

**EFFECT OF CATARACT SURGERY ON INTRAOCULAR PRESSURE
AMONG ADULT PATIENTS ATTENDING TERTIARY EYE
HOSPITALS IN DAR ES SALAAM**

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**MMed. (Ophthalmology) Dissertation
Muhimbili University of Health and Allied Sciences
October, 2021**



Muhimbili University of Health and Allied Sciences
Department of Ophthalmology



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By

Jasmine Juma Kachemela

**A Dissertation Submitted in (Partial) Fulfillment of the Requirement for the Degree
of Masters of Medicine (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: *“Effect of Cataract surgery on intraocular pressure among adult patients attending tertiary eye hospitals in Dar es Salaam”*, in partial fulfillment of the requirement for the degree of Masters of Medicine (Ophthalmology) of Muhimbili University of Health and Allied Sciences.

Dr Suzan Mosenene
(Supervisor)

Date _____

Prof. Milka Mafwiri
Co-supervisor)

Date: _____

DECLARATION AND COPYRIGHT

I, **Dr Jasmine Juma Kachemela**, declared that this dissertation is my original work and that it has not been presented nor will it be presented to any other university for similar or any other degree award.

Signature Date

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DEDICATION

To my children

ABSTRACT

Background: Cataract as a cause of reversible blindness have been shown to affect intraocular pressure (IOP) as a result of change in the size of the opacified crystalline lens. Cataract surgery is the only treatment option for cataract and is a commonly performed procedure worldwide. Additionally, as the cataractous lens is removed the intraocular pressure may remain the same, increase or decrease. Therefore, IOP measurements before and after cataract surgery provide important information to ophthalmologist about IOP changes and the effect of cataract surgery in cataract patients and those with co-existing glaucoma.

Objective: To determine the IOP changes following cataract surgery among cataract patients attending MNH/CCBRT hospital.

Methodology: A hospital based prospective cross sectional study with consecutive sampling technique was conducted between July 2020 and December 2020. A total number of 198 patients in 202 eyes of patients who were above 18years underwent cataract surgery at MNH and CCBRT hospital. The IOP was measured using Icare rebound tonometer thrice before cataract operation, postoperative IOP was measured after 24hrs and 6weeks of follow up. IOP findings were recorded on a structured questionnaire. Data sheet was coded and the information was entered and analyzed using the statistical package for social science (SPSS) version 23, a P-value ≤ 0.05 was considered statistically significant.

Results: A total number of 178 patients with 180 eyes were analyzed of which 80(44.44%) and 100(55.56%) underwent MSICS and phacoemulsification respectively. The overall mean IOP preoperatively was 17.05 ± 6.04 mmHg which increased at 1st day post-operative period to 20.94 ± 11.04 mmHg p-value=0.00. There was a decline of IOP by 6th week post-operative period 14.61 ± 6.48 mmHg and the difference was statistically significant with p-value=0.00. In patients with co-existing glaucoma majority had high preoperative IOP but at 6weeks the mean IOP for MSICS and phacoemulsification was 16.11 ± 7.39 mmHg and 17.92 ± 7.13 mmHg respectively with p-value=0.643 in which there was no statistical difference.

Conclusion and Recommendations: There was a significant IOP reduction from baseline in patient with normal as well as those with high preoperative IOP. Both MSICS and phacoemulsification procedures showed an equal IOP reduction. Therefore, MSICS or phacoemulsification may be considered as initial technique for IOP control.

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LIST OF ABBREVIATION

AC	Anterior Chamber
CCBRT	Comprehensive Community Based and Rehabilitation in Tanzania
ECCE	Extracapsular cataract extraction
IOP	Intraocular pressure
MNH	Muhimbili National Hospital
MSICS	Manual small incision cataract surgery
OAG	Open angle glaucoma
POAG	Primary open angle glaucoma
TM	Trabecular meshwork
VA	Visual acuity
WHO	World health organization

DEFINITION OF TERMS

Intraocular pressure: Is the fluid pressure inside the eye which is determined by production and drainage of aqueous humor by the ciliary body and its drainage via trabecular meshwork and uveoscleral outflow.

Intraocular Pressure changes: The difference between preoperative and postoperative IOP.

Glaucoma: Is a group of disorders of the eye characterized by increased or normal intraocular pressure, optic nerve damage with visual field defects that cause progressive loss of vision.

High intraocular Pressure: The pressure in the eye that is more than 21mmHg.

**Manual Small Incision
Cataract Surgery:** Is the type of surgical technique involving manual expression of the lens through a small self-sealing scleral tunnel wound usually about 6-7mm.

Phacoemulsification: Cataract surgery that involves the use of a machine with ultrasonic hand piece equipped with titanium or steel tip, the tip vibrates at ultrasonic frequency and the lens material is emulsified, then aspirated out of the eye.

CHAPTER ONE

1 INTRODUCTION

1.1 Background

Cataract is opacification of the crystalline lens and is the commonest cause of reversible blindness responsible for about 51% global blindness. This represent about 20million people in the world (1). Blindness from cataract is due to opacification of the lens which was previously transparent and allow the patient to see (2).

A cataractous lens increases in thickness and the anterior lens capsule is generally displaced forward. Consequently, the zonules exert traction on the ciliary body and uveal tract, which in turn compresses the canal of Schlemm and the trabecular meshwork leading to narrowing of the angle of the anterior chamber. Drainage of aqueous humour continues to be impeded as the angle is getting narrower (3) (4). Additionally, leakage of lens proteins through a capsule of a mature or hypermature cataract and lodge into TM causing an outflow obstruction leading to Intraocular pressure fluctuation (2).

These different pathophysiological mechanisms may result into elevated intraocular pressure (IOP) which lead to optic nerve fibre (retinal ganglion cell axon) death and is a major risk factor for the optic nerve damage. Prolonged high intraocular pressure eventually develops into glaucoma which account for 47% blindness worldwide and is the second common cause of irreversible blindness (1) (2).

Intraocular pressure is the fluid pressure inside the eye which is determined by production and drainage of aqueous humor by the ciliary body and its drainage via TM and Uveoscleral outflow. A balance between the rate of aqueous humor production (inflow) and the rate of reabsorption (outflow) is essential to maintain the IOP within normal limits, this drainage is through two independent pathways the trabecular meshwork and uveoscleral outflow (3) (4).

Cataract surgery is the only treatment for cataract and pre-operative intraocular pressure is an essential aspect in the evaluation of patients going for cataract surgery, it normally ranges from

10-21mmHg and it is measured by using a tonometer. The treatment of cataract is done through surgical removal of the opaque lens which may change intraocular pressure postoperatively where several studies have reported these changes to be increased IOP, decreased IOP and even no changes at all (5). However, majority of current studies suggest that there is an overall significant and sustained decrease in IOP after cataract surgery which also allow for greater IOP control among patients with co-existing cataract and glaucoma (6) (7).

Evidence from recent reports suggests that by lowering the IOP after cataract surgery the damage to optic nerve axons will be stabilized (6) (7) (8). Cataract surgery has also been noted to reduce intraocular pressure (IOP) in eye without glaucoma. This reduction effect can be seen weeks or months after removal of the lens (9) (10).

Although the physiological reasons for decreased IOP after cataract surgery remain speculative, the facility of outflow is known to increase after cataract surgery. However cataract surgery itself may result into a lens disruption and therefore release of lens material into anterior chamber (AC) sometimes leading into obstruction of aqueous outflow affecting IOP thereby leading to an increase in IOP (11) (12)

If a patient has medically uncontrolled IOP and coexisting visually significant cataract, it can be difficult to determine the appropriate surgical management. In such situation, the surgeon can choose one of the following surgical procedures: cataract surgery alone followed by medical anti glaucoma treatment or glaucoma surgery, glaucoma surgery alone followed by later cataract surgery, or combined cataract and glaucoma surgery (13).

