ANALYSIS OF KERATOMETRIC READINGS AND ASTIGMATISM IN PATIENTS WITH DIFFERENT GRADES OF PTERYGIUM ATTENDING ADULT EYE CLINIC AT MUHIMBILI NATIONAL HOSPITAL

Moustafa Ibrahim, MD

MMed (Ophthalmology) Dissertation

Muhimbili University of Health and Allied Sciences

October 2021

Muhimbili University of Health and Allied Sciences

Department of Ophthalmology



By

Moustafa Ibrahim

A Dissertation submitted in partial fulfillment of the requirement for the Degree of Master of Medicine in Ophthalmology of Muhimbili University of Health and Allied Sciences

October 2021

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Science a dissertation entitled: ***"Analysis of keratometric readings and astigmatism in patients with different grades of pterygium attending adult eye clinic at Muhimbili National Hospital",*** in (partial) fulfillment of the requirement for the degree of Master of Medicine (Ophthalmology) of the Muhimbili University of Health and Allied Science.

_____

Professor Milka Mafwiri

(Supervisor)

Date_____

_____

Dr Celina Mhina

(Co-supervisor)

Date_____

DECLARATION AND COPYRIGHT

I, **Dr. Moustafa Ibrahim Elmasry**, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature.....

Date.....

This dissertation is a copyright material protected under the Berne Convention, the Copyright Act of 1999 and other international and national enactments, in that behalf, on intellectual property. It may not be reproduced by any means in full or in part, except for short extracts in fair dealings; for research or private study, critical scholarly review or discourse with an acknowledgement, without the written permission of the Directorate of Post Graduate Studies, on behalf of both author and the Muhimbili University of Health and Allied Sciences.

ACKNOWLEDGEMENT

I sincerely thank **Professor M. Mafwiri** whose support, patience and care guided me to undertake this study to a successful completion. I am really so proud to be one of her students.

I am very grateful to **Dr. Celina Mhina,** Head of Department of Ophthalmology at Muhimbili University of Health and Allied Sciences for all her help, guidance and support that she has given me throughout my residency program.

I take this opportunity to pay my respect to **Dr Paul Nyaluke**, Head of Department of Ophthalmology at Muhimbili national hospital for allowing me to conduct the study in the department and use all necessary departmental instruments and equipment for the study.

I would like to thank the department of biostatistics for their effort in analyzing and compiling the results of this study, without whose time and effort, my work wouldn't have seen the light of this world.

I couldn't forget my parents, sisters and my wife for always being a strong pillar of support.

Last but not the least, Alhamdulillah for making all this happen and for supporting me to achieve my target.

DEDICATION

To my parents, sisters, nieces and nephews.

To my lovely wife

To my lovely daughter Malak and my sons (Youssef & Ibrahim)

To my dear friend Dr Shomirza

ABSTRACT.

Background: Pterygium is a worldwide disease affecting people of all races especially in tropical and sub-tropical areas. It has a direct effect on corneal curvature leading to visual impairment in the form of astigmatism especially in advanced grades.

Surgical removal is the treatment of choice for a progressive pterygium. However, recurrence of pterygium after surgical removal discourages surgical intervention during early stages of the disease. Reports from literature show that encroachment of the cornea by a progressive pterygium causes astigmatism with resultant visual loss even before a pterygium obscures the visual axis. Furthermore, the grade of pterygium is related to keratometric readings and the amount of astigmatism. Knowing the grades of pterygium that are associated with changes in corneal dioptric power and astigmatism can emphasize the fact that astigmatism is an indication for surgical removal of a pterygium before visual impairment occurs.

Objective: To determine and analyze the keratometric readings and astigmatism in different grades of pterygium

Methodology: A hospital based cross-sectional descriptive study was conducted in adult eye clinic at Muhimbili National Hospital between June and December 2019. Consecutive sampling of 64 patients with pterygium was done. Recruited patients was underwent a short history and ophthalmological examination for assessment of the size of pterygium by using slit lamp bio microscopy. Auto refractometry and keratometry were performed.

Ethical approval to conduct this study was obtained from the Research and Publication Committees of Muhimbili University of Health and Allied Sciences and the executive director of Muhimbili National Hospital. Data was analyzed with the help of the statistical package for social science software version 21.

Results: 95 out of 1346 (7.06%) patients were diagnosed to have pterygium during the study period. 64 (124 eyes) patients were recruited. 34 (53%) were females. 48% were aged between 41 to 50 years with a mean age of 45.14+/- 9.93(SD) years. 34(27.4%) eyes had grade one, 41(33%) had grade two, 28(22.6%) eyes grade 3 and 21(17%) eyes with grade four pterygia. The mean keratometric reading for the vertical (K1) and horizontal meridian (K2) were 43.05D and 44.16D respectively. 79.5% eyes with grade 3 and 4 pterygia presented with astigmatism of more than 1D. The overall mean magnitude of astigmatism was 1.429DC +/- 0.6225SD. The keratometric readings and magnitude of astigmatism increased with increasing size of pterygium with a positive correlation of r=0.922 r=0.786 respectively.

Conclusions and Recommendations

Eyes with high grades of Pterygium and astigmatism of 1DC has a significant initial effect.

It is highly recommended to do Keratometry and refraction for all patients with pterygium. Those patients found to have with the rule astigmatism of more than one diopter need be counseled for pterygium excision.

TABLE OF CONTENTS

CERTIFICATION II
DECLARATION AND COPYRIGHT III
ACKNOWLEDGEMENT IV
DEDICATION V
ABSTRACT VI
LIST OF TABLES XI
LIST OF FIGURES XII
ABBREVIATIONS XIII
DEFINITION OF KEY TERMS XIV

CHAPTER 1.....

INTRODUCTION 16
1.1 literature of review 19
1.2 problem statement 25
1.3 rationale 26
1.4 research questions 26
1.5 broad objective.....27
1.6 specific objectives.....27
1.7 conceptional framework 28

CHAPTER 2.....

METHODOLOGY 29

2.1 study design 29

2.2 study area 30

2.3 study duration.....30

2.4 target population 30

2.5 study population 30

2.6 inclusion criteria 30

2.7 exclusion criteria 31

2.8 sample size and sampling technique 31

2.9 data collection tools 33

2.10 data collection procedures 34

2.11 data management and analysis 35

2.12 ethical consideration 35

CHAPTER 3.....

RESULTS ----------36

3.1 Proportion of pterygium 37

3.2 Size and grades of pterygium 37

3.3 Keratometric readings in patients with different grades of pterygium 39

3.4 Magnitude of astigmatism in different grades of pterygium 40

3.5 correlation between grades of pterygium and astigmatism 41

3.6 Correlation between grades of pterygium and keratometric readings 42

CHAPTER 4 .....

DISCUSSION 43

CHAPTER 5 .....

CONCLUSION AND RECOMMENDATIONS .....

5.1 conclusion 47

5.2 recommendations 47

5.3 study limitations 48

5.4 study mitigations 48

REFERENCES 49

APPENDIX 1: QUESTIONNAIRE (ENGLISH VERSION) 54

APPENDIX 2: QUESTIONNAIRE (SWAHILI VERSION) 57

APPENDIX 3: INFORMED CONSENT FORM (ENGLISH VERSION) 59

APPENDIX 4: INFORMED CONSENT FORM (SWAHILI VERSION) 62

LIST OF TABLES

TABLE 1: SOCIODEMOGRAPHIC CHARACTERISTICS OF STUDY POPULATION.....37
TABLE 2: RELATION BETWEEN GRADES OF PTERYGIUM & ASTIGMATISM.....40
TABLE 3: CORRELATION BETWEEN GRADES OF PTERYGIUM & ASTIGMATISM 41
TABLE 4: CORRELATION BETWEEN GRADES OF PTERYGIUM & KERATOMETRIC READING 42

LIST OF FIGURES

FIGURE 1: FRAMEWORK FOR THE ANALYSIS OF FACTORS IMPORTANT FOR OPTIMAL MANAGEMENT OF PTERYGIUM-INDUCED ASTIGMATISM……..…… 28
FIGURE 2: PATIENTS FLOW DIAGRAM 36
FIGURE 3: DISTRIBUTION OF DIFFERENT GRADES OF PTERYGIUM ……...…….38
FIGURE 4: DISTRIBUTION OF K1 & K2 READINGS ……..39

LIST OF ABBREVIATIONS

ATR	Against the rule.
BE	Both eyes.
CYL	Cylinder.
D	Diopter.
DC	Dioptric cylinder.
DS	Dioptric sphere.
G	Grade.
IOP	Intra ocular pressure.
K1	Keratometric reading of horizontal meridian of the cornea
K2	Keratometric reading of vertical meridian of the cornea
LE	Left eye.
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
N	Refractive Index of the cornea
RE	Right eye.
SAI	Surface asymmetry Index
SLE	Slit Lamp Examination
SPSS	Statistical Package of Social Sciences
SPH	Sphere.
SRI	Surface regularity index
TZS	Tanzanian Shillings
WTR	With the rule.

