration. Before beginning, ethical approval was sought and granted by the Kenyatta National Hospital-University of Nairobi Ethics and Research Committee. Permission was sought and granted by the administration of EELC. Written and informed consent was obtained from each participant.

Inclusion criteria: All eyes undergoing phacoemulsification during the study period. The center lacked an anaesthesia machine at the time, hence only adults were included in the study

Exclusion criteria: Eyes with other ocular pathology such as trauma, inflammation or infection which would be possible cause of endothelial cell loss post-operatively were excluded. Any eyes that had intraoperative complications hence had a longer than was usual exposure to phacoemulsification energy and intra-operative fluids were also excluded. Eyes with ECD <2000 were also excluded because this would be considered low for an adult eye with increased risk of accelerated endothelial cell loss and delayed corneal recovery post-operatively[18]. The eyes in which no phaco power was used intraoperatively due to very soft lenses that didn't require it were also excluded because they did not have the exposure on interest to the study.

Data collection and analysis: To be included in the study, recruited patients were asked to sign informed consent. The principal investigator or research assistant then filled into a questionnaire their name, age, sex, ocular history and diabetic status (yes or no). ECD was then taken to be an average of two readings from the Tomey 300 specular microscope to enhance accuracy, Axial length and anterior chamber depth were taken from the biometry data. Intraoperatively, the phaco power was read from the Alcon Accurrus© phacoemulsifier. Three months post-operatively, the ECD was calculated as an average of two readings and also recorded in the patients' questionnaire. The collected data was then fed into Microsoft Excel 2019 and analyzed using SPSS version 25. Descriptive analysis was used to determine frequencies and proportions. ANOVA test was used to test variance and statistical significance was set at p-value of <0.05 and confidence interval was set at 95%.

RESULTS

Forty-one eligible consecutive eyes of 33 patients were included in the study following exclusion of 14 eyes. The 14 eyes were excluded for the following reasons:

- 5 eyes had no phaco power used intra-operatively
- 5 eyes had intra-operative complications
- 3 eyes had missing post-operative data; the patients were lost to follow up
- 1 eye developed post-operative uveitis.

The pre-operative demographics of the participants and intra-operative characteristics are in Table 1.

Table 1: Demographics and pre-operative patient characteristics

Characteristic	Study population	P-value
Age (Mean ±SD)	65.48 ±12.32	0.904
Gender (M:F)	18/15 (55%/45%)	
Laterality R:L	19/22 (46%/54%)	
Diabetes Y:N	8/25 (24%/76%)	
Axial Length (mm) Mean ±SD	23.76 ±1.14	0.258
Anterior chamber depth (mm) mean ±SD	3.70 ± 0.80	0.434
Overall pre-op corneal ECD (cells/mm^2) mean ± SD	2399 ± 196.19	
Mean corneal ECD in eyes of male vs female (n=23 vs 18)	2363 vs 2427	
Mean corneal ECD Right vs Left eye (n=19 vs 22)	2431 vs 2372	
Mean corneal ECD DM vs No DM	2477 vs 2382	
Mean corneal ECD Normal axial length ≤25mm (n=35) vs longer axial length >25mm (n=6)	2393 vs 2436	

Table 2: Post-operative corneal ECD measurements and changes in cells/mm^2

Characteristic	ECD in cells/mm^2	Change in ECD (%)	P-value
Post-op ECD at 3 months (cells/mm^2) mean ± SD	2227 ±192.41	-172 (7.2%)*	
Male vs female	2231 vs 2248	-132(5.6) vs -179 (7.4)	0.514
Right vs left eye	2271vs 2224	-160(6.6) vs -148(6.2)	0.340
DM vs non DM	2276 vs 2235	-171(7.0) vs -147(6.2)	0.870
Normal axial length (≤ 25mm) vs longer axial length (>25mm)	2204 vs 2364	-189 vs -72	

The change in ECD was calculated as the percentage of the difference between the pre-op and post-op ECD.

A multivariate analysis of age, diabetic status, axial length and anterior chamber depth had a p value of 0. 046.

DISCUSSION

This study found an overall endothelial cell loss of 7.2% which is in keeping with several studies[12,13,19], who found a range of loss of between 4-19 % in their studies. This value was calculated as a percentage of the difference between overall mean pre-op and post-op corneal ECD at 3 months.

This study found a slight male preponderance, similar to a study done by Khalid *et al*[11]. When eyes of males were compared to those of females, there was no statistically significant difference in loss of endothelial cells which was in keeping with findings by Mohan *et al*[20] and Mazhar *et al*[21] who had similar results. We further found an average age of 65 years in patients with cataracts who underwent phacoemulsification which is in keeping with other studies[11,22] which found that the prevalence cataracts is high among those over 50 years old in sub Saharan Africa. Age was however not found to be a statistically significant factor in endothelial cell loss such as found by *Dewan et al*[23]. Endothelial cell loss between right and left eyes was comparable and not statistically significant which could be explained by both surgeons being competent in their operative skills on operating either eye.