At Muhimbili National Hospital (MNH) and Comprehensive Community Based and Rehabilitation in Tanzania (CCBRT) Hospital cataract surgery is a highly performed procedure. This is because a large number of population are blind due to cataract and the vision can be restored back through cataract surgery.

Additionally, the main types of cataract surgery performed in these two hospitals are Manual small incision cataract surgery (MSICS) and phacoemulsification. MSICS is done through the corneo-scleral incision of about 6-7mm width and phacoemulsification the lens extraction is through a clear cornea incision of about 3mm to permit a probe where the cataractous lens is

emulsified and aspirated by an ultrasound probe after making a circular opening in the anterior lens capsule (2). However, MSICS is commonly performed since it is less costly for patients and affordable for most of the developing countries like Tanzania. Moreover, majority of patients usually attend late to the hospital already blind due to the issues of accessibility and affordability and most surgeries are performed on a hard nucleus. On the contrary phacoemulsification is more preferable to be conducted on an immature cataract but it also needs skilled personnel and expensive materials which is difficult to achieve in most of developing countries. Furthermore, both procedures have shown to have an effect on IOP from weeks, month to years after surgery and different studies reported the change to be low or high and sometimes no change at all (14).

The main objective of the current study was to assess the intraocular pressure changes following cataract surgery at MNH and CCBRT hospital. Therefore, this study has evaluated the mean IOP changes in cataract patients who underwent MSICS and phacoemulsification at both hospitals. This study has also looked at IOP changes in cataract patient with co-existing glaucoma.

1.2 Problem Statement

Cataract affect 20 million people in the world where about 85% of patients from variable sample of adult with cataract in India, USA and Japan are being treated for it surgically and documented to have long term postoperative IOP reduction. Isolated case reports from East Africa have also reported a decrease in IOP post cataract surgery.

A cataractous lens increases in thickness and the anterior lens capsule is generally displaced forward which cause changes in the anatomy of the anterior chamber angle and most likely changes in intraocular pressure while other patients may also have co-existing glaucoma (11) (12). Additionally, in the presence of mature or hypermature cataract there is leakage of lens protein resulting into an increase in IOP (11).

However, to the best of my knowledge, there is no objective measure and detailed information available on post cataract IOP changes in Tanzania. Therefore, there was a need to conduct a research on IOP changes among patients undergoing cataract surgery at MNH and CCBRT hospital.

1.3 Conceptual Framework

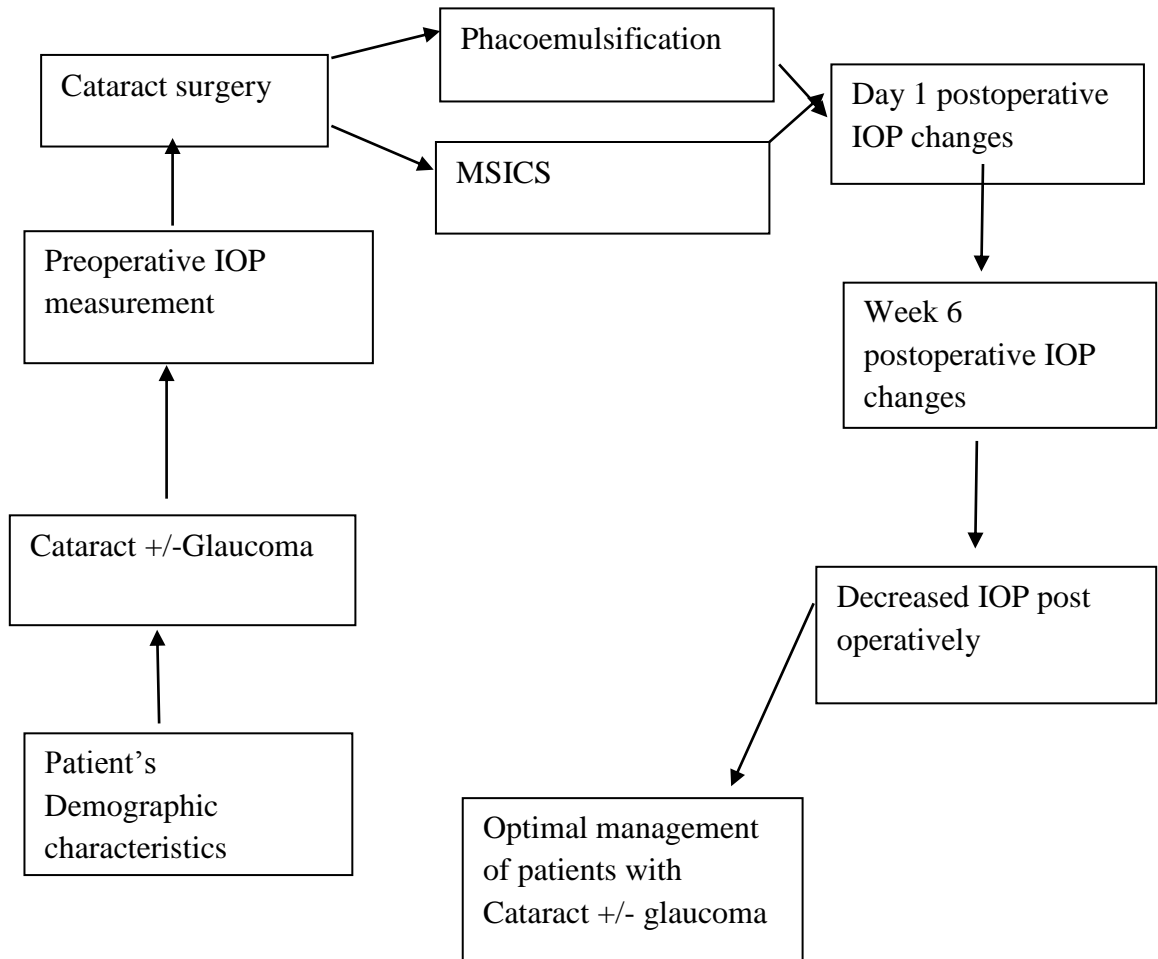


Figure 1: Conceptual framework for intraocular pressure changes following cataract surgery.

1.4 Rationale

The information obtained from this study has provided a baseline data on IOP changes following cataract surgery.

The results from this study will be used for the development of treatment protocol for patients with cataract and glaucoma at MNH/CCBRT hospital.

1.5 Research Questions

1. What is the impact of cataract surgery on intraocular pressure in adult patients operated at MNH/CCBRT hospital during the study period?
2. What is the mean preoperative and postoperative IOP among adult patients attending at MNH/CCBRT hospital during the study period?
3. What are the mean changes of IOP at 6weeks following phacoemulsification and MSICS in adult patients attending MNH/CCBRT hospital during the study period?

1.6 Objectives

1.6.1 Broad Objective

- To assess the impact of cataract surgery on intraocular pressure among adult patients with cataract attending MNH/CCBRT during the study period.

1.6.2 Specific Objectives

- To determine the mean preoperative and postoperative IOP among adult patient attending at MNH/CCBRT hospital during the study period.
- To determine mean IOP changes at 6weeks for MSICS and phacoemulsification among adult patients attending at MNH/CCBRT hospital during the study period.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Intraocular Pressure in cataract patients

A cataractous lens is involved in IOP variation from different pathophysiological mechanisms (11) (15) (16) (17) (18). The two major categories in which a lens causes an elevated IOP which are the blockage of the aqueous humor flow in the anterior chamber by the lens and the second one is the blockage of TM from the lens protein, lens material or debris (15). Some studies from Indian show that there is a high percentage of blockage of aqueous humor flow from the lens than blockage of TM by lens proteins or material (16) (17) (18). This was shown to be 52.7% due to blockage of aqueous humor flow by the lens and 47.3% due to blockage of TM by lens protein studied by Venkatesh et al (17) while Pradhan et al (18) reported 72% and 28% respectively.