DEFINITION OF KEY TERMS

i. **Pterygium** is a triangular fibrovascular encroachment of bulbar conjunctiva over the cornea with apex directed to the cornea while the base directed to the canthus.

ii. **Astigmatism** is a refractive error in which the light rays coming from infinity will be focused into a line not a point which can be either in front of the retina (myopic astigmatism) or behind the retina (hyperopic astigmatism).

iii. **Clinical classification of astigmatism** is a special classification of astigmatism depending on the location of the line of focused rays either in front or behind or even partially on the retina. It includes simple, compound and mixed astigmatism.

iv. **Optical classification of astigmatism** is a special classification of astigmatism depending on the dioptric power of each meridian which can be with the rule (WTR) or against the rule (ATR).

v. **With the rule astigmatism** is an optical type of astigmatism in which the vertical meridian is steeper than the horizontal one.

vi. **Against the rule astigmatism** is a special type of astigmatism in which the horizontal meridian is steeper than the vertical one.

vii. **Induced corneal astigmatism** is a significant degree of corneal astigmatism (more or equal to 0.50 DC) which is induced by the encroachment of a pterygium onto a cornea of emmetropic eye.

viii. **Clinically significant astigmatism is** a state of refraction in which the cut point of magnitude of astigmatism is 0.50 DC.

ix. **Keratometry** is an investigation to detect the power of anterior surface of the cornea by measuring the curvature of its meridians.

x. **Visual acuity** is the relative ability of the eye to resolve detail that is usually expressed as the reciprocal of the minimum angular separation in minutes of two lines just resolvable as separate and that forms in the average human eye an angle of one minute.

xi. **Visual acuity test** is a measurement of central vision only which can be tested for both distance and near vision.

xii. **Snellen chart is** an eye chart used to measure visual acuity at definite distance.

xiii. **Refraction** is defined clinically as a measurement of the focusing characteristics of an eye or eyes.

xiv. **Error of refraction** is a clinical problem with focusing light accurately onto the retina either due to change axial length of the eye or change in curvature of refractive surfaces.

xv. **Retinoscope** is an instrument used for objective assessment of the refractive error of the eye.

xvi. **Snellen chart** is an eye chart used to measure visual acuity at a definite distance.

xvii. **Slit lamp bio microscope** is an instrument consisting of a high-intensity light source and bio microscope that can be used to examine the eye lids and anterior segment of the eye.

CHAPTER ONE

1. INTRODUCTION

Pterygium

Pterygium is a triangular fibro vascular sub- epithelial encroachment of degenerated bulbar conjunctival tissues over the limbus on the cornea(1). It is a worldwide disease which is particularly common in tropical and sub-tropical regions(2).The prevalence of pterygium is expected to increase in Africa due to poor health care and inadequate awareness among the people about the condition and how to prevent it. In Tanzania, despite having no statistics for pterygium, clinical data show that it is one of the common external ocular diseases (3).

Pathophysiology:

Among the several risk factors reported, exposure to UV rays is perhaps the most accepted risk factor for the occurrence of pterygium. UV radiation can cause mutations in genes such as the p53 tumor suppressor gene, resulting in abnormal pterygial epithelium. Recent studies have suggested that human papilloma virus may also be implicated in pterygium pathogenesis. These findings suggest that pterygium is not just a degenerative lesion, but could be a result of uncontrolled cell proliferation. Matrix metalloproteinases (MMPs) and tissue inhibitors of MMPs (TIMPs) at the advancing pterygium edge may be responsible for the inflammation, tissue remodeling, destruction of Bowman's layer and pterygium invasion into the cornea. Surgical techniques that fail to address these pathophysiologic causative factors, such as the bare sclera technique, appear to be associated with the highest rates of recurrence. Since a recurrence is more aggressive than the primary lesion in speed and extent of corneal invasion, it is important to choose the primary procedure that has the highest rate of success (2)(3)(4).

The condition is more common in males than females and in old age rather than young age (5). It grows as a wing of conjunctival tissue moving towards the corneal surface(6). It is therefore graded according to its progression and involvement of the cornea. Growth of a pterygium over the cornea causes deformation and changes of the curvature of the cornea leading to differences in refractive power of the cornea in the different meridians, a condition known as astigmatism(7). By encroaching on the cornea from the nasal side, a pterygium flattens the horizontal meridian of the cornea and consequently causes with the rule (WTR) astigmatism by mechanical traction(8).

Astigmatism and pterygium:

Astigmatism is a state of refraction in which the light rays coming from infinity will be focused onto a line due to the difference in refractive power of the eye in different meridians (8). This causes poor vision which is correctable optically by cylindrical lenses or contact lenses and also surgically through refractive surgeries including LASIK (laser in-situ keratomileusis) and Astigmatic keratotomy (AK) or even by normal surgery through LRI (limbal relaxation incision). Astigmatism represents about 13 % of refractive errors worldwide(9). Astigmatism can be clinically classified into simple, compound and mixed depending on the difference in main corneal meridians(9). It can be optically classified according to the corneal regularity into regular and irregular type(9).

Several ways are used to assess astigmatism such as a placido disc which is used to screen for irregular astigmatism. Keratometry is a procedure of measurement of the curvature of the anterior surface of the cornea. Keratometry is used to assess astigmatism by measuring the curvatures of the cornea at different meridians (10). keratometric readings are obtained K1 for the horizontal meridian and K2 for the vertical meridian. Keratometric readings denote the degree of corneal curvature in the respective meridians. The keratometric readings in presence of pterygium differ depending on how much pressure has been exerted on the cornea by a progressive pterygium. Auto-refractometry and retinoscopy are performed to determine the magnitude of a refractive error including astigmatism.

The treatment of choice for a progressive pterygium is surgical removal(10). However, recurrence of a pterygium following surgical removal is very high(11). This discourages ophthalmologist to routinely remove pterygia until they invade the cornea and cause visual impairment.

Knowing the grades of pterygium that are associated with changes in corneal dioptric power and astigmatism can emphasize astigmatism as an indication for surgical removal of a pterygium even before visual impairment occurs. This knowledge may also empower ophthalmologist and other eye health workers to establish protocols for the management of pterygium thereby improve services. Despite having many cases of pterygium, the analysis

of keratometric readings and astigmatism in different grades of pterygium has never been studied at Muhimbili National Hospital.

1.1 LITERATURE REVIEW

Prevalence of pterygium

Pterygium is a worldwide external ocular degenerative disease which is more common in warm and dry climates. The prevalence of pterygium is about 22% in equatorial areas and less than 2 % in latitudes above 40 degrees (12)**.** Data on the prevalence of pterygium from different areas of the world show highest prevalence in tropical countries including Brazil, Peru and Central Sahara Africa(12).A recent Study done in Gondar city, Northwest Ethiopia showed that the prevalence of pterygium was (38.7%)(13).

A study done in Iran, 2012 showed the highest prevalence of pterygium was in Brazil and Peru with 36.6% and 31.06% respectively while in Central Sahara and Nigeria showed prevalence of 18% and 8% respectively. The lowest prevalence of pterygium in this study was in Solomon Islands and Denmark with prevalence of 0.3% and 0.7% respectively (12). The prevalence of pterygium in Tanzania is not known. However, in a study to determine the histological pattern of acquired conjunctival growths at Muhimbili National Hospital in 2003, pterygia ranked second with a prevalence of 24.2%(13).

Proportions of different grades of pterygium

The proportions of different grades of pterygium differ depending on risk factors, awareness of the population about pterygium and availability of eye care. However, in most studies, grade one pterygia are the commonest while progressive (grades 3 and 4) pterygia are the least(14).

In a study by Gazzard, M Farooq et al in Indonesia which recruited a total of 163patients, the proportion of different grades of pterygium were: 54%were grade 1, 25.7 % were in grade 2 and 19.6 % pterygia were of grade 3. Similar results were noted in a study that was conducted in Pakistan in 2012 by Pir Salim Mahar and Nabil Manzar which reported the different grades of pterygium to be 85 (70.8%) were affected by grade1.while (16.7%) were affected by grade2 and (12.5%) were affected by grade 3(15).

Few studies on pterygium have been done in Africa. Among them was a study by Dereje Hayilu in Ethiopia in 2016 with sample size 360 eyes. In this study the proportion of

different grades of pterygium was (64.2 %) for grade1 and (34.4%) for grade 2 and (5.9%) for grade 3.

Management of different grades of pterygium

Management of pterygium mainly based on its grade as well as the patient complaints. The early grades of pterygium usually presenting with eye discomfort and irritation which are variables from patient to another and mainly treated medically by using lubricant eye drops +/- topical steroids which might be helpful to reduce the inflammation. On contrary, the high grades of developed pterygium especially grade 4 whereby the patients start complain of visual disturbance due to partial obscure of visual axis by the proliferative pterygium indicating surgical intervention as soon as possible which has many modalities such as bare scleral excision, Conjunctival Autograft, Free Conjunctival Autograft, Conjunctival Rotation Autograft Surgery, Amniotic Membrane Transplantation and Cultivated Conjunctival Transplantation (16). The new modalities include Fibrin Glue, Autologous Serum and Split Graft for Double Pterygia.

Most updating studies are underway to try Bevacizumab as an adjuvant in pterygium surgery to prevent recurrence (17).

Keratometric readings in different grades of pterygium

Keratometric readings show the different refractive power of different meridians of the cornea. The keratometric readings depend mainly on the degree of curvature of the corneal meridians. A progressive pterygium flattens the cornea at a certain meridian, thereby affecting directly the keratometric readings. Reports from literature show an increase of keratometric readings in proportion to the increase in the size of pterygium over the corneal surface especially from grade two to grade four (17). In a study that was done in India in2006 with a sample size of 151 eyes with primary pterygia, The increase in the grade of pterygia had a significant effect on corneal induced astigmatism especially in patients who presented with grade 3 and grade 4 pterygia(18).