The diabetic patients had slightly more endothelial cell loss at the end of the 3 month follow up period, but this was not statistically significant. Our findings are in keeping with those of *Yang et al*[14] and *Tang et al*[15] in their systematic review and metanalysis of corneal endothelial changes after phacoemulsification in diabetic vs non-diabetic patients, whereby they found no statistically significant difference between the two groups at all time points. They then concluded that despite the greater loss and more in diabetic patients' corneas, there is recovery of these cells albeit delayed compared to non-diabetics. This could be explained by hyperglycemia causing more dysmorphological changes in the corneal endothelium, damage to the basement membrane, abnormal cell adhesion and limited cell migration[14,15].

According to studies by Bhardwaj *et al* [24] and Jing *et al*[25], the normal axial length is considered to be between 22-25mm. In our study, 35 eyes were found to be of

normal axial length, while were found to be longer than 25mm. The endothelial cell loss in longer eyes was found to be less than in those with normal axial length. Longer axial lengths may be associated with deeper anterior chambers hence allowing more space and less contact with the endothelium, thus less cell loss as similarly shown by Walkow *et al*[26] and Bhardwaj *et al*[24]. However, on statistical analysis of axial length and anterior chamber depth these factors were not found to be significant. This was not similar to what was found by Khalid *et al*[11] who found significance in both of these factors. Our study had a significantly larger number of eyes with normal axial length compared to those with longer eyes, hence the statistical analysis may not be as applicable. However both *Hwang et al* [26] and *Cho et al*[16] found that ACD wasn't a significant factor in corneal endothelial cell loss which was more influenced by cataract density and corneal incisional tunnel length which we did not study.

Limitations: ECD readings were made only at the central cornea which does not factor in changes in peripheral areas of the cornea that are also likely affected by phacoemulsification whose incision and ultrasound energy are applied on the peripheral cornea. Cataract density wasn't graded pre-operatively and would have been compared to the change in endothelial cell density. Intraoperative factors such as corneal incision site and length were also not measured and compared in our study.

Recommendation: A randomized control study in a large volume center with clear grading of the cataracts pre-operatively and measurement of the incisional tunnel length to evaluate the impact of these factors.

CONCLUSION

Phacoemulsification is a safe procedure despite causing inevitable minimal loss of endothelial cells due to various patient and anatomical factors. However, the loss is well compensated for by 3 months postoperatively. Caution should be taken when operating on diabetic patients due to their increased susceptibility to endothelial cell loss.

Acknowledgment

Eagle Eye and Laser Center, Nairobi for providing the specular microscope.

Declaration

Funding: This work was not funded

Consent for publication: all authors have read and approved the final manuscript

Availability of data and materials: The data is available from the corresponding author upon reasonable request.

Competing interests: None to declare.

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The effect of a scorpion sting on the eye: A review

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ABSTRACT

Background: Scorpions are arachnids with a specialized stinger on their tail that can envenom enemies or preys through a sting. There is little data on the ocular effects of scorpion envenomation.
Objective: The aim of this paper is to discuss the ocular conditions through the means of a literature review.
Methods: A search in the PubMed, Scopus, and SCiELO databases produced 16 papers, which were summarized.
Results: Most complications, such as pupillary abnormalities, ophthalmoplegias, and ptosis, were caused by neurotoxins. Other sequalae, like branch retinal vein occlusion, retinal haemorrhages, and necrotic skin, were reported as well.
Conclusion: This paper is the first to give an overview of all reported ocular symptoms caused by scorpion stings.

Key words: Scorpions, Stings, Review, Ophthalmology

INTRODUCTION

Scorpions (Scorpiones) are a group of arachnids that are characterized by two grasping pincers and a long, segmented tail with a curved stinger at the final segment (called telson). This stinger can be used to inject venom to either deter an enemy or attack a possible prey. Scorpions live in (sub) tropical regions on all continents, with the exception of Antarctica. There are about 1,500-2,000 species, of which about one third are potentially dangerous to humans. Almost all lethal scorpions belong to the large and widespread family of *Buthidae*[1]. All scorpions are nocturnal and hide during the day, leading to incidents when accidentally encountered[2]. Human envenomation is called scorpionism; this is a potentially life-threatening condition that needs prompt medical care, especially in vulnerable patients such as children or the elderly[3]. Symptoms vary from pain or paresthesia at the sting site to life-threatening respiratory failure or cardiac arrhythmias. The estimated global incidence is 1.5 million envenomings per year, resulting in 2,600 deaths[4].

Scorpion venoms are a complex mixture of various compounds, of which neurotoxins are the most important part in human envenomation[4]. There are multiple types of neurotoxins that can have paradoxical effects, such as paralysis or myoclonic reactions. In addition, neurotransmitters (such as noradrenalin and acetylcholine) released from the nerve endings can cause autonomous dysregulation (“autonomic storm”), such as tachycardia, hypertension, hyperthermia, vasoconstriction, and tachypnea (adrenergic reactions) or vomiting, salivation, bronchospasm, bradycardia, and hypotension (cholinergic reactions)[4,5].