Additionally Ramakrishanan et al study done in India 2001 reported elevated IOP due to blockage of the aqueous humor flow by the lens being a common entity in developing countries due to lack of awareness of cataract and delayed surgical interventional removal(16). This was mainly due to the general misbelieve that cataract should be mature at the time of surgery in order to avoid complications.

2.2 Preoperative and Postoperative Intraocular pressure measurement in cataract patients

Intraocular pressure measurement before and after cataract surgery usually varies from low to normal or high depending on different factors mentioned by different authors(16)(19)(20)(21).

A study done by Ramakrishanan et al in 2001, reported that in 74 cataract patients with elevated preoperative IOP 44 (58%) patients had preoperative IOP of 25-40mmHg, 27 (36%) patients had preoperative IOP of 41-55mmHg and 3 (4%) patients had preoperative IOP of 56-70mmHg (16). Another study from Mumbai, India done in 2010 by Ramakrishanan et al, the mean preoperative IOP was reported to be 25.11 ± 2.75 mmHg in 60 patients studied(19). However, other studies from United States of America and India observed a normal IOP preoperatively (20) (21) (22). In a study done by Pal et al (21) showed that mean preoperative

IOP was 13.58 ± 2.31 mmHg in 117 eyes undergoing cataract surgery. However, it is believed that most of the glaucoma patients with cataract have a slight elevated preoperative IOP than those without glaucoma despite being under treatment (10) (23).

The levels of preoperative IOP have been observed to lower more after cataract surgery. It is believed that cataract extraction alone lowers IOP by 2-4 mmHg and is slowly evolving towards an understanding of a larger and more sustained IOP reduction. Studies showed that patients with high preoperative levels tended to show higher reduction compared to those with lower IOP levels where in patients with higher preoperative IOP it could reduce an IOP of up to 7mmHg (23) (24) (25) (26). However, it is believed that most of the patients with high preoperative IOP have a higher IOP reduction than those with normal or low IOP before surgery (10) (23) (24). Poley et al in 2009 study on intraocular pressure reduction in glaucomatous and non-glaucomatous patients showed that IOP was reduced by 6.5mmHg in the 23-31mmHg preoperative group, a 4.8mmHg decrease in the 20-22mmHg preoperative group, a 2.5mmHg decrease in the 18-19mmHg preoperative group and a 1.6mmHg decrease in a 15-17mmHg preoperative group (24). Additionally, a study by Matsumura et al showed that there was an average decrease in IOP by 5.5mmHg in patients with preoperative IOP of ≥ 21 mmHg (23). Another study by Sengupta et al observed a decrease in IOP by 80% of 441 eyes in patients undergoing cataract surgery from baseline IOP of 14.4 ± 2.8 mmHg to 11.8 ± 2.8 mmHg at 6 months of follow up (5).

This lowering effect of IOP after cataract surgery have been observed ranging from 1 to 6 months post-surgery (24) (20). Ramakrishanan et al study on effect of cataract surgery on ocular hypertension done in Mumbai in 2017 noted a 22.7% fall of IOP by the end of 3 months (19). Longer term studies have shown a drop in IOP of about three mmHg in POAG patients and non-glaucoma patients with 75-85% of patients maintaining a IOP reduction at five years (10) (19) (21) (24). Shingleton et al carried a follow up study at an average of 5 years in POAG, glaucoma suspect and no glaucoma patients and the IOP decreased significantly by 1.8mmHg, 1.3mmHg and 1.5mmHg respectively (10).

Further studies on IOP fluctuations after cataract surgery in normotensive eyes reported the same effect (20) (21) (22) (27).

Moreover there has been reports on an increase in postoperative IOP as a major postoperative complication within 24 hours after cataract surgery (28) (29) (30), Ahmmed II K et al observed incidence of early postoperative IOP increase above 28mmHg with a peak at 3-7hrs after cataract surgery within the first 24hrs (29). However, Ahmed II et al also found that glaucoma patients were more likely to have an elevated IOP postoperatively compared to patients without the disease (46.4% vs 18.4%)(31). The most risky time reported for glaucoma patients is at 3-4hrs post operatively where IOP rises up to 30mmHg (32) (33), Although, in the study on the risk factors for rise in IOP following phacoemulsification done by Coban-Karatas et al in 2013 found that among 584 eyes studied within 2hrs high IOP was detected in 249 (30.7%) eyes with a mean of 30.7 ± 7.5 mmHg of which all were glaucoma patients (34). Moreover, Yasutani et al. also mentioned that a considerable increase in IOP occurred in approximately 13% of the eyes with open angle glaucoma 1 day after phacoemulsification surgery (32). However, in most patients, postoperative increases in IOP is transient and benign (35) and most intraocular pressures will return to normal by 24 hours postoperatively (36). Among other contributors of IOP spike within 24hrs after cataract surgery include a preexisting compromise of outflow facility and retained ophthalmic visco surgical devices (OVDs) (37) (38) (39). Surgical trauma, watertight wound closure, retained lenticular debris, the release of iris pigment, hyphema, and inflammation are also thought to contribute to raise in IOP (35). The skillfulness of the surgeon has been implicated as well (30) (40).

2.3 Intraocular pressure and type of cataract surgery

Studies have shown that the technique of cataract extraction may influence fluctuations of IOP (5) (14) (23) (41) (42). Phacoemulsification is believed to have more IOP reduction than MSICS (23) (25). Other different studies show that there is no statistical difference between phacoemulsification and MSICS (5) (14). Sengupta et al 2016 reported IOP reduction by 2.7 ± 2.9 mmHg vs 2.6 ± 2.6 mmHg in phacoemulsification and MSICS respectively but was not statistically different. Although, Sacca et al 2001 found that MSICS had more reduction of IOP about 20% in normal patients and 31% in patient with glaucoma while phacoemulsification had 19% and 22% respectively but the difference was not statistically significant (41).

CHAPTER THREE

3 MATERIALS AND METHODS

3.1 Study Design

The study design was a hospital based descriptive cross sectional study.

3.2 Study Area

The study was conducted at Muhimbili National Hospital (MNH) and CCBRT hospital both located in Dar es salaam, Tanzania receiving patients from all around the country.

MNH is a tertiary teaching hospital located at Kalenga street in Ilala district and it acts as one of the main national referral hospital, Research Centre and University teaching hospital for Muhimbili University College of Health and Allied Sciences. It has an average of 20 cataract surgeries performed in adults monthly.

CCBRT hospital is located in Kinondoni district and it acts as a largest local provider of disability and rehabilitation services in Tanzania including eye services in tackling blindness and an average of 240 cataract surgeries are being performed monthly. The outpatient ophthalmology clinics at MNH and CCBRT hospital are conducted on daily basis from 8.00 am to 5.00 pm.