Similar results were shown in a study done in Turkey in 2003 with sample size of 16 eyes with primary pterygium. In that study, the keratometric readings in patients who presented with pterygium grade 3 was between (1.22–5.84 D) with an average of 4.3171 D(17).

Types and magnitude of astigmatism in different grades of pterygium

A pterygium growing on the cornea induces different types of astigmatism depending on the meridian affected. The pterygium generally causes with-the-rule corneal astigmatism that is hemi meridional on the side of the pterygium which can be explained by the mechanical pressure of pterygium on the horizontal meridian of the cornea leading to flattened of horizontal meridian and relative steeper of vertical meridian.

The magnitude of astigmatism also differs depending on the grade of pterygium as more advanced grade of pterygium means more pressure on the cornea and then high magnitude of astigmatism (18).

In a study that was done in India in 2014 with sample size of 50 participants, the most common type of corneal induced astigmatism was regular astigmatism. Among4 patients with grade1, 25% presented with an oblique astigmatism. Regarding grade 2 pterygia, 14 out of 36 patients had horizontal meridian astigmatism,14 patients had an oblique meridian astigmatism and 8 patients showed vertical meridian astigmatism. Three out of 6 patients with grade 3 showed horizontal meridian astigmatism while the other 3 presented with an oblique meridian astigmatism. Among 4 patients with grade 4 pterygium, 2 patients showed horizontal meridian astigmatism while the other 2 patients presented with an oblique meridian astigmatism(16).

According to a report from a case control study that was done in Nigeria with sample size of 141 cases, a higher proportion of with the rule (WTR) astigmatism was found among cases (85.7%) than controls (79.4%). It was also found that overall the average magnitude of astigmatism was higher in cases (1.56D) compared to controls who had an average of 0.92D (19).

In another study that was done in Ibadan Nigeria with sample size of 50 patients with pterygium whereby the refraction was also done in both eyes of patients with unilateral pterygium, there was a statistically significant association ($p<0.01$) between refractive astigmatism and the presence of pterygium(20).

In a study that was done in Japan in 2000 with sample size of 136 participants the average magnitude of astigmatism in different grades of pterygium from grade 1 to grade 4 was 3.8

+/- 2.8 DC(9). Similarly another study that was done in Turkey in 2003 noted that pterygium caused serious corneal astigmatism with an average magnitude of 4.3171 D(17).

In the same country, Turkey in 2000 where 148 eyes of 108 adult patients with primary pterygia were examined, the mean magnitude of WTR (88.4%) astigmatism was 1.66 ± 0.84 D in the eyes with pterygium(21).

Association between grades of pterygium and astigmatism

Previous studies showed that with increasing progression of pterygium, there is a change in the curvature of the cornea leading to a corresponding change in the keratometric readings. In a study done in Chicago in 1995 with sample size of 60 participants who presented with grade1 to grade3 pterygium it was noted that there was an increase in astigmatism with increasing size of the pterygium. In thirty patients with grade1, the average magnitude of astigmatism was1.66 +/- 0.50 DC, while among 26 patients with grade2, it was 2.67 +/- 0.74 DC. Additionally four patients with grade3 presented with the highest magnitude of astigmatism of 3.47 +/- 1.46 D (22).The study in Japan in 2000 also showed that there was a strong correlation between grades of pterygium and surface asymmetry of the cornea(9). Similarly, a stronger correlation was noted between pterygium size and the difference in corneal astigmatism between cases and controls in a study involving 77 eyes in Malaysia in 2008. It was noted that pterygium induced 2D of corneal astigmatism when its extension exceeded 2.2 mm (grade 3 and grade 4) (23).

Furthermore, it has been noted that the increasing distance of a pterygium head from the limbus results in increased amount and irregularity of induced corneal astigmatism which may explain the decrease in visual acuity in patients with pterygium even before it reaches the visual axis. This was shown in a study which was conducted in Germany in 2001 with sample size of 52 patients(24). Similar results were obtained in a study in USA involving 33 eyes of 25 patients who presented with primary pterygium. In that study pterygium induced WTR was noted when the lesion size was more than or equal 45 % of the corneal radius or if the head of pterygium was located at 3.22 mm or less from the visual axis (25). Both studies (22, 23) showed a strong correlation between size of pterygium and induced astigmatism.

Reports from literature have shown a high prevalence of pterygia in tropical regions of the world. It is explained being closer to the equator, there is a high incidence of exposure to harmful UV rays and dust which are the main precipitating factors of pterygium. Progressive pterygia lead to corneal induced astigmatism which causes visual impairment even before they obscure the visual axis. Furthermore, reports have shown a strong correlation between increasing size of pterygium and high induced astigmatism.

Up to date, still surgical intervention is the preferable method for the management of a case of pterygium especially those presenting with advanced grade. Because of the tendency to recur after surgical excision, ophthalmologist may be discouraged to remove pterygia that have not reached and obscured the visual axis. Early pterygium surgical intervention has been practiced at MNH in order to avoid pterygium complications like astigmatism.

Tanzania being one of the countries in the tropical region, there are many patients who suffer from the effects of pterygia. However, no studies have been done in Tanzania on the analysis of keratometric readings and astigmatism among patients with pterygium. The aim of the present study is to determine and analyze the keratometric readings and astigmatism among patients with pterygium. Specifically, the study will determine the proportion of patients affected with pterygia, the keratometric readings and types of astigmatism in different grades of pterygium and the association between pterygia and induced corneal astigmatism at MNH in order to establish protocols for management of

pterygia and encourage early surgical intervention. These measures will improve quality of management for pterygium at Muhimbili National Hospital.

1.2 PROBLEM STATEMENT

Pterygium is one of the common external ocular diseases which is particularly common in tropical and sub-tropical regions. The prevalence of pterygium is expected to increase in Africa due to poor health care and inadequate awareness among the people about the condition and how to prevent it. Clinical data show that about 200 patients per year present to MNH to seek medical advice for pterygia. A progressive pterygium causes irritation and corneal induced astigmatism which leads to significant visual impairment. However, information on the actual magnitude of pterygium-induced astigmatism and keratometric readings among patients presenting with different grades of pterygium in our setting is limited.

1.3 Rationale

The aim of the study was to analyze the keratometric readings and astigmatism in different grades of pterygium. The findings of this study would be used as a platform to improve management protocol of pterygium through which it would help ophthalmologist in decision making to surgically remove pterygium in early grades before they cause astigmatism and visual impairment.

Additionally, the study results would also increase awareness and knowledge among eye health care providers at Muhimbili National Hospital on the correlation between grades of pterygium and keratometric readings and astigmatism. This would encourage them to follow appropriately the management protocol for pterygium and educate the general public about the complications of neglected or delayed management of pterygium.

1.4 RESEARCH QUESTIONS.

1. What is the proportion of patients with pterygium at the adult eye clinic at MNH during the study period?
2. What are the keratometric readings of patients with different grades of pterygium who are attending the adult eye clinic at MNH during the study period?
3. What are the types & magnitude of astigmatism in patients who have pterygium attending adult eye clinic at MNH?
4. Is there a relationship between grades of pterygium and keratometric readings among patients with pterygium attending the adult eye clinic at MNH?

OBJECTIVES

1.5 MAIN OBJECTIVES

To determine the magnitude of pterygium-induced astigmatism and record associated keratometric readings among patients presenting with different grades of pterygium at MNH.

1.6 SPECIFIC OBJECTIVES

1) To determine the proportion of patients with pterygium at the eye adult clinic at MNH during the study period.
2) To determine the keratometric readings of patients with different grades of pterygium attending the adult eye clinic at MNH.
3) To determine the types of astigmatism in patients with different grades of pterygium attending the adult eye clinic at MNH.
4) To determine the association between grade of pterygium and keratometric readings among patients with pterygium who are attending the adult eye clinic at MNH

1.7 Conceptual Framework

Significant proportion of adult patients with pterygium never undergo eye checkup for this condition either due to poor awareness about the disease itself and / or its complications.
This study revealed the changes in keratometric readings and magnitude of astigmatism associated with different grades of pterygium among patients with no prior consultation for pterygium.
In order to think about what is the most appropriate method and develop analytical plan, I constructed this conceptional framework to show the relationship among the factors I am going to investigate.