Treatment of scorpionism generally consists of antivenom and supportive care[1,3]. Most commonly used antivenoms (also called antiserum) are immunoglobulins (IgG) or purified fragments of immunoglobulins (F(ab’)2) made from hyperimmune plasma of large mammals, such as horses, that can reduce the adverse effects of the venom[1]. Supportive treatment consists of intravenous fluids, analgesics (such as paracetamol), and local cooling of the sting site, or, in the case of respiratory failure, mechanical ventilation[1,3].

Little is known about the ocular effects of scorpionism, and there is no thorough appraisal of the literature. The aim of this paper is to discuss the ocular conditions caused by scorpion envenomation through the means of a literature review.

MATERIALS AND METHODS

In January 2025, a search was performed in the PubMed, Scopus, and SciELO databases using the term “scorpion” in combination with multiple (partial) terms that refer to the eye in general (“eye”, “opht*”, “ocul*”, “pupil”) or common symptoms caused by scorpionism (“diplopia”, “ptosis”, “ophthalmoplegia”, “mydriasis”, or “miosis”). Inclusion criteria were all types of papers that detail ocular and/or visual symptoms caused by scorpions in human beings. There were 89 hits, of which 12 papers were deemed relevant after screening the title and abstract. All papers were successfully retrieved online. One paper was excluded afterwards, because it discussed whip scorpions (vinegaroons), which are no true scorpions[6]. All references of the papers found were cross-checked for additional sources. This resulted in six more papers, of

which five could be retrieved online. In total, 16 papers were included in the review. For this review, no ethics approval was required, since there were no human or animal participants for this article.

RESULTS

All found articles can be found in Table 1. As one would expect with a varying geographic distribution of reported species, ocular symptoms of scorpionism differ per region. Reported cases came from Africa, North America, and Southwest Asia. With the exception of one case (*Nebo hierochonticus,* a species of scorpion in the *Diplocentridae* family[7]), all reported species belong to the *Buthidae* family. Interestingly, there were no reports from Australia, Europe, or South America, even though scorpions from the *Buthidae* family do occur there (including *Buthus occitanus* and *Centruroides* spp).

Table 1: summary of all found papers discussing ocular/visual symptoms caused by a scorpion sting, split out based on region

	Author (year)	Type of paper	Country	Scorpion species	Patient details	Ophthalmological symptoms/diagnosis	Systemic involvement	Treatment	Long-term ophthalmological results/sequelae
Southwest Asia	Thacker *et al.*[26] (2002)	Case report	*India*	*Hottentotta tamulus**	Male, 17 years	Anisocoria with sluggish pupillary reactions to light and left-sided papilledema and retinal edema with perimacular haemorrhage	Acute dyspnea and multiple watershed cerebral infarctions	Intravenous fluids and dexamethasone	Bilateral disc pallor with perimacular haemorrhage and pigmentary retinal degeneration on the left
	Sengupta *et al.*[25] (2009)	Case report	*India*	Not reported	Female, 40 years	Bilateral occipital cerebral and cerebellar infarction, leading to low visual acuity (light perception in both eyes)	Venom-induced multi-organ failure; pulmonary edema, myocarditis, and acute renal failure	Supportive care; endotracheal intubation, intravenous fluids, low-dose aspirin, and enalapril	No visual improvement after six months
	Bawaskar *et al.*[17] (2017)	Case report	*India*	*Hottentotta tamulus**	Male, 55 years	Mydriasis	Profuse sweating, hypertension, poor myocardial contraction	Supportive care (intravenous fluids) and antivenom	Full recovery after three hours
	Sadeghian[12] (2003)	Case report	*Iran*	*Mesobuthus eupeus*	Female, 54 years	Bilateral ptosis, mydriasis, and loss of adduction, elevation, and depression	No	Conservative treatment; antibiotics, hydrocortisone, ibuprofen, and promethazine	Full recovery after nine days
	Hamid *et al.*[18] (2019)	Case report	*Iran*	*Mesobuthus eupeus*	Female, 45 years	Macular branch retinal vein occlusion (BRVO) with lowered visual acuity (0.4) and peri-orbital edema after scorpion sting in eyebrow two days prior	No	Intravitreal injection with bevacizumab	Resolution of macular edema, two weeks after injection
	Shiravani *et al.*[20] (2024)	Case report	*Iran*	*Hemiscorpius lepturus*	Male, 34 years	Ocular inflammation, corneal stromal melting, and anterior chamber inflammation	No	Anti-venom and topical antibtiotics and steroids	Residual central corneal stromal scar
	Annobil *et al.*[7] (1991)	Case report	*Saudi Arabia*	*Nebo hierochonticus*	Male, 3 years	Dilated pupils with reaction to light, vertical nystagmus, bilateral papilledema, and flame-shaped retinal haemorrhages were noted on the 8th day (after extubation)	Acute pulmonary edema, petechiae, tachycardia, acute renal failure, deafness, and multiple intracranial haemorrhages.	Treatment on intensive care unit, including assisted ventilation, peritoneal dialysis, and antivenom	Full recovery; retinal haemorrhages resolved after four weeks
North America	Rimsza *et al.*[8] (1980)	Retrospective study	*United States of America*	*Centruroides sculpturatus*	24 patients; 19 under 10 years	12 patients experienced visual symptoms; roving eye movements (8), nystagmus (3), and "oculogyric movements" (1)	Various. Duration of symptoms was inversely related to patients' age	Various: i.e. antivenom, diazepam, hydrocortisone, phenobarbital, epinephrine, conservative therapy. It was not specified which therapy was given patients with ophthalmological symptoms.	Not reported
	Clark *et al.*[9] (1991)	Case series	*United States of America*	*Centruroides sculpturatus*	4 patients; 3 children and 1 adult	Involuntary, slow, roving eye movements, and unsustained primary position nystagmus. Movements resembling opsoclonus in two children	Cranial nerve and/or somatic skeletal neuromuscular dysfunction	Antivenom or symptomatic treatment	Antivenom: recovery within one hour in most patients. Symptomatic treatment: recovery within 24 hours.
	Hurst *et al.*[10] (2018)	Case series	*United States of America*	*Centruroides sculpturatus*	Female, 22 years; male, 33 years; female, 52 years	Dysconjugate, roving eye movements in all patients. One patient had blurry vision and a granular sensation in both eyes	All patients had generalized symptoms as tachypnoea, tachycardia, numbness and tingling, and/or muscle twitching	Antivenom	Resolution of all symptoms between 30 minutes to two hours