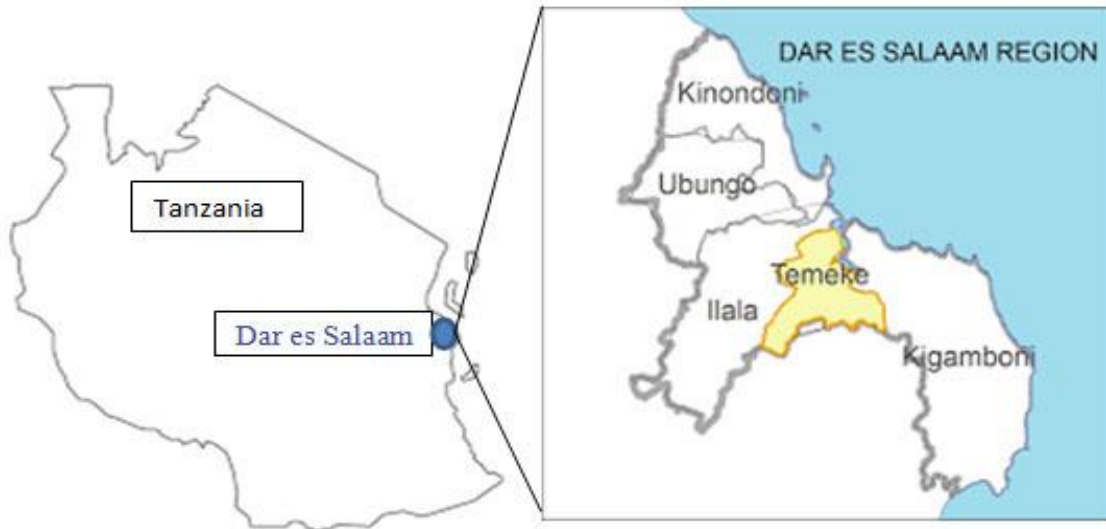


Figure 2: Map of Dar es Salaam city showing municipalities

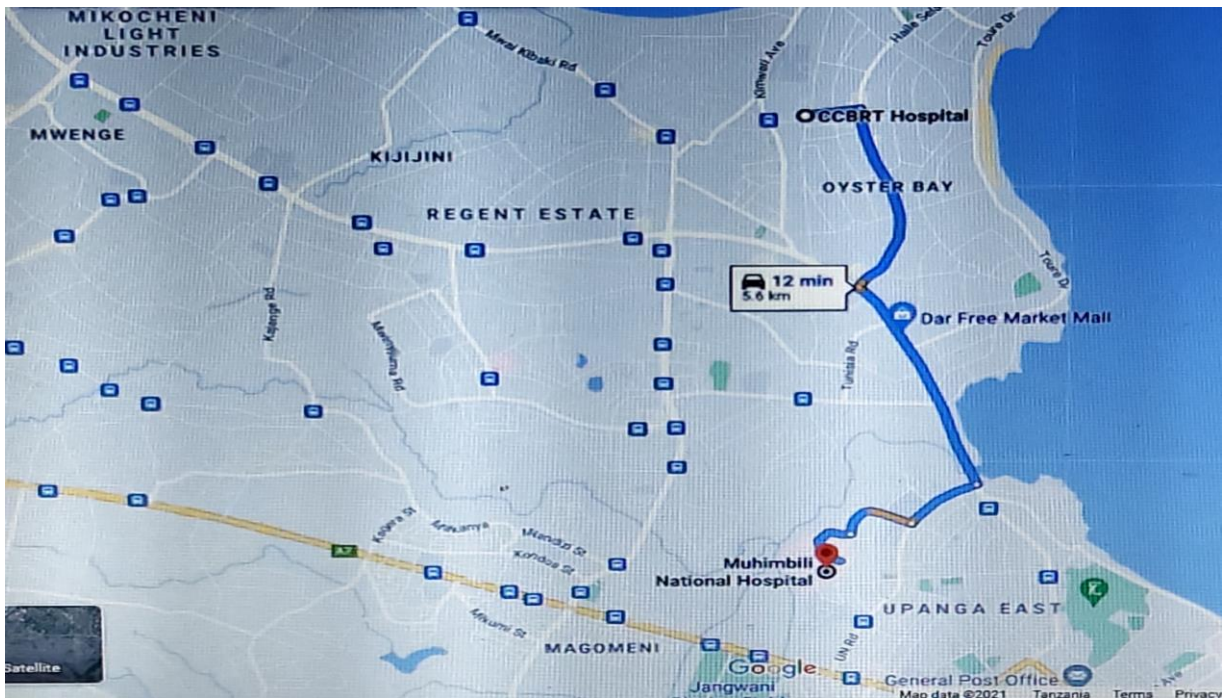


Figure 3: Location of MNH in Ilala municipal and CCBRT hospital in Kinondoni municipal.

3.3 Study population

The study population constituted all adult patients with cataract undergoing cataract surgery at MNH/CCBRT hospital.

3.3.1 Inclusion criteria

- All patients aged 18years old and above who underwent cataract surgery.
- Patients who will consent for the study.

3.3.2 Exclusion criteria:

- Patients with traumatic or complicated cataract or other ocular commodities such as uveitis.
- Patient undergoing combined intraocular surgery such as Phacotrabeulectomy.
- Patient developing ocular complications during or after surgery such as vitreous loss or hyphema.

3.4 Sample Size

Sample size was calculated using the formula below;

$$n = \frac{Z^2\sigma(N/N-1)}{d^2 + (Z^2\sigma^2/N-1)}$$

Where:

- n: minimum required sample size
- N : size of the target population 490 (estimated total number of cataract surgery done at Muhimbili National Hospital and CCBRT from July to December in the year 2018 from Hospital registry)
- Z: statistic for 95% confidence interval (1.96)

- σ : estimated standard deviation of IOP outcome after cataract surgery (study done in Mumbai, India in 2017 on Effect of Cataract surgery on Ocular Hypertension which was 2.7mmHg) (19)
- d: margin of error

$$N = \frac{1.96^2 \times 2.7^2 \times (490/489)}{0.05^2 + (1.96^2 \times 2.7^2 / 489)}$$

$$N = 174.$$

Therefore, the minimum sample required was 174 however; all patients who met inclusion criteria were recruited in the study.

3.5 Sampling Method:

Non-probability consecutive sampling technique was used where all patients who underwent cataract surgery during the study period and who met the criteria were recruited in the study.

3.6 Data Collection

3.6.1 Data Collection Tools

Data collection tools used included rebound tonometer machine (I care) for measuring the IOP, Snellen chart for taking the visual acuity and the tumbling E chart for the illiterate patients was used. Slitlamp biomicroscope Zeis type from Germany for anterior and posterior segment examination, The 78D/90D lens was used for viewing the disc and fundus. A structured questionnaire for filling the information.

3.6.2 Data Collection Procedure.

The investigator attended the adult eye clinic and selected all patients that met the inclusion criteria. All patients with cataract who met the inclusion criteria and planned for cataract surgery were captured from the adult ophthalmology clinics. They were informed about the study and requested to participate and those who agreed to participate signed the informed consent.

A thorough history was taken to every patient who consented for the study. The patient's personal information was filled, any history of comorbidities like glaucoma, hypertension or diabetes, use of topical anti glaucoma medications, history of prior ocular trauma were noted. The investigator with the help of the trained research assistant from CCBRT hospital examined recruited patients. Clinical examination started with assessment of visual acuity using snellen chart and tumbling E for illiterate patients. Intraocular pressure measurement was done three times and the mean IOP was recorded using Icare rebound tonometer. Intraocular pressure of more than 21mmHg was considered high while less than 10 mmHg was regarded as low (43).

Slit lamp examination was also performed before operation to assess the integrity of the conjunctiva, cornea, iris, anterior chamber and lens. In this part any conjunctival redness, corneal edema, shallow anterior chamber, hyphema, pupillary abnormalities were noted. The patients were also dilated using tropicamide with phenylephrine eye drops in order to evaluate the status of the lens and grade the cataract and rule out lens dislocation/subluxation or zonular dehiscence. Grading of cataract was done using WHO – simplified cataract grading system (2002) whereby cataracts were graded as grade 1 up to grade 3 whether it was nuclear, cortical or posterior sub capsular cataract and were planned for phacoemulsification or manual small incision cataract surgery.

All phacoemulsification and MSICS were performed by experienced surgeons from the two hospitals (MNH/CCBRT Hospital).

Intraoperative intraocular lens insertion position was noted whether inserted in the posterior chamber, anterior chamber, in the sulcus or not at all.