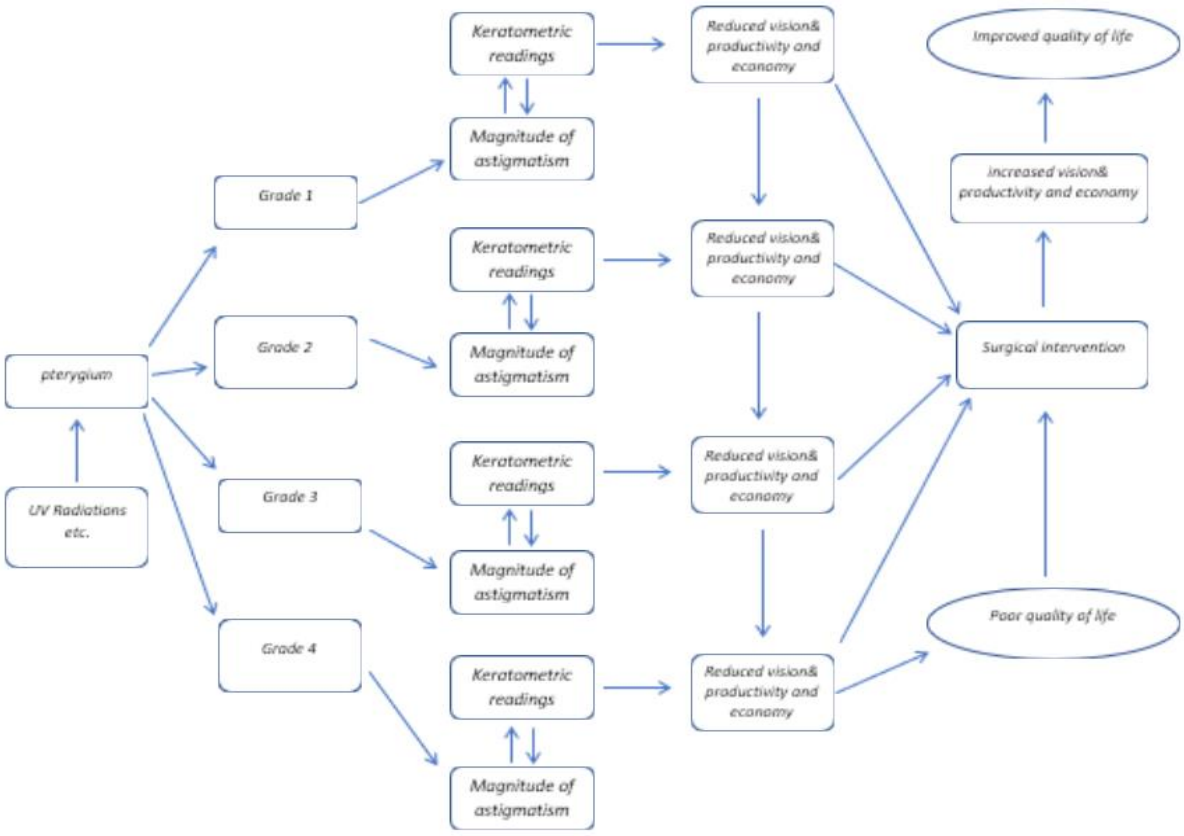


Figure 1. framework for the analysis of factors important for optimal management of pterygium-induced astigmatism.

CHAPTER TWO

METHODOLOGY

2.1 Study design

This is a hospital based descriptive cross-sectional study.

2.2 Study area

The study was conducted at the adult eye clinic at Muhimbili National Hospital (MNH) in Dar es Salaam. MNH is the biggest national consultant and teaching hospital for both undergraduate and postgraduate students from MUHAS.

It is also a tertiary referral center attending an average of 120 out-patients with eye problems per day with an average of 600 patients per week. The adult eye clinic at MNH is made up 3 big rooms. In the first room, patients routinely undergo visual acuity assessment using a Snellen chart and intraocular pressure measurements by air puff automated tonometer (TOPCON). The second room is well equipped with 8 slit lamp bio microscopes from different brands (KAWA, ZEISS) placed in sectioned parts whereby patients will be examined by ophthalmologist. The third room is equipped with refraction equipment including trial case, Retinoscope and visual acuity charts. There is an auto-refractometer and Keratometer (CANON) that are used whenever needed. The clinic is staffed with 8 ophthalmologists who use the clinic in turn depending on their area of super specialization. There are 2 nurses who are responsible for arranging the clinic works. The adult clinic runs from Monday to Friday with consultation time from 8.00am to 5.00pm. Data was collected at the outpatient adult clinic.



2.3 Study duration.

The study was conducted from June to December 2019.

2.4 Target population

All patients who attended adult eye clinic at MNH were eligible for the study.

2.5 Study population

All patients confirmed to have pterygium.

2.6 Inclusion criteria

Patients with primary unilateral or bilateral pterygium

2.7 Exclusion criteria

1. Patients with history of refractive errors before they developed pterygium.

2. Patients with corneal pathology that can affect vision e.g., keratitis, Keratoconus. Current or previous corneal diseases or surgeries are likely to affect corneal curvature and lead to abnormal keratometric readings**.**

3. Patients with recurrence pterygium.

4. Patients with pseudo pterygium.

5. Patients with physiological astigmatism (less than 0.5 DC)

2.8 Sample size and sampling technique.

Consecutive sampling technique was used to select the study participants whereby all the patients with pterygium who attended adult eye clinic at MNH during study period and who met the inclusion criteria were recruited in the study until the sample size was achieved.

The sample size was estimated by using the following formula;

Whereby the prevalence of pterygium is 8.8 % obtained from a study done in southern Ethiopia.

Prevalence of pterygium

$$n = z2p\,(100 - p) / \varepsilon 2$$

n = Minimum required sample size

z = percentage point of normal distribution corresponding to the level of confidence

£= Maximum likely error/ margin of error

p= expected proportion with the characteristic of interest (prevalence)

95% confidence interval (Z) = 1.96

Error rate (£) = 5%

P = 4.4 %

n = (1.96/5)2x (8.8(100-8.8) =**120 eyes**

From above,

The sample size was = **120 eyes**

Variables

Independent variables

The independent variables were age, sex, laterality and the grades of pterygium (grade 1, grade 2, grade 3 and grade 4)

Dependent variables

The dependent variables included K1 and K2 readings and magnitude of astigmatism.

DATA COLLECTION

2.9 Data collection tools

1. A semi structured questionnaire was used to collect patient's information which included demographic characteristics, clinical history and ophthalmic examination.
2. Snellen's chart for literate while tumbling E and Landolt C charts for the illiterate was used to assess the VA in these patients.
3. KEELER Retinoscope was used for objective refraction.
4. A ZEISS Slit lamp bio microscope was used for measuring the size and type of pterygium.
5. KOWA Keratometer was used to measure the keratometric readings and detect the optical type of astigmatism.
6. KOWA auto refractometer was used to detect the clinical types and magnitude of astigmatism.

2.10 Data collection procedure

On every clinic day, the assistant investigator (registered ophthalmic nurse) was stationed in the visual acuity room where all patients routinely passed for visual acuity assessment. The assistant investigator got a short training by the main investigator about morphology of pterygium to be able to screen all patients for the presence of a pterygium and channelled them to him. The principal investigator informed patients who met the inclusion criteria about the study and those who agreed to participate were requested to sign an informed consent after which they were consecutively recruited until the sample size was reached.

Data collection included a short history taken from the patient on demographic data, onset of the disease, duration, and presentation to the hospital and past history of refractive errors. Patients then underwent clinical examination starting by measuring presenting visual acuity and visual acuity with pin hole was done in patients with VA less than 6/9. Assessment of the pterygium was done using a slit lamp bio-microscopy (Zeiss) to establish the type, grade and size of the pterygium and to exclude any corneal abnormalities which can cause visual disturbances such as corneal scars and keratoconus.

Refraction was done objectively by using a Retinoscope followed by subjective refraction to obtain the best corrected visual acuity (BCVA). Keratometry was then performed using KOWA Keratometer to exclude the physiological astigmatism (less than 0.5 DC). Auto refractometry was done by using KOWA auto refractometer to determine the type and magnitude of astigmatism for both eyes regardless of whether they had a pterygium or not.

All collected information was recorded on a structured questionnaire.

2.11 Data management and analysis.

The questionnaires were checked for completeness and consistency prior to entering the data in the computer. The patient's data was recorded and saved in a computer under password known to the main investigator only.

The study data was transferred from the hand-written questionnaire into a data spreadsheet and analyzed with the help of the statistical package for social science (SPSS) software version 21.0, IBM LTD. The study findings were summarized in tables, graphs and charts. The total number of patients who presented with pterygium was considered as the numerator of the proportion. The denominator was the number of all study patients who attended the adult eye clinic at Muhimbili National Hospital. The proportion was presented as a percentage. The proportion of patients with different grades of pterygium was obtained by using the numerator as the number of patients in the particular grade and the denominator was the total number of patients with pterygium. Type of astigmatism was obtained from keratometric readings and written as frequencies. Magnitude of astigmatism was obtained from auto refractometry readings and was presented as frequencies. Bivariate analysis using Chi-square test was used to assess the association between the grades of pterygium and magnitude of astigmatism. A p-value of < 0.05 was considered significant.

2.12 ETHICAL CONSIDERATION

Ethical approval to carry out this study was obtained from the Research and Publication Committees of MUHAS and the Executive director of MNH through Executive director of MNH. Written informed consent of all participants in the study was taken after the procedures of the study had been fully explained to the patients. The benefits to the patients were also well explained. patients will undergo for eye refraction with full examination of anterior segments of the eye. All examinations were non-invasive. Participants had the right to withdraw from the study without affecting their treatment schedules. Participant's information kept confidentially as per the ethical standards.