North Africa	Delma[13] (2012)	Case report	*Algeria*	Not reported	female, 24 years	Patient suffered three scorpion stings within four days; severe visual deprivation (questionable light perception ODS) and oculomotor paralysis. Visual evoked potential (VEP) revealed bilateral (toxic) neuropathy. There were no signs of cerebral infarction on magnetic resonance imaging (MRI).	No	Antivenom after every scorpion sting despite only having local symptoms; toxic neuropathy was treated with high-dose intravenous steroids	Visual acuity ODS after four months remained at counting fingers at one meter (1/300); eye movements returned to normal
	Moutei *et al*.[19] (2019)	Case report	*Morocco*	Not reported	male, 41 years	Scorpion sting in palpebral region, leading to intense pruritis and palpebral pain and eventually necrosis of the peri-ocular skin caused by local arterial spasm	No	Surgical debridement of the necrotic skin	Not reported
	Bahloul *et al*.[14] (2004)	Retrospective study	*Tunisia*	*Androctonus australus* and *Buthus occitanus*	951 patients mean age 14.7 years (range 0.5 to 90 years)	Squint in 119 patients (12.5%), bilateral miosis in 43 patients (4.5%), bilateral mydriasis in 16 patients (1.7%), and anisocoria in 4 patients (0.4%)	All patients were admitted to the intensive care unit for various reasons	Antivenom was used in 509 patients (53.5%)	Miosis, mydriasis, or anisocoria were correlated with poor general outcome. No specific effect of treatment on ophthalmologic symptoms described.
Sub-Saharan Africa	Sarkies[15] (1951)	Case report	*Ghana*	Not reported	female, 34 years	Scorpion sting in right eyebrow, causing complete oculomotor nerve paralysis with permanent ptosis and abduction and partial infraduction	No	Surgical repair of the ptosis (fascia lata graft) and strabismus surgery	Diplopia on extreme eye movements and paralyzed accommodation
	Müller[5] (1993)	Retrospective study	*South Africa*	*Parabuthus granulatus* and *P. capensis*	42 patients; 19 children <13 years	Ptosis in 9 patients (21.4%) and visual disturbances in 7 patients (16.7%)	16 patient (38.0%) presented with difficulty breathing or respiratory distress of which 4 (all children) died, 2 patients (4.8%) presented with cardiac arrhythmias	Antivenom was given in 35 cases (83.3%); there was no significant response	Not reported
	Bergman[16] (1997)	Retrospective study	*Zimbabwe*	*Parabuthus transvaalicus*	17 patients; 10 <13 years	Absent corneal reflexes with reduced blinking in 4 patients (23.5%), ptosis in 10 patients (58.8%), and "visual disturbance" in 2 patients (11.8%)	In 40% of patients	Antivenom was given in 12 cases (70.6%); hospital stay was reduced from 7 to 4 days	Not reported

* The Indian red scorpion (*Hottentotta tamulus*) was originally referred to as *Buthus tumulus*[17] or *Mesobuthus tamulus*[26]

DISCUSSION

All 32 cases of involuntary ("roving" or "oculogyric") eye movements were caused by the Arizona bark scorpion (*Centruroides sculpturatus*) in North America[8-10]. In 22 cases this involved children. Various treatments were used, including hydrocortisone, diazepam, and antivenom. Recovery of ocular function was reported to be within 30 to 120 minutes in patients that received antivenom and within 24 hours in patients that received symptomatic treatment[9,10]. It was found that toxins from certain neotropical (New World) genera, including *Centruroides*, contain peptides that bind to Na^+ channels (toxins-β) and induce a repetitive firing of action potentials, causing myoclonic or spastic muscular responses[4,11]. Paleotropical (Old World) scorpion toxins (toxins-α) also bind Na^+ channels, but cause depolarization of the membrane instead, leading to paralysis[4]. This could explain ptosis and oculomotor nerve palsy as seen in Asian and African cases[5,12-16].