Postoperative follow up was done where IOP was also checked on 1st day and 6weeks after surgery. The changes on IOP were observed in both follow up visits. Slit lamp examination on the 1st day and at 6weeks was also be performed by the investigator with assistance from the research assistant. The cornea, anterior chamber, pupil, intraocular lens position were assessed. However, funduscopy was performed 6weeks post operation in order to check the optic disc and note the cup/disc ratio to confirm those with diagnosis of glaucoma and identify those with a high cup/disc ratio suspicious of glaucoma. The diagnosis of glaucoma was diagnosed by patient's response to being a glaucoma patient, the use of glaucoma medication reported by the patient and presence of glaucomatous disc changes like asymmetry of 0.2 cup/disc ratio (CDR) on both eyes, notching and nasalization of blood vessels on funduscopy.

All the information and examination findings were then filled in a semi structured questionnaire.

3.7 Data Analysis

The semi-structured questionnaire was coded and the data was entered using SPSS (Statistical Package for Social Sciences) version 23. The mean and standard deviation were used for continuous variables, and frequency and proportions for categorical variables. The Chi-square was used in analysis of categorical data. Paired *t* test was used to assess the difference in IOP at each follow-up from baseline. Furthermore, an independent *t* test was used to determine differences in IOP for groups of data at each point in time. Oneway ANOVA was applied when more than two variables were analyzed. All P-values of <0.05 were considered statistically significant

3.8 Ethical Consideration

Ethical approval from the MUHAS Research and Publications Committee was sought before commencement of the study. Permission to conduct the study was requested from Executive director of MNH as well as CCBRT hospital through the heads of department of ophthalmology in each hospital. Written informed consent was obtained from all patients. The right to withdraw from the study was also explained to the patients and their names were kept confidential but instead the identification numbers were used.

CHAPTER FOUR

4 RESULTS

A total of 482 patients met the eligibility criteria for the enrollment during the study period. Of these, 198 patients (202 eyes) were recruited in the study. However, only 178 patients (180 eyes) were analyzed and completed the 6 weeks of follow-up. Two patient were bilateral.

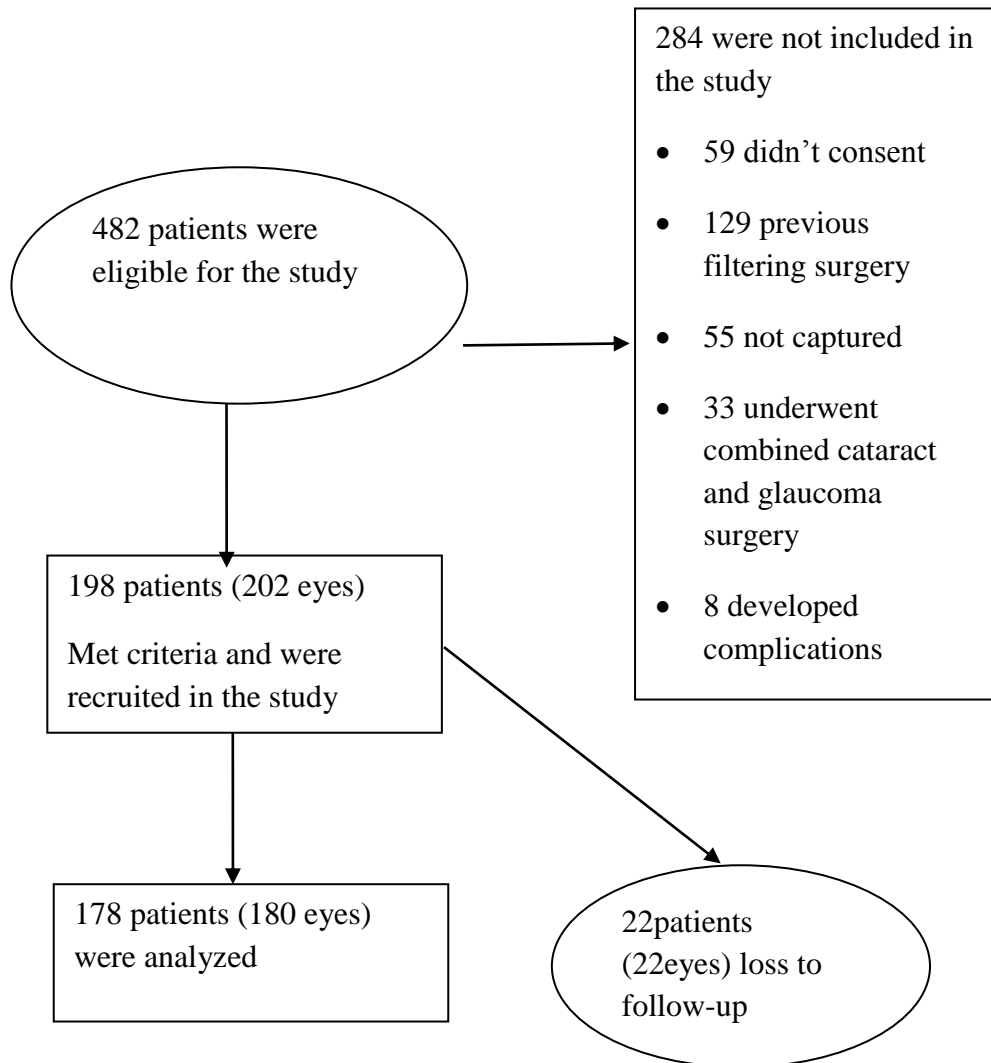


Figure 4: Flow chart of enrollment of the study population

Table 1: Age and sex characteristics of the study population (n=178 patients)

Characteristic	Number	Percentage
Age (years)		
18-39	7	3.9
40-59	32	18.0
≥ 60	139	78.1
Total	178	100.0
Sex		
Male	100	56.2
Female	78	43.8
Total	178	100.0

The majority (78.1%) of patients were >60 years of age. There were more males (56.2%) than females (**Table 1**).

One hundred (55.56%) eyes underwent phacoemulsification procedure (**Figure 5**)

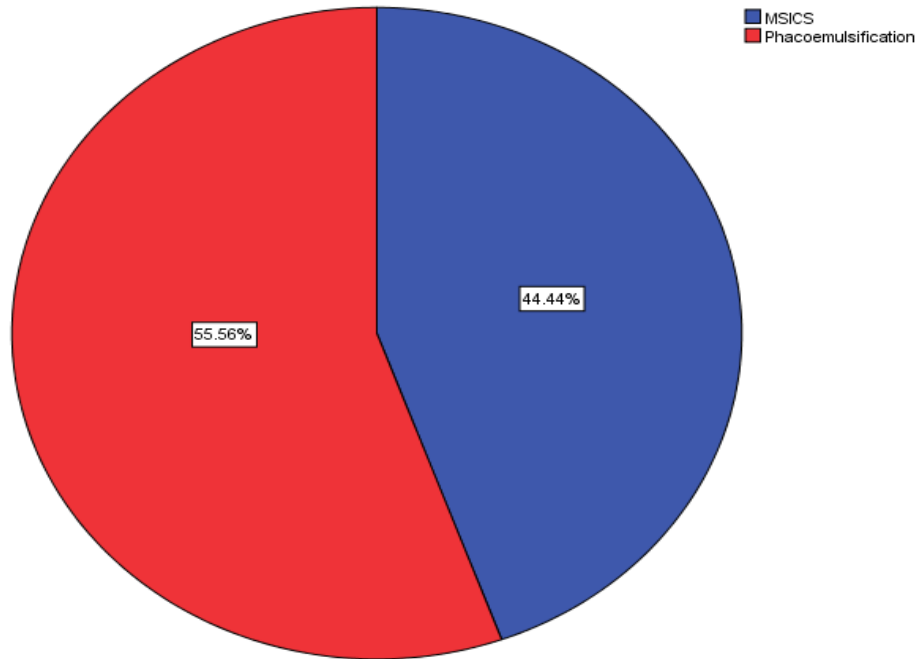


Figure 5: Types of cataract surgery among operated eyes (n=180).