CHAPTER THREE

RESULTS

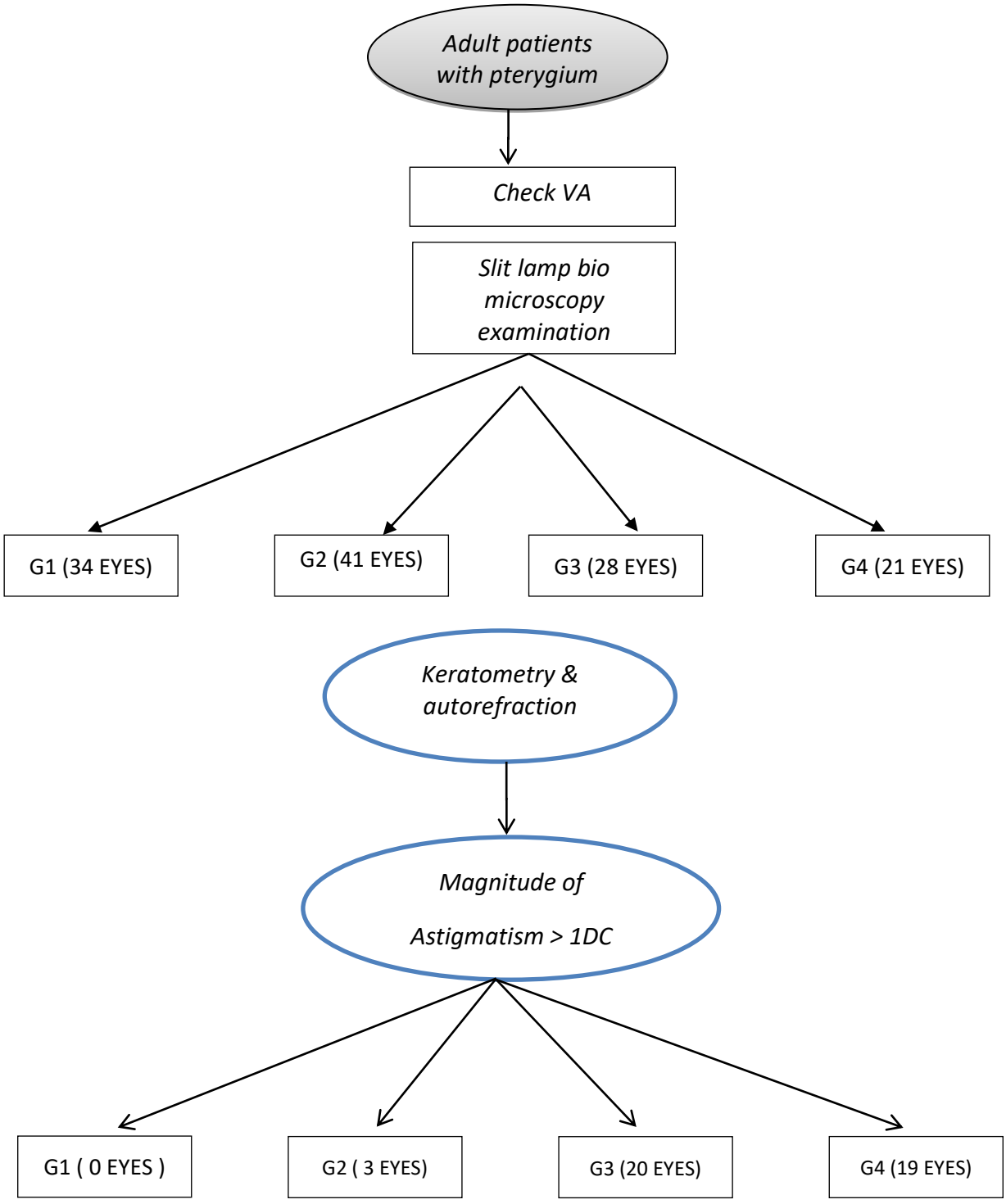


Figure 2 : patient flow diagram

Table1: The socio-demographic characteristics of the study population

Characteristics		**Total Number**	**Grades of pterygium (worse eyes)**				**Total**
			G1	**G2**	**G3**	**G4**	
Age	19-39	16	11	9	3	4	
categories	40-59	45	20	27	13	12	
	≥60	3	3	5	12	5	
Sex	M	30	5	7	12	6	
	F	34	3	15	9	7	
TOTAL							64

A total number of 1346 of new patients attended the adult eye clinic during the study period of 1st June to 31st December 2019. There were 95 patients diagnosed to have pterygium during the same period making a proportion of 7.06 %.

Sixty-four patients (124 eyes) were included in the study after exclusion of 31 patients who didn't meet inclusion criteria. Sixty patients presented with bilateral pterygium and 4 patients had unilateral pterygium. The mean age was 45.14+/- 9.93 (SD) years. The minimum age was 25 years and maximum age was 62 years. Majority (48%) of the patients were in the age group of 41 to 50 years old. There were 34 (53%) females.

Description of participants by presenting pterygium grades according to the age and sex shown in table 1. (N=64)

Forty-one eyes (33%) presented with a small size pterygium of grade 2 while the largest size pterygia of grade 4 were found in twenty-one eyes (17%).

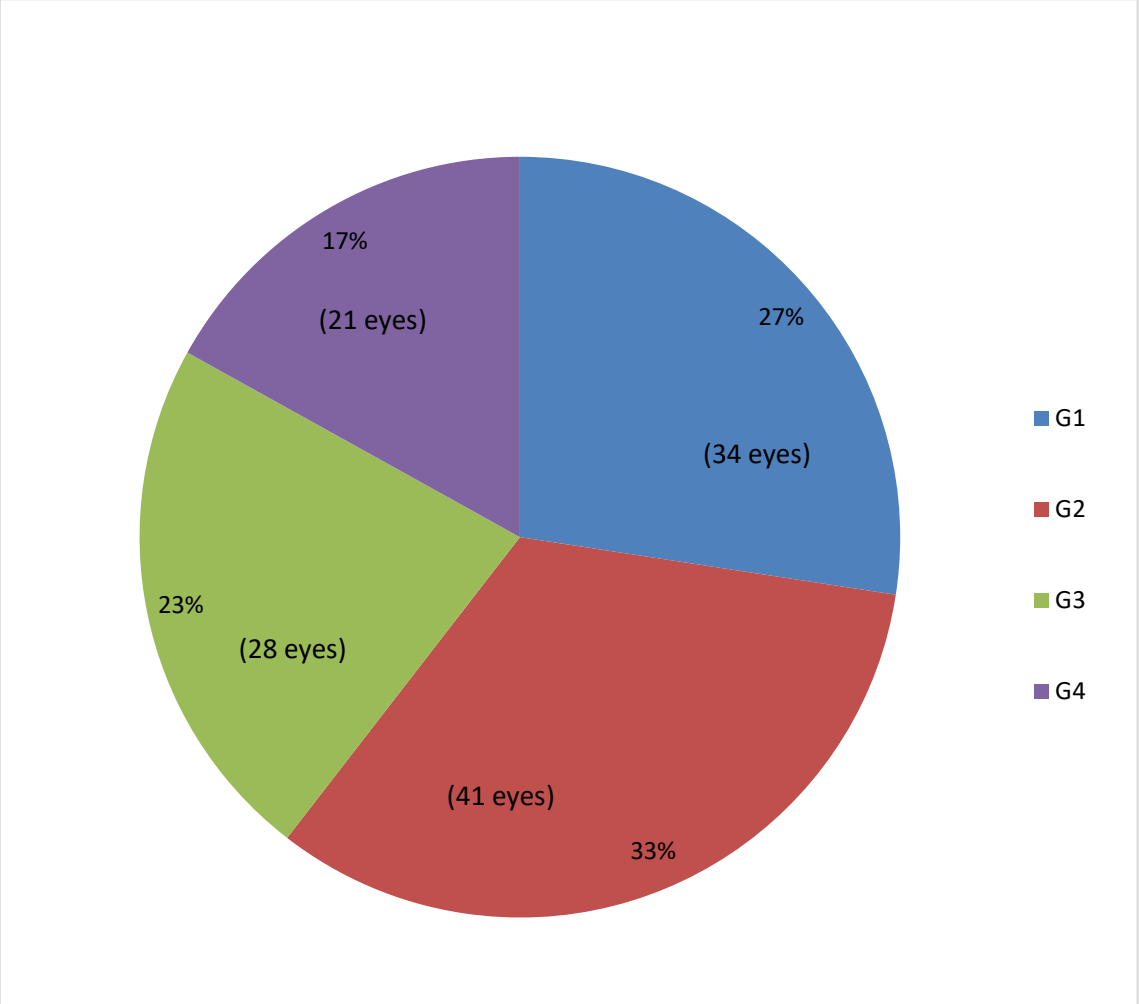


Figure 3: Distribution of different grades of pterygium in the studied eyes.