Pupillary abnormalities, such as a sluggish reaction to light, mydriasis, miosis, and anisocoria, were the most common symptoms. Abnormal pupils could indicate early signs of systemic (neurologic) involvement, but this was not always the case[12]. In the case reported by Bawaskar *et al*.[17], a 55-year-old man suffered from hypertension and poor myocardial contraction, accompanied by bilateral mydriasis[17]. Symptoms waned after three hours with supportive care and antivenom. In one large, retrospective study of 951 Tunisian patients that were admitted to the intensive care unit after a scorpion sting ocular involvement was reported, including pupillary abnormalities as bilateral miosis (4.5%), bilateral mydriasis (1.7%), and anisocoria (0.4%). Squint was most commonly seen (12.5%). All pupillary abnormalities were correlated with poor general outcome[14]. More than half of the patients

were treated with antivenom. However, no specific effect of treatment on ophthalmologic symptoms was described.

Ocular effects were mostly attributed to be part of systemic envenomation. In three cases of peri-ocular scorpion stings, however, severe and unique local effects were reported[15,18,19]. Branch Retinal Vein Occlusion (BRVO) was seen two days after a patient was stung in her eyebrow[18]. This was theorized to be an expression of localized intravascular coagulation. One patient developed necrosis of the peri-ocular skin after a sting in the palpebral region, possibly caused by a local arterial spasm, eventually needing surgical debridement[19]. In one case, a palpebral sting led to an infectious keratitis[20]. Another case of a sting in the eyebrow lead to permanent oculomotor paralysis with ptosis and partial ophthalmoplegia, which required surgical intervention[15]. There were no reported cases of direct ocular exposure with venom from the African "spitting scorpion" (*Parabuthus transvaalicus*), which can spray venom through the air to deter its enemies.

One patient suffered three scorpion stings within four days, for which she received (unspecified) antivenom every time even though there were no signs of systemic involvement[13]. On the fifth day, she suffered from severe visual deprivation, attributed to a bilateral optic neuropathy. Coincidentally, there are multiple similar case reports of bilateral optic neuropathy, six days after a snakebite for which antivenom (IgG or Fab) was given[21-24]. In one of these cases, the offending snake was later found to be non-venomous, making the antivenom a suspected cause[24]. One could theorize that this case of optic neuropathy could also be a side effect of the (scorpion) antivenom instead of the envenomation itself.

Severe cerebral visual loss, caused by bilateral occipital cerebral infarction due to hypotension, was seen in one patient[25]. Another patient also had multiple (watershed) cerebral infarcts, but in combination with retinal haemorrhages[26]. Since blood pressure and coagulation tests were normal, both were attributed to severe vasospasms, causing reduced blood flow through the arterial carotid system and retinal vessels. Finally, one patient had retinal and intracranial haemorrhages[7]. This patient was stung by a *Nebo hierochonticus*, the only non-buthid species in this review, and also suffered from hypotension as a consequence. *Nebo hierochonticus* venom also has a specific haemolytic effect and is known to cause haemorrhages[27]. Partial thromboplastin time was prolonged in this patient. This would make the mechanism of injury in this patient different from all other described cases.

CONCLUSION

This paper gives a structured overview of ocular symptoms recorded in literature. Scorpion envenomation can cause a wide array of ocular symptoms, depending on species, systemic involvement, location of the sting, and possibly antivenom treatment. However, available data is scarce and is mostly based on case reports and retrospective studies.

Reported treatment varies widely, and therefore one can say very little on the specific treatment of ocular pathology in scorpionism. Little data suggests that patients with neurologic ocular symptoms (such as mydriasis and involuntary eye movements) recover faster after treatment with antivenom[9,10,17]. The level of evidence is low, however. Since there is little data, ocular treatment should be empirical and on an individual case-by-case basis.

Funding details: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Disclosure statement: The author declares that he has no competing interests.

Data availability statement: All data generated or analyzed during this study are included in this article.

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Unilateral ocular manifestation of cat-scratch disease in a 13-year-old child: Case report

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ABSTRACT

Cat-Scratch Disease (CSD) is a zoonotic infection caused by gram-negative facultative intracellular bacillus *bartonella henselae*. Ocular manifestations of Cat-scratch disease include Parinauds oculoglandular syndrome, uveitis, vitritis and neuroretinitis. Although there is wide range of ocular manifestations of Cat-scratch disease, the concurrent presentation of Parinaud's oculoglandular syndrome and neuroretinitis is rare. We present a case of a 13-year-old girl with cat-scratch disease who developed both conditions in the left eye following multiple cat scratches. The patient was treated with intravenous gentamycin, oral doxycycline and tapering oral prednisolone. Her visual acuity improved from hand movement to 6/9 in the left eye and ocular inflammation resolved by discharge.