Table 2: Intraocular pressure distribution: preoperative, postoperative day 1 and 6weeks (n=180 eyes)

IOP	Preoperative No (%)	Day 1, No (%)	Week 6, No (%)
<10mmHg	8(5)	16(8.9)	18(10)
10-21mmHg	117(65)	85(47.2)	141(78.3)
>21mmHg	55(30.6)	79(43.9)	21(11.7)

Only 55 (30.6%) eyes had IOP > 21mmHg before surgery which increased to 79 (43.9%) eyes in the 1st day after surgery. This proportion of eyes with high IOP decreased to 21(11.7%) by the 6th week after surgery. (**Table 2**).

Table 3: Comparison between preoperative and postoperative IOP on day 1. (n=180 eyes)

IOP category	Mean	SD	Paired t test
Pre operative (mmHg)	17.05	6.05	
At 1 st day post operative (mmHg)	20.94	11.04	< 0.000
Mean change in IOP (mmHg)	-3.894	10.64	

The mean IOP at 1st day postoperative period was 20.94 mmHg (SD \pm 11.04). The mean change in IOP at 1st day was -3.894 which was statistically significant (p value =0.000). (**Table 3**).

Table 4: Comparison between preoperative and postoperative IOP at 6th week (n=180 eyes)

IOP category	Mean	SD	Paired t test
Pre-operative (mmHg)	17.05	6.05	
At 6 th week post operative (mmHg)	14.61	6.48	< 0.000
Mean change in IOP (mmHg)	2.44	6.39	

The mean IOP at 6 weeks postoperative period was 14.61 mmHg (SD±6.48). The mean change in IOP at 6 weeks was 2.44 which was statistically significant with p value =0.000. (**Table 4**).

Before surgery, there were slightly more eyes (33%) with high IOP in the phacoemulsification group than MSICS group. While at 6 weeks postoperative, both groups showed almost equal percentage of eyes with high IOP of >21 mmHg. (**Figure 6**)

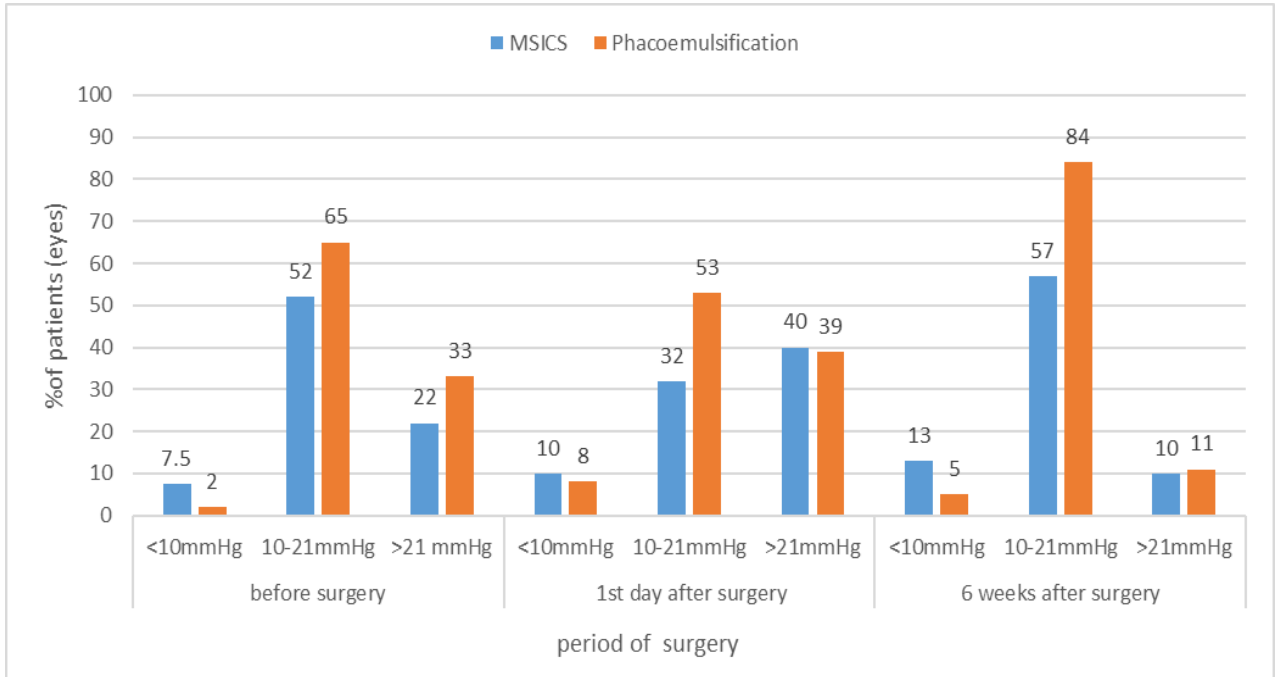


Figure 6: Distribution of IOP before surgery, at first day and 6 weeks in MSICS and phacoemulsification procedures. (n=180)

Table 5: Pre-operative and post-operative mean IOP in different cataract surgical procedures.

Period	MSICS Mean IOP\pm(SD) mmHg	Phacoemulsification Mean IOP\pm(SD) mmHg	P-value
Pre-operative	16.08(6.65)	17.83(5.42)	0.05
Day 1, post-operative	21.45(10.56)	20.54(11.45)	0.58
6 th week post-operative	14.29(6.51)	14.87(5.47)	0.55
Mean change at 6weeks	1.79(6.09)	2.96(6.59)	0.22

The mean IOP at 6 weeks following MSICS and phacoemulsification was 14.29 mmHg and 14.87 mmHg respectively. The mean difference 1.79 mmHg for MSICS and 2.96 mmHg for phacoemulsification respectively, which showed no statistical significance. (**Table5**).

Table 6: Distribution of eyes with and without glaucoma by cataract surgical procedures. (n=180 eyes)

Type of cataract surgery	Eyes with glaucoma	Non Glaucoma eyes	Total
	No(%)	No(%)	No(%)
MSICS	9(42.9%)	71(44.7%)	80 (44%)
Phacoemulsification	12(57.1%)	88(55.3%)	100(66%)
Total	21(100%)	159(100%)	180(100%)

Twelve (57.1%) eyes with glaucoma underwent phacoemulsification procedure. (**Table 6**)

Table 7: Preoperative and postoperative mean IOP in glaucoma and non glaucoma eyes (n=180).

Period	Glaucoma	Non glaucoma	p-value
	Mean IOP \pm (SD) mmHg	Mean IOP \pm (SD) mmHg	
Pre-operative	22.05(6.18)	16.39(5.73)	0.00
Day 1, post-operative	22.81(7.77)	20.70(11.4)	0.41
6 th week post-operative	17.14(7.12)	14.28(6.34)	0.06
Mean change at 6weeks	4.91(6.82)	2.11(6.28)	0.06

Eyes with glaucoma had a higher mean IOP compared to the non-glaucoma eyes pre-operatively and during postoperative period. The difference in the mean was statistically significant only pre-operatively. (**Table7**)

Although high proportion (77.8%) of patients with glaucoma who underwent MSICS had a higher IOP of >21 mmHg during the preoperatively period which persisted to day one postoperative, but at 6weeks the proportion had reduced to 22.2% as compared to phacoemulsification (25%). (Figure 7).