Keratometric readings in patients with different grades of pterygium

For all eyes, the mean average of K1 was 43.05 D, while the mean average of K2 was 44.16 D. Keratometric readings for K2 (indicating the horizontal corneal meridian) were higher than K1 (vertical meridian) in all eyes. Most (73%) of eyes presented with high K2

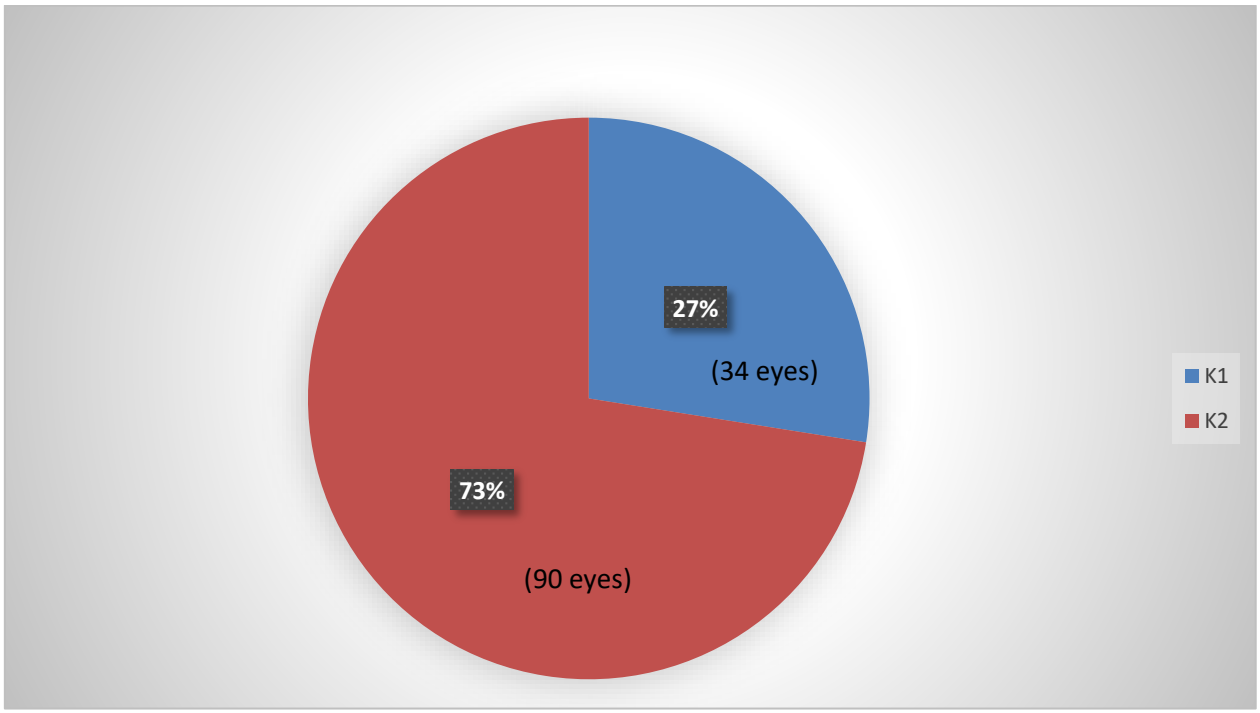


Figure 4: Distribution of k1 & k2 readings

Table 2: Relationship between the grade of pterygium and corneal astigmatism (n=124 eyes)

Grade of pterygium	Total number of eyes (%)	Magnitude of astigmatism		P-value	Total
Grade 1	34 (27.4)	0.11 +/- 0.23 DC	0 (0 %)		
Grade 2	41 (33)	0.37 +/- 0.49 DC	3 (7.3%)		
Grade 3	28 (22.6)	0.41 +/- 0.89 DC	20 (71.4%)	0.0001	
Grade 4	21 (17)	0.54 +/-0.96 DC	19 (90.4%)	0.001	
Total					124

Description of patients by magnitude of astigmatism according to the grade of pterygium.

The overall mean magnitude of astigmatism for all eyes was 1.429 DC +/- 0.6225 SD. Magnitude of astigmatism increased with increasing grade of pterygium (Table 2).

Twenty (71.4%) and 19(90.4%) of eyes with grade 3 and 4 pterygia respectively presented with corneal astigmatism of more than 1 diopter. None of the eyes with grade one pterygia presented with astigmatism of more than one diopter. There was a strong relationship (P=0.001) between the grade of pterygium and the number of eyes with astigmatism of more than one diopter (Table 2)

Table 3 : Correlations between grades of pterygium and induced astigmatism (n=124 eyes)

			Induced astigmatism
Grades	Pearson Correlation	1	0.786**
	Sig. (2-tailed)		0.001
	N	124	124
	Pearson Correlation	0.786**	1
	Sig. (2-tailed)	0.001	
	N	124	124

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation between size of pterygium and induced astigmatism

There was a positive correlation (r = 0.786) between the size of pterygium and the corneal induced astigmatism. The correlation was statically significant (P value = 0.001). (Table 3)

Table 4: Correlations between size of pterygium and keratometric readings (n=124 eyes)

			KERATOMETRIC READINGS
GRADE OF PTERYGIUM	Pearson Correlation	1	0.922**
	Sig. (2-tailed)		0.001
	N	124	124
	Pearson Correlation	0.922**	1
	Sig. (2-tailed)	0.001	
	N	124	124

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation between size of pterygium and keratometric readings

There was a positive correlation (r = 0.922) between the size of pterygium and the keratometric readings.

The correlation was statically significant (P value = 0.001). (Table 4)

CHAPTER FOUR

DISCUSSION

This was a study to determine and analyze the keratometric readings and astigmatism at Muhimbili National Hospital with sample size of 124 eyes of 64 patients whereby 60 patients presented with bilateral pterygium and 4 patients had unilateral pterygium.

Proportion of pterygium

The overall prevalence of pterygium was 7.06%. This is prevalence is similar to the findings in a study done in Ethiopia(26)where the prevalence was 8.8 %. Both countries are in the equatorial zone which is associated with development of pterygia. However, the prevalence found in our study was higher compared to similar a hospital based cross-sectional study done in Iran with an overall prevalence of 1.3 %. Compared to Iran(27), Tanzania is closer to the equator with more exposure to ultraviolet rays.

Results of the study are in agreement with previous studies which showed the prevalence of pterygium to be more common among females than males(26)(28). Considering the etiopathogenesis of pterygium being linked to ultraviolet light and outdoor occupations that are common in males, the fact that more females were affected in this study could be explained by females being cosmetically aware of anything noticeable as different in the eye. Additionally, females nowadays embark on outdoors activities leading to more exposure to UV light and irritants. Other previous studies showed high incidence of pterygium been reported among indoors suggesting that other factors may operate in some situations(15) and may affect women.

On the contrary, some of the previous studies showed prevalence in males was greater than females which could be due to increased environmental insults because the outdoor workers are more likely to be males(4)(29).

Majority of the patients (48%) were in the age group of 41-50 years with mean age of 45.14 +/- 9.93 years. This mean age is similar to most of other previous studies(16)(28). It takes prolonged exposure to UV rays and irritants such as dust and wind to cause a pterygium such that younger people are commonly not affected (12)(27). Additionally , reports in literature describe instability of tear film playing an important role in development of a pterygium which is very common in the age above 40 years due to physiological changes in the corneal epithelium(30)(31).

Study findings indicate that a third of eyes had grade one pterygium at presentation to MNH. This is a lower proportion compared to the study in Northwest Ethiopia(26)where majority of eyes (64%) presented with grade one. The difference in the classification of the grades of pterygia between the two studies explains this difference. The Ethiopian study used the surgical classification of pterygia where there are only 3 grades compared to 4 in the current study. However, the findings of the current study show that only a few people come to hospital with small sized pterygia of grade one which are easier to operate and have low recurrence rate(32). The findings that a third of eyes (33%) of patients had grade 2 pterygia at presentation to MNH indicates that the pterygium was already visible to the patients and relatives and therefore patients wanted to seek medical opinion on the new growth in their eye. However, another third of eyes (32%) presented with progressive pterygia of grade 3 and 4 indicating late presentation where already there is clinically significant astigmatism causing visual disturbance and patients had to seek help or consult eye specialist in order to reduce their visual problems. Late presentation also has implications on outcome of surgery as studies have shown that advanced, progressive pterygia tend to recur at higher rates than smaller pterygia(33)(34).

Keratometric readings

In this study, most (72.5%) eyes presented with high keratometric readings (K2) indicating with the rule astigmatism (WTR).The corneal invasion and subsequent destruction of anterior stromal lamellae may cause flattening of horizontal meridian and changes in corneal curvatures leading to changes in keratometric readings(25)(35). All the patients with different grades of pterygium had WTR. The findings of this study are similar to previous studies(31)(36)(37).

Pterygium size and induced astigmatism

Pterygium induces corneal astigmatism which is usually WTR due to the mechanical pressure of pterygium on the horizontal meridian and also due to the exerted traction of pterygium where the vertical meridian is steeper than horizontal meridian. However further progression of pterygium gradually leads to irregular astigmatism in which the amount of astigmatism changes from one meridian to another(9)(14).

Findings from this study showed variable changes in magnitude of astigmatism depending on the grade of pterygium. The findings that 20 (71.4%) and 19 (90.4%) of eyes with grade 3 and 4 pterygia respectively presented with induced corneal astigmatism of more than 1 diopter is similar to a previous study in Iran(27).

In the current study, eyes with grade 4 pterygium had the highest mean (0.54 +/- 0.96 DC) amount of astigmatism. Likewise, in this grade, there was a highest proportion (90.9%) of eyes with astigmatism of more than one diopter. This is in contrast to the study in Iraq where comparatively high proportions of significant astigmatism was also found in 5(16.6%) of eyes with pterygium grade two(4). The use of different tools with different sensitivity in measuring astigmatism could explain this difference. Our study used the autorefractometer which has low sensitivity in the assessment of changes in keratometric readings as compared to corneal topography (SCAN II NIDEK) which was used in the study in Iraq.

The autorefractometer measures mainly the curvatures at the center of the cornea while corneal topography measures both central and peripheral curvatures of the cornea thereby enabling it to be more sensitive(15).