Key words: Cat-scratch disease, Neuroretinitis, Parinaud's oculoglandular syndrome

INTRODUCTION

Cat-Scratch Disease (CSD) is one of the zoonotic infections caused by a gram-negative facultative intracellular bacillus *bartonella henselae*[1-3]. Other less common possible causative agents include *afipia felis* and *bartonella clarridgeiae*. Flea faeces are the major sources of these bacteria, through scratch, bite, or lick from infected cats, specifically kittens, humans are usually infected, or less commonly through ticks and other animal scratches and bites[3,4]. Overall, the disease manifests itself as a self-limiting illness marked by regional lymphadenopathy, pustular skin lesions, mild fever, and generalised malaise. Most cases recover without complications, though some atypical presentations can occur especially in immunocompromised persons. In such cases, there is the risk of systemic spread, with the liver, spleen and bones being affected or developing neurological and ocular complications[5]. Due to lack of randomized clinical trials the treatment of CSD is not standardized and it varies among clinicians. However observational data describe potential clinical response with trimethoprim–sulfamethoxazole, rifampin, azithromycin, gentamicin and ciprofloxacin[6]. Furthermore, various combinations of doxycycline, rifampin and gentamicin have been used for encephalopathy, neuroretinitis and hepatosplenic disease; in some instances of the latter conditions, resolution has been achieved in combination with steroid use[7]. Despite generally good outcomes, potential long-term sequelae include disc pallor, afferent pupillary defects, retinal pigmentary changes, and mildly decreased visual acuity and mild postinfectious optic neuropathy[8].

The ocular manifestations of CSD can be divided into two main groups. The first, Parinaud's Oculoglandular Syndrome (POGS), will have conjunctivitis and will often have preauricular lymphadenopathy[9]. The second is neuroretinits characterized by optic nerve swelling, granulomatous inflammation of the retina and optic nerve, the presence of macular stars, and subsequent possible vasculitis[10]. Overall, ocular involvement will be unilateral, although there are rare reports of bilateral disease. We present a case of a female child with CSD who developed unilateral POGS and neuroretinitis.

CASE REPORT

A 13-year-old girl presented to Lions Sight First Eye Hospital in Mzuzu, Malawi on February 12th 2025. She complained of redness in both eyes for the past month, followed by swelling of the left eyelids, which began one week prior. Her symptoms were associated with tearing and occasional left eye pain. She also reported reduced vision in the left eye, which was initially normal when the redness started but began to decline over the past week. Additionally, she experienced occasional headaches. Upon further questioning, the patient revealed a history of multiple exposures to cat scratches. Most recently, she was scratched by a juvenile cat six days prior, sustaining injuries on her left arm and right (Figure 1). The patient reported no history of systemic diseases. She had a history of eye conditions including bacterial conjunctivitis and allergic conjunctivitis.

On examination, the patient's visual acuity was 6/9 in the right eye and hand movement in the left eye. The

pupils were reacting to light and ocular motilities were full in both eyes. Furthermore, intraocular pressure was 9mmHg in the right eye and 10mmHg in the left eye.

Right eye: The right eye showed mild conjunctival hyperaemia, but the other anterior segment structures were healthy. Fundus examination of the right eye the cup to disc ratio was 0.3 with a healthy retina.

Left eye: Anterior segment examination revealed swollen eyelids and a hyperaemic conjunctiva with follicles. Fundus examination of the left eye showed a swollen optic nerve head with blurred disk margin, a hyperaemic optic disc and exudates around the macular (Figure 2). A full blood count was ordered which revealed an elevated white blood cell count of 12,400 and neutrophils levels were markedly elevated at 71.6%, consistent with a bacterial infection.

Figure 1: Images showing cat scratches (Black arrow) and left eye inflammation. Image showing a cat scratch on the leg (A). Image showing a cat scratch on the arm (B). Image showing left eye swollen eyelids (C)