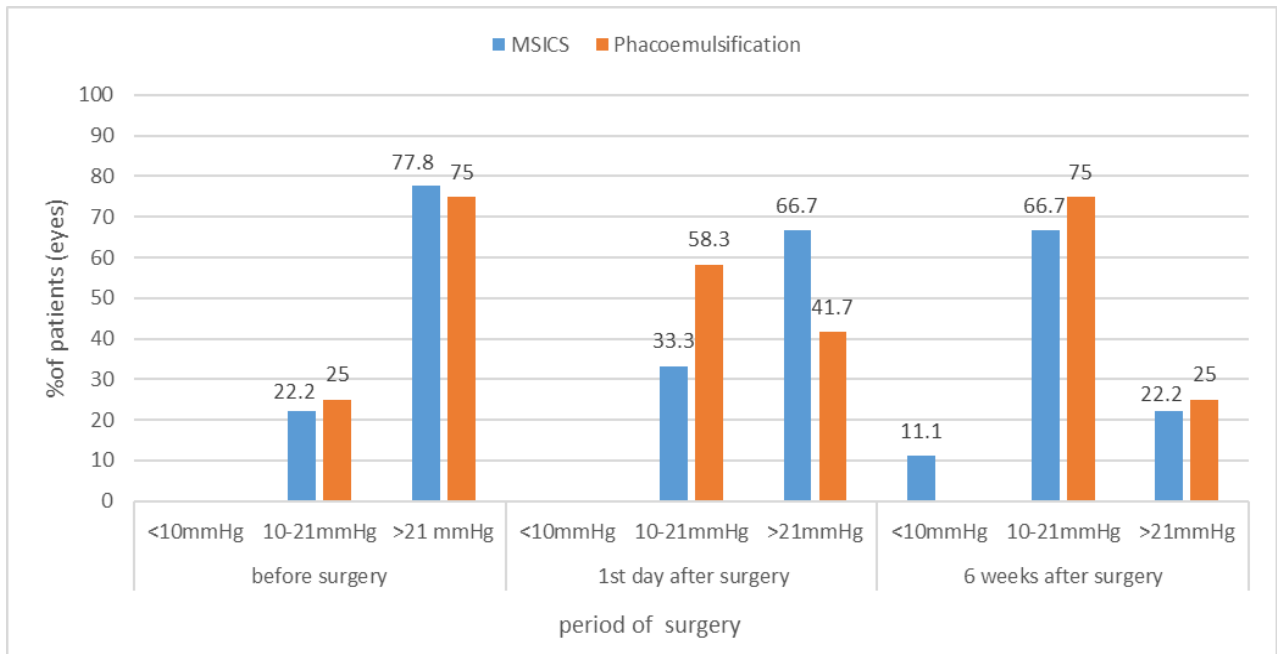


Figure 7: Distribution of Intraocular pressure in eyes with glaucoma before surgery, 1day and 6weeks after surgery(n=21).

Table 8: Mean IOP among eyes with glaucoma in different cataract surgical procedures.

Period	MSICS	Phacoemulsification	p-value
	Mean IOP _± (SD) mmHg	Mean IOP _± (SD) mmHg	
Pre-operative	21.22(7.10)	22.67(5.65)	0.910
Day 1, post-operative	23.78(8.72)	22.08(7.0)	0.868
6 th week post-operative	16.11(7.39)	17.92(7.13)	0.643

At 6 weeks the mean IOP in glaucoma patients who had undergone phacoemulsification was higher than for MSICS, but the difference was not statistically significant at $p=0.64$ (**Table 8**).

CHAPTER FIVE

5 DISCUSSION

5.1 Discussion

The findings from this study have shown that most patients who underwent cataract surgery were aged between 60-69 years with the mean age of 65 years. This could be because cataract is common in this age group. These findings are similar to the study done by Onakpoya in Nigeria (42). Our study found a male predominance 100 (56.2%) where a similar observation was seen by Onakpoya et al in Nigeria as opposed to female predominance observed by studies in America, India and Italy (5) (19) (21) (41). The reason for male predominance is not clear but it could be due to reason that most males are engaged in income generating activities therefore economically independent and are financially able to access health services easily. Additionally, women have less decision regarding their health care and most of them need financial support from their husbands. Therefore, limiting access for care.

Intraocular pressure evaluation is important entity in cataract patients before and after cataract surgery as it is one of the clinical signs for glaucoma patients and is necessary to establish expected surgical problems. In the current study the IOP changes were compared preoperatively and postoperatively at 1st day and 6th week following cataract surgery. Preoperatively a good number of patients (65%) had a normal intraocular pressure of 10-21mmHg. There was a rise in mean IOP at day one postoperatively which was statistically different from preoperative values. However, at 6weeks the mean IOP of 14.61 ± 6.498 mmHg was significantly lower than before surgery ($P=0.000$). The finding is similar to a study by Shingleton et al (10) where he reported a mean preoperative IOP of 16.42 ± 2.77 mmHg which increased slight on day 1 to 16.75 ± 4.82 mmHg and by 6 week post- operative it reduced to 15.30 ± 3.15 mmHg. The rise in IOP in the first day postoperative is probably due to retained viscoelastic and or residue cortical lens matter (9) (20) (31).

Our study also showed that by 6 weeks after surgery the mean overall IOP reduction was 2.72 mmHg. This was consistence with the study done by Jacob et al in which IOP reduction was

observed to be 2.04 mmHg with SD of 2.416 mmHg by the end of 3 months of follow up (22). Also the study done by Shingleton showed that reduction of IOP varied from 0.5-3 mmHg(10). This could be due to reduced inflammation, removal of cataractous lens, disappearance of viscoelastic material and capsular matter in anterior chamber.

The technique of cataract surgery also influences intraocular pressure variations as previously reported by different authors. In Africa phacoemulsification remains as uncommon procedure as in Tanzania it is still available in relatively few tertiary hospitals. Although this technique is gradually overtaking the MSICS which is still a cost effective technique for cataract removal, the costs of the machine and surgical consumables are a hindrance for its acquisition. Many hospitals will therefore continue performing MSICS. Our study showed that more eyes 100 (55.56%) underwent phacoemulsification technique while only 80 (44.44%) of eyes had MSICS. This could be due to the reason that phacoemulsification is the frequently done surgical technique at CCBRT hospital which is a Non-Governmental Organization (NGO) facility. As opposed to the study done by Onakpoya in Nigeria (42) where only 36.6% of patients underwent phacoemulsification and Pal et al (21) in which only 26.96% of 117eyes the procedure was performed. Similar studies in Korea and India phacoemulsification was highly performed (14) (21).

This study also showed that there was no statistical difference on the mean preoperative IOP between the mean IOP of 17.83 ± 5.42 mmHg in phacoemulsification and 16.65 ± 6.65 mmHg in MSICS. Likewise, there was an insignificant difference in mean IOP between phacoemulsification and MSICS at day 1 post-operative (P-value=0.58). Similar results were reported by Sengupta et al (5). On the contrary, Onakpoya et al in Nigeria observed lower IOP on day 1 after surgery in patients operated by phacoemulsification (42). The reason for the low IOP on day1 after surgery in this Nigerian study was due to use of viscoelastic material which was more cohesive during phacoemulsification as for the current study a dispersive viscoelastic material was used. Dispersive viscoelastic is more difficult to aspirate out of AC than cohesive viscoelastic (2) which increases possibility of retention in AC and therefore raise in IOP (38) (44). However, in this current study both phacoemulsification and MSICS resulted into significant lower IOP changes at 6 weeks after surgery but there was no statistical difference

between the two surgical techniques (P-value=0.55). This was in keeping with the study done by Sengupta et al (5). On the contrary Shingleton et al (10) showed that phacoemulsification particularly clear cornea seems to lower IOP more than MSICS while other studies showed more IOP reduction in MSICS than phacoemulsification procedure (41) (42). Therefore, the finding that IOP was lowered equally by both surgical techniques could suggest that the mechanism of IOP lowering is the consequence of cataract removal rather than ultrasound energy used in phacoemulsification as previously reported in the Korean study (13).