Correlation between grades of pterygium, astigmatism and keratometric readings

The finding that there was a positive correlation between the grade of pterygium and the amount of astigmatism is in agreement with the etiopathogenesis of the disease. The increasing size of a pterygium results in increased of curvature and irregularity of the cornea leading to astigmatism. These findings are similar to a study in Germany(38).The findings highlight the importance of good follow up care for patients with pterygium and decision for surgical excision before they cause significant visual loss due to induced astigmatism.

CHAPTER 5

CONCLUSION AND RECCOMENDATION

5.1 Conclusion

1) The prevalence of pterygium among patients presenting to MNH is high (7.06%) with most affected patients being in the productive age range of 41 to 50 years.
2) Patients with pterygium presented with high K2 keratometric readings indicating with the rule astigmatism due to effect of the progressive pterygium on the horizontal curvature of the cornea.
3) The magnitude of astigmatism increased with increasing grade of pterygium.
4) There was a significant correlation between grades of pterygium and keratometric readings and induced astigmatism.

5.2 Recommendations

1) Keratometry and refraction should be done in all patients with pterygium. Those patients found to have with the rule astigmatism of more than one diopter need be counseled for pterygium excision.
2) Multi-centric descriptive study using probability sampling technique could be recommended to have the national data on pterygium.

5.3 STUDY LIMITATION.

1) It was difficult to ensure that the astigmatism in all study participants was due to pterygium only.
2) It is possible that some patients with pterygium were not captured by the investigators thereby reducing the proportion of pterygium at MNH.

5.4 STUDY MITIGATION

1) History taken from the patients to establish the onset of pterygium helped to rule out the presence of any refractive errors before the onset of pterygium. Additionally, autorefractometry was done in both eyes even in patients with unilateral pterygium where the magnitude of astigmatism was higher in eyes with pterygium than in eyes without.
2) The use of other eye doctors in the adult eye clinic to identify and inform the principal investigator about patients with pterygium on a day that the investigator was in another clinic increased the assurance that all patients with pterygium were covered. Additionally, screening by the assistant researcher at the visual acuity room ensured that all patients with pterygium were identified.

References

1. M.Monselise , Schwartz M, Politi F et al ,Pterygium and beta irradiation. Acta Ophthalmology. 1984 , 62 (1) : 315-319.

2. D.J. Moran , Hollows FC. , Pterygium and ultraviolet radiation: A positive correlation. Br J Ophthalmology. 1984 , 68 (3) : 343-346.

3. Asokan R, Venkatasubbu RS, Velumuri L, Lingam V, George R Prevalence and associated factors for pterygium and pinguecula in a South Indian population. Ophthalmic Physiological Optics 2012 , 32 (1) :39-44.

4. Kim KW, Park SH, Wee SW, Kim JC. Overexpression of angiogenin in pterygium body fibroblasts and its association with proliferative potency. Invest Ophthalmol Vis Sci. 2013, 54(9):6355–6362.

5. Ozgurhan EB, Agca A, Kara N, Yuksel K, Demircan A, Demirok A Topical application of bevacizumab as an adjunct to recurrent pterygium surgery. Cornea 2013, 32:835-8.

6. D. H. Anbesse, T. Kassa, B. Kefyalew et al , Prevalence and associated factors of pterygium among adults living in Gondar city, Northwest Ethiopia, PLOS One, 2017 12 (3): 1–9.

7. A. Achar et al., The effect of corneal irregularity on astigmatism measurement by automated versus ray tracing keratometry, Br. J. Ophthalmology, 2017 , 2 (1) : 1–9.

8. Y. P. Liu , M. Sc and D. T. H. Tan , Ocular Surface Changes in Pterygium, 2002 , 21 (1) : 38–42.

9. J. B. Oldenburg, J. Garbus, J. M. McDonnell et al , Conjunctival pterygia. Mechanism of corneal topographic changes., 1990 , 9 (3) 200–204.

10. S. A. Read, M. J. Collins, and L. G. Carney, A review of astigmatism and its possible genesis , Invited review, Clin. Exp. Optom., 2007 , 90 (1) : 5–19.

11. A. Achar, A. Kudva, R. K et al , Astigmatism in Primary Pterygium and Its Effect on Visual Acuity, J. Evid. Based Med. Healthcare , 2017 , 2 (38) : 6036–6040.

12. A. Tomidokoro, K. Miyata, Y. Sakaguchi et al , Effects of pterygium on corneal spherical power and astigmatism , Ophthalmology, 2000 , 107 (8) : 1568–1571.

13. B. D. S. Allan, P. Short, G. J. Crawford et al , Pterygium excision with conjunctival autografting : an effective and safe technique , 1993 , 3 (6): 698–701.

14. S. C. Kaufman, D. S. Jacobs, W. B. Lee et al , Options and Adjuvants in Surgery for Pterygium , OPHTHA, 2013 , 120 (1) : 201–208.

15. F. Rezvan et al., The prevalence and determinants of pterygium and pinguecula in an urban population in Shahroud, Iran , Acta Med. Iran., 2012, 50 (10) :689–696.

16. Barasa AK , Kalebi AY and Muchiri LW , Histological pattern of concunctival lesions seen at two centres in kenya , ophth.pathology 2012 , 61 (1) : 184-186.

17. J. D. Twelker and I. L. Bailey, Clinical evaluation of pterygium , Pterygium, 2000 , 4 (2) : 57–69.

18. A. Achar et al., Pterygiurm -induced corneal astigmatism , Br. J. Ophthalmol., 2014 , 2 (1) : 200–203.

19. C. A. Mccarty, C. L. Fu , H. R. Taylor et al , Epidemiology of pterygium in Victoria, Australia Centre for Eye , J Ophthalmol, 2000 , 84 (1) : 289–292.

20. T Yasar , M Ozdemit , A Cinal et al , Effects of fibrovascular traction and pooling of tears on corneal topographic changes induced by pterygium. Eye , 2003 , 17 (1) : 492-496.

21. Tomidokoro A, Oshika T, Amano S et al , Quantitative analysis of regular and irregular astigmatism induced by pterygium , Cornea. 1999 , 2 (1) : 299-301.

22. C. U. Ukponmwan , O. A. Dawodu , O. P. Edema et al , Prevalence of pterygium and pingueculum among motorcyclists in Nigeria , East African Medical Journal, 2007 , 84 (11) : 516–521.

23. Mootha, V., Pingree, M. and Jaramillo et al, Pterygia with deep corneal changes, Cornea , 2004 , 23 (6) : 635-638 .

24. Oner FH, Kaderli B, Durak I et al , Analysis of the pterygium size inducing marked refractive astigmatism. Eur J Ophthalmol , 2000 , 2 (1) : 344-347.

25. M. A. Pavilack and B. L. Halpern , Corneal topographic changes induced by pterygia , J. Refract. Surg., 1995 , 11(2) : 92–95.

26. Ahmed Fauzi M.D. Sharif and Payman A-K Mohammad-Salih , Analysis of Pterygium Size and Induced Corneal Astigmatism ,2008 , 27 (4) : 434–438.

27. I. Maharjan, E. Shreshth, B. Gurung et al , Prevalence of and associated risk factors for pterygium in the high altitude communities of Upper Mustang, Nepal , Nepal. J. Ophthalmology , 2014 , 6 (1) : 65–70.

28. H. C. Roh, R. S. Chuck, J. K. Lee et al , The effect of corneal irregularity on astigmatism measurement by automated versus ray tracing keratometry , Med. (United States), 2015 , 94 (13) : 1–9.

29. D. H. Anbesse, T. Kassa, B. Kefyalew et al , Prevalence and associated factors of pterygium among adults living in Gondar city, Northwest Ethiopia., PLOS One, 2017 , 12 (3) :1-9 .

30. M. Parviz, H. Esfandiari, N. Behnaz et al , Risk Factors for Pterygium in Ilam Province, Iran Parviz , J. Ophthalmic , 2017 , 1 (2) : 112-123.

31. Nemesure B, Wu SY, Hennis A, Leske MC et al , Incidence and Risk Factors for Pterygium in the Barbados , Eye Studies. Ophthalmology. 2008 , 1 (2) : 117-122

32. Marcus Ang , Xiang Li , Wanling Wong et al , Prevalence of and racial differences in pterygium , J.Ophtha. 2012 , 119 (8) : 1509-1515.

33. G. Gazzard et al , Pterygium in Indonesia: Prevalence, severity and risk factors , Br. J. Ophthalmol., 2002 , 86 (12) : 1341–1346.

34. Yasar T, Ozdemir M, Cinal A et al , Effects of fibrovascular traction and pooling of tears on corneal topograhic changes induced by pterygium , Eye. 2003, 12 (3) : 245-251.

35. Mahar PS, Manzar N. , Pterygium recurrence related to its size and corneal involvement . J Coll Physicians Surg Pakistan . 2013 , 2 (7) : 267-274.

36. Rasool AU, Ahmed CN, Khan AA , Recurrence of Pterygium in Patients Having Conjunctival Autograft and Bare Sclera Surgery , 2010 , 5 (1) :129-133.

37. S. C. Kaufman, D. S. Jacobs, W. B. Lee et al , Options and Adjuvants in Surgery for Pterygium , Ophthalmology, 2013 , 120 (1) : 201–208.

38. T. Tano et al., Prevalence of pterygium in a population in Northern Japan: The Locomotive Syndrome and Health Outcome in Aizu Cohort Study , Acta Ophthalmol., 2013 , 5 (1): 23-36.