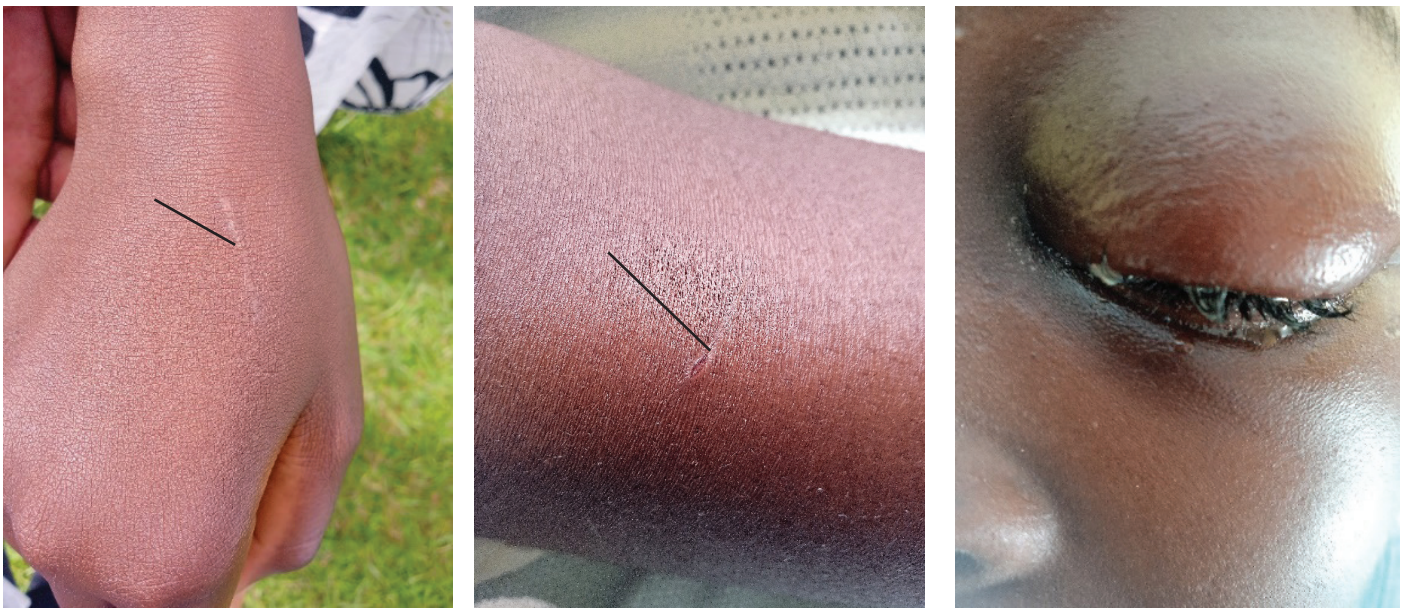
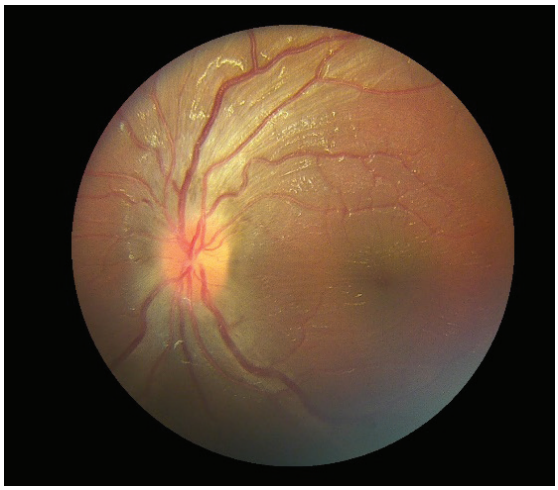


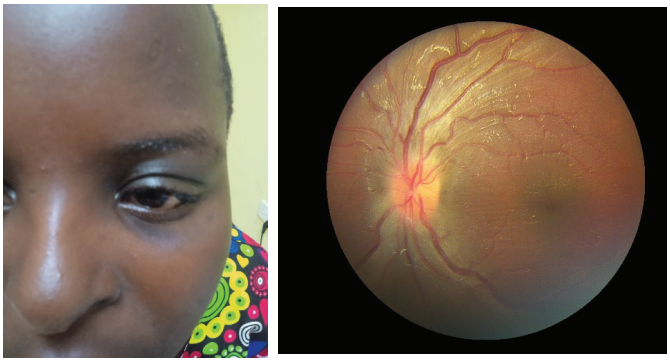
Figure 2: Retinal image of the left eye on day of presentation



The diagnosis was Parinaud's oculogranduar syndrome and neuroretinits in a female child with CSD. The patient was admitted in the paediatric ward at Lions Sight First Eye Hospital in Mzuzu, Malawi. The patient was prescribed gentamicin IV 80mg once daily for 14 days, doxycycline PO 100mg twice daily for 6 weeks and tapering prednisolone was also prescribed (40mg-5mg) for 7 days. On the day of discharge, the visual acuity was 6/9 in the left eye and the eye inflammation was resolving (Figure 3).

Figure 3: Left eye images on the day of discharge. Image depicting the resolved eye inflammation (A). Image illustrating the resolving neuroretinitis (B)

A B



DISCUSSION

Our patient presented with Parinaud's oculoglandular syndrome and neuroretinitis which led to the clinical diagnosis of Cats Scratch Disease (CSD). She had remarkably reduced vision, with a visual acuity of Hand Movement (HM) in the left eye, follicular conjunctivitis and neuroretinitis. The reduced vision could be attributed to macular exudates and optic neuritis. Other ocular presentations of CSD reported in literature include multi focal retinitis, uveitis, retinal vessel occlusion and retinal detachment[11].

Ocular manifestations of CSD are divided into two groups namely Parinaud's oculograndular syndrome and neuroretinitis[12]. Features of Parinaud's oculoglandular syndrome include conjunctivitis and preauricular lymphadenopathy while features of neuroretinitis are optic nerve swelling, granulomatous inflammation of the retina and optic nerve, the presence of macular stars, and subsequent possible vasculitis[13]. Overall, ocular involvement is unilateral, although there are rare reports of bilateral disease[8]. Most case reports describe neuroretinitis as the ocular manifestation of CSD while POGS is uncommon, occurring in only about 6% of patients[14]. Our patient uniquely showed concurrent Parinaud's oculoglandular syndrome and neuroretinitis as evidenced by follicular conjunctivitis, optic nerve head swelling, hyperaemic optic disk, blurred optic margins and macular exudates.