This study also analyzed the changes of IOP in glaucoma eyes co-existing with cataract and non-glaucoma eyes. Among the 21 (11.9%) eyes with glaucoma the overall preoperative mean IOP was high 22.05 ± 6.18 mmHg with a slight increase 22.81 ± 7.77 mmHg on day 1 post-operative. This was in agreement with the study done by Shingleton et al (10) Yasutani et al (32) which showed a great 1day postoperative rise IOP though it was insignificant. Conversely, when the eyes were analyzed separately according to the type of cataract surgery the MSICS showed higher immediate IOP elevation at post-operative day 1 of 23.78 ± 8.72 mmHg than for phacoemulsification 22.08 ± 7.00 mmHg. This could be due to higher intraoperative manipulation during MSICS.

However, the mean IOP at 6th weeks post-operative was lower than pre-operative value in both groups. This was similar to the study done by Sacca and Shingleton in patients with glaucoma where a reduction in IOP was observed 1month post operatively similar to normal patients (10) (41). Additionally, this study also showed that IOP reduction was found to be proportional to the preoperative IOP. Eyes with glaucoma which had higher preoperative IOP compared to non-glaucoma eyes also had correspondingly greater mean change of IOP (4.91mmHg vs 2.11mmHg) at 6weeks postoperatively. The findings were in agreement with studies from Shingleton et al (10), Poley et al (24) and Freidman et al (25). Conversely, this is in disagreement with Hayashi et al who reported uncontrolled raised IOP after surgery in eyes with higher preoperative IOP (12). The reason for the great decrease in IOP in the current study could be due to increase in depth and width of AC which allow great facility outflow (11).

CHAPTER SIX

6 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Most operated eyes had normal IOP before surgery. The IOP was high one day after surgery, but was lower than preoperative IOP at 6 weeks postoperative.

The significant IOP reduction was equally observed at 6 weeks in both phacoemulsification and MSICS.

Majority of glaucoma patients had high preoperative IOP which reduced to normal at 6 weeks postoperative. The higher the preoperative IOP, the higher the observed reduction in IOP.

6.2 Recommendations

- Both phacoemulsification and MSICS may be considered initially for IOP control in cataract patients with co-existing glaucoma followed by glaucoma surgery later if required.
- A need for another study on number of antiglaucoma medication use after IOP reduction following cataract surgery in patients with glaucoma.

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APPENDIX**Appendix I: Questionnaire: English version****TITLE: EFFECT OF CATARACT SURGERY ON INTRAOCULAR PRESSURE
AMONG ADLT PATIENTS ATTENDING TERTIARY EYE HOSPITALS IN DSM****PATIENT IDENTIFICATION NUMBER.....****REGISTRATION NUMBER.....***(Circle or fill in spaces provided)***SECTION A: DEMOGRAPHIC INFORMATION**

S/N	Question and answer	Code
1.	Age in years.....	
2.	Sex : 1.Male 2. Female	
3.	Place of residence 1.Ilala 2.Kinondoni 3.Temeke 4.Ubungo5. Kigamboni 6.Others	

SECTION B: PATIENT'S HISTORY

S/N	Question and answer	Code
4.	Glaucoma : 1.Yes 2. No	
5.	Hypertension : 1. Yes 2. No	
6.	Diabetes : 1. Yes 2. No	
7.	None of the above Comobidity: 1.Yes 2. No 3. others	
8.	Use of topical medications: 1.Yes 2. No	
9.	Ocular trauma : 1. Yes 2. No	

SECTION C: SURGICAL INFORMATION**Preoperative and Intraoperative**

S/N		
10.	VA:	
11.	IOP: _____	
12.	Cornea : 1. Normal 2. Others	
13.	AC: 1. Normal 2. Deep 3. Shallow 4. Others	
14.	Iris : 1. Normal 2. Others	
15.	Pupil: 1. Normal 2. Others	
16.	Type of cataract: 1. Immature 2. Mature 3. Hypermature 4. Others	
17.	Type of cataract surgery: 1. MSICS 2. Phacoemulsification	
18.	IOL positioning: 1. In the bag 2. At the sulcus 3. In the AC 4. None	

SECTION D: POSTOPERATIVE ASSESSMENT

S/N		1 st day	6weeks
19.	BEST CORRECTED VA 1 6/6-6/18 2 <6/18-6/60 3 <5/60-3/60 4 <3/60-LP
20.	IOPmmHgmmHg
21.	Cornea: 1. Normal 2. Hazy		
22.	A/C : 1. Normal 2. Deep 3. Shallow 4. Others		
23.	Iris : 1. Normal 2. Others		
24.	Pupil : 1. Normal 2. Others		
25.	Fundus (CDR): 1) <0.4 2) 0.5-0.7 3) 0.8-1		

Appendix II: Informed Consent Form: English Version**MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES**

Consent to participate in a research study: Greetings. I am Dr Jasmine Juma Kachemela, a postgraduate student, doing a masters of medicine in Ophthalmology at Muhimbili University of Health and Allied Sciences. I am doing a research on Effect of cataract surgery on IOP among adult patients attending MNH/CCBRT hospitals from July 2020 to December 2020.

Purpose of the study: To help knowing the best cataract surgery technique to consider in cataract patient with high preoperative IOP and this may influence the approach to treatment especially in patients with glaucoma.

Confidentiality: All the information collected in the questionnaire will not be disclosed to anyone not related to this study. Identification numbers will be used instead of the name of the study participant.

Risk; No harm is expected to occur because of joining in the study.

Benefits: The results of this research will help to improve the quality of care in patients undergoing cataract surgery.

Right to withdrawal : Joining in this study is completely your voluntary. You can withdrawal at any particular moment even after signing the consent form. This will not involve penalty or loss of any benefits to which you are entitled.

Whom to contact: If you have any inquiries about this study, please do not hesitate to contact:
The principal investigator ,Dr Jasmine J Kachemela,
Muhimbili University of Health and Allied Sciences,
P.O BOX 65001, Dar es salaam, Tel +255768327658

OR

My supervisor Dr Suzan Mosenene (Lecturer MUHAS,
Ophthalmologist) **Tel: +255689527952**

OR

In case you have any question concerning your rights as a
participant you may contact Dr. Bruno Senguya, Director of
Research and Publications (DRP) of MUHAS, P.O BOX 65001
DSM. **Tel: +255022 2152489.**

Participant Agreement

I(Participant's initials) have read the contents in this form. My
questions have been answered and I agree to participate in this study.

Signature of participant Date.....

Signature of researcher/research assistant..... Date.....

Appendix III: Dodoso**MABADILIKO YA PRESHA YA MACHO KWA WAGONJWA WATUWAZIMA WENYE MTOTO WA JICHO WANAOFANYIWA UPASUAJI KATIKA HOSPITALI YA TAIFA MUHIMBILI NA CCBRT.**

Nambari ya dodoso.....

Nambari ya usajili ya mgonjwa.....

*(jaza au zungushia jibu sahihi)***KIPENGELE A: TAARIFA YA MGONJWA.**

Na.	Swali na Jibu	
1.	Umri (Miaka).....	
2.	Jinsia: 1.Mme 2. Mke	
3.	Mkazi anapotoka: 1.Ilala 2.Kinondoni 3.Temeke 4.Ubungo5. Kigamboni 6.Others	

KIPENGELE B: HISTORIA YA MGONJWA.

S/N	Swali na Jibu	Code
1.	Ugonjwa wa presha ya macho : 1.Ndio 2. Hapana	
2.	Ugonjwa wa presha ya mwili : 1. Ndio 2. Hapana	
3.	Ugoinjwa wa sukari mwilini kupanda : 1. Ndio 2. Hapana	
4.	Sina ugonjwa kati ya hayo: 1.Ndio 2. Hapana 3.Mengineyo	
5.	Utumiaji wa dawa machoni