39. Alexandra Z. , Crawford Dipika , V.Patel et al , Comparison and repeatability okeratometric and corneal power measurements obtained by Orbscan II , Pentacam, and Galilei corneal tomography systems . A. J Ophthalmology 2013 , 156 (1) : 53-60.

40. Seitz B, Gutay A, Kuchle M et al , Impact of pterygium size on corneal topography and visual acuity , Klin Monbl Augenheilkd , 2001, 12 (2) : 324-341.

41. M. T. Coroneo et al., Quantification of astigmatism induced by pterygium using automated image analysis , Cornea , 2000 , 19 (3) : 734–739.

42. Lawan A, Hassan S, Ifeanyichukwu EP et al .The astigmatic effect of pterygium in a tertiary hospital in kano, Nigeria , Ann Afr Med 2018 , 17 (1) : 7-10.

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

QUESTIONNERE (ENGLISH)

TITLE:

ANALYSIS OF KERATOMETRIC READINGS AND ASTIGMATISM IN PATIENTS WITH DIFFERENT GRADES OF PTERYGIUM ATTENDING ADULT EYE CLINIC AT MUHIMBILI NATIONAL HOSPITAL

A: **DEMOGRAPHIC CHARACTERISTICS**

1) Date of consultation / ----------
2) Patient name / ----------
3) Patient hospital registration number / ----------
4) Age / ……
5) Occupation / ----------
6) Sex
    a) Male □
    b) Female □
7) Address / ----------
8) Eye affected
    a. RE □
    b. LE □
    c. BE □
9) Patient cell phone number / ----------

Patient using sunglasses (Y / N)

B: OCULAR ASSESSMENT

1. Visual acuity (without PH) RE LE
2. Visual acuity (with PH) RE LE
3. BCVA.
    a) Right eye.
    b) Left eye.
4. Auto refractometer readings

	SPH	**CYL.**	**AXIS**
RE			
LE			

5. Keratometric readings

	K1	**K2**	**Type of astigmatism**
RE			
LE			

6. Pterygium SLE

	RE	LE
LATERALITY		
TYPE		
SIZE		
GRADE		

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

QUESTIONNERE (SWAHILI)

TITLE:

ANALYSIS OF KERATOMETRIC READINGS AND ASTIGMATISM IN PATIENTS WITH DIFFERENT GRADES OF PTERYGIUM ATTENDING ADULT EYE CLINIC AT MUHIMBILI NATIONAL HOSPITAL

A: MAELEZO YA DEMOGRAPHIC

- Tarehe ya majadiliano / ----------
- Jina la mgonjwa / ----------
- Numba ya usajili wa mgonjwa / ----------
- Umri / .....
- Kazi ya mgonjwa / ----------
- Jinsia
    - kiume □
    - kike □
- Makazi / maskani / ----------
- Jicho lililo na shida /
    - Kulia □
    - Kushoto □
    - Yote □
- Namba ya simu ya mgonjwa / ----------
- Mgonjwa- matumizi ya miwwani (N / H)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

APPENDIX 2: CONSENT FORM

Appendix i: Consent Form (English Version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS

ID - NO……

CONSENT TO PARTICIPATE IN THE STUDY

I am Dr. MOUSTAFA IBRAHIM ELMASRY. M.MED 2 resident in the Department of Ophthalmology at Muhimbili University of Health and Allied Sciences.
I am conducting a study with the above title as part of my study program.

Aim of the study:

To analyze the keratometric readings and astigmatism in different grades of pterygium at Muhimbili National Hospital

Participation in this study:

All adult patients with pterygium attending eye clinic at Muhimbili National Hospital between June and December 2019
Patients will go through certain ophthalmological examinations.
All examinations will be performed by me (the principal investigator).

Risks:

This study will have no physical risks to the patient since the above means of measurements are mainly non-invasive procedures and painless with no side effects on the patient later on.

Benefits:

If you agree to participate in this study, you will benefit by having proper eye refraction (BCVA) for both eyes not only the affected eye in addition to proper examination of the anterior segment of the eye and provide treatment for any discovered problem.

Confidentiality:

All data collected will be recorded with strict confidentiality and stored in locked cabinets, encrypted computer (my own laptop) and will not be revealed to anybody outside the research team.

Cost:

Patients will not be required to make any payments to participate in this study and there will be no financial compensation for participation.

For further information, questions or queries, you can contact:

The Principal Investigator,

Dr / MOUSTAFA IBRAHIM ELMASRY

Department of Ophthalmology,

MUHAS

P. O. Box 65001

Dar es Salaam

Tel: +255 738639443.

Email:m625591@yahoo.com

PROFESSOR M. Moshi

Chairperson of the Senate Research and Publications Committee

P. O. Box 65001

Dar es Salaam

Tel: +255 022 2152489

PROFESSOR M. MAFWIRI

Department of Ophthalmology,

MUHAS.

P. O. Box 65001

Dar es Salaam

Tel: +255 784323280

DR / CELINA MHINA

Head of Department of Ophthalmology,

MUHAS

P. O. Box 65001

Dar es Salaam

Tel +255 719326498

Signature:

I, ---------- have read / been told the contents of this form.

My questions have been answered. I agree to participate in this study.

Signature of participant _____

Signature of researcher_____

Date of signed consent_____

CHUO KIKUU CHA AFYA NA SAYANSI SHIRIKISHI MUHIMBILI

Appendix ii: Consent Form (Swahili Version)
CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILIKURUGENZI YA TAFITI NA UCHAPISHAJI

FOMU YA RIDHAA

Nambayautambulisho ----------

RIDHAA YA KUSHIRIKI KWENYE UTAFITI

Naitwa Dkt. Moustafa Ibrahim Elmasry, Wagonjwa wote wazima wenye pterygiamu wanahudhuria kliniki ya macho huko MNH kati ya Juni na Desemba 2019.
Wagonjwa wataenda kupitia mitihani fulani ya ophthalmological.
Mitihani yote yatafanyika na mimi (mchunguzi mkuu).

DHUMUNI LA UTAFITI

Dhumuni la utafiti huu ni kutaka kujua sababu zinazopelekea miongoni mwa wazazi wenye watoto wenye retinoblastoma wanaohudhuria katika Hospitali ya taifa Muhimbili kukubali au kukataa watoto wao wasifanyiwe upasuaji wa kutoa jicho au macho.

Dhumuni jingine la Utafiti huu ni pamoja na kutimiza sehemu ya matakwa ili kutunukiwa shahada ya uzamili wa matibabu ya Macho ya Chuo Kikuu cha Afya na Sayansi Shirikishi Muhimbili.

Matokeo ya utafiti huu yatasaidia katika kuleta hamasa na mwamko katika jamii yetu kuhusu kuwahi kwenda Hospitali na kukubali tiba zinazopendekezwa na wataalamu wa afya ya macho, hii itasaidia katika kupunguza vifo vya watoto wenye saratani ya pterygium.

JINSI YA KUSHIRIKI

Ukikubali kushiriki katika utafiti huu, utasailiwa alafu utatakiwa kujibu maswali kutoka kwenyedodosolililoandaliwa na mtoto wakoataendeleanatibakamakawaida.

USIRI

Takwimu zote zilizokusanywa zitasajiliwa kwa siri kali na zihifadhiwe kwenye makabati yaliyofungwa, kompyuta iliyofichwa (kompyuta yangu mwenyewe) na haitatolewa kwa mtu yeyote nje ya timu ya utafiti.

Hatari:

Utafiti huu hautakuwa na hatari ya kimwili kwa mgonjwa tangu njia za hapo juu za vipimo ni taratibu zisizo za kuvuta na zisizo na madhara kwa mgonjwa baadaye.

Faida:

Ikiwa unakubali kushiriki katika somo hili, utafaidika kwa kuwa na macho ya macho yanayofaa (BCVA) kwa macho yote sio tu jicho lililoathiriwa kwa kuongeza uchunguzi sahihi wa sehemu ya anterior ya jicho na kutoa matibabu kwa shida yoyote iliyogunduliwa.

Gharama:

Wagonjwa hawatahitajika kufanya malipo yoyote kushiriki katika utafiti huu na hakutakuwa na fidia ya kifedha kwa kushiriki.

UHURU WA KUSHIRIKI NA HAKI YA KUJITOA

Kushiriki kwenye utafiti huu ni hiari.Unaweza kushiriki au kukataa kushiriki na hii haita muondolea mtoto wako haki yake ya kupata matibabu.

MAWASILIANO

Kama unamaswali kuhusiana na utafiti huu, wasiliana na mtafiti mkuu, Dkt. Moustafa Ibrahim Elmasry. ChuoKikuu cha Afya naSayansi Shirikishi Muhimbili, S. L. P. 65001, Dar es Salaam. Simu**+255783639443**.Prof M. Moshi**,** Mwenyekiti wa kamati ya UtafitinaUchapishaji, S.L.P 65001, Dar es Salaam. Simu+255 022 2152489au msimamizi wa utafiti huu Prof. M. Mafwiri Simu +**255 784323280**

Kama umekubalikushirikiweka sahihi

Mimi..... nimesoma maelezo ya fomu hii nimeyaelewa na nimekubali kushiriki katika utafiti huu.

Sahihi ya mshiriki……Tareheyakutia/----------.

Sahihi ya maftir……. Tarehe ya kutia sahihi/----------