Exposure to young cats or kittens is a significant risk factor for CSD[15]. One week before presentation the patient sustained cat scratches and lived with cats in her home. No Bartonella specific laboratory tests were performed which is a limitation of the case report although clinical findings strongly supported CSD.

Bartonella henselae is a gram-negative intracellular bacillus that cause CSD and spread via scratches, bites, or flea feaces. The bacteria induce reginal lymphadenopathy and occasionally systemic lymphadenopathy after entering the lymphatic system[16]. When the bartonella spreads haematogenously to the optic nerve and retina, it causes a granulomatous inflammatory reaction that involves the eyes. Conjunctivitis and preauricular lymphadenopathy are the hallmarks of POGS, whereas optic disc oedema, macular star formation and vasculitis are the hallmarks of neuroretinitis[11].

CDS related neuroretinitis must be differentially diagnosed for the inflicting conditions of infectious, inflammatory and neoplastic processes. The most common immune mechanisms involving neuroretinitis include syphilitic perineuritis, toxoplasmosis, tuberculosis, and leptospirosisi. Autoimmune and inflammatory opticulate conditions e.g. optic neuritis, sarcoid papillitis, or pseudotumor cerebri cause swelling of the optic nerve and need to be ruled out carefully. Neoplastic causes like lymphoma ought to be suspected when associated with systemic symptoms[17].

In order to confirm the diagnosis, laboratory tests are essential. The Enzyme Linked Immunosorbent Assay (ELISA) and Immunofluorescence Assay (IFA) are the two serological assays for bartonella henselae that aid in the detection of IgM or IgG antibodies where high titers indicate a recent infection[18]. Bartonella DNA can be found in blood or ocular fluids with great specificity using Polymerase Chain Reaction (PCR) testing, however blood cultures are less accurate because of the bacteria picky character[19].

Other diagnostic measures offer considerable support for the diagnosis of CSD induced neuroretinitis. Some preferred indicators include retinal vasculitis, macular exudate, and disc oedema, which can be visualized through fundoscopy. Optical coherence tomography reveals any retinal thickness and macular oedema, while fluorescein angiography detects leakage from the optic disc. MRI contrast is used to exclude optic neuritis or lesions threatening the brain in case of neurological involvement[20].

Management of CSD mainly comprises of antibiotic therapy[21]. Our patient was managed with antibiotics and glucocorticosteroids. While many studies report the use antibiotics as the primary management for CSD few studies had included a steroid in their treatment regimen[20]. Our patient's vision improved to 6/9 in the left eye within 10 days with resolution of conjunctivitis, neuroretinitis and macula exudates. Follow up in CSD is necessary to note disease progression and complications[22]. Our patient was followed for a period of two weeks during admission, and a follow up appointment was scheduled for two weeks and then six months after discharge, however the patient missed the first outpatient visit.

Overall, CSD resolves on its own, however if there is ocular phenotype involved, it has to be treated to prevent vision loss. Oral doxycycline, historically prescribed as the most efficacious treatment at 200mg once a day for 14-28 days. In addition, some other antibiotics have also been used in the therapy of CSD and may include ciprofloxacin, rifampin, trimethoprim and gentamicin[23]. Alternative treatments include erythromycin for children under 12 years to prevent tooth discoloration and azithromycin for rapid lymphadenopathy. In severe cases, intravitreal anti-VEGF therapy may be considered for neovascularization or macular oedema[24]. Depending on the severity of neuroretinitis, the prognosis of vision varies. According to some studies, 80% of the affected eye achieve better than 20/40 vision at diagnosis, 14% have moderate visual impairment (20/40-20/200), and 6% have severe visual impairment (<20/200)[20]. Recovery is poor when the optic nerve is heavily involved.

CONCLUSION

Parinaud's oculoglandular syndrome and neuroretinitis are rare findings in patients with CSD. This case report emphasizes on how important it is to identify POGS and neuroretinitis as abnormal ocular signs of CSD and therefore suggests that CSD should be included in the differential diagnosis of patients presenting with POGS and neuroretinitis. In order to rule out other infectious and inflammatory diseases, laboratory and imaging tests are required. Early antibiotic and glucocorticosteroid therapy are important for better visual outcome. Public awareness campaigns should be conducted to educate communities about the transmission of CSD through cat scratches, bites, and flea feaces. Comprehensive flea treatment for cats can help lower the risk of infection in people because CSD is a zoonotic infection that is sustained and spread among cats by fleas. Handwashing after interacting with cats can also lower the danger because flea feaces can burrow into injured skin.

Declaration

Funding: The authors declare that no funding was received for this manuscript.

Consent for publication: The authors have read and approved the final version of the manuscript for submission and publication

Competing interests: The authors declare that they have no competing interests.

Authors' contributions

Dr Patty Mopamboli Mboli conceptualized the case report and was the primary author responsible for drafting the manuscript. Benjamin Tenson Msopole was responsible for the taking all patient photographs and their subsequent incorporation into the manuscript as figures. Phillip Chisomo Nyambalo conducted the proofreading of the manuscript, ensuring accuracy and clarity and was responsible for the formatting and referencing.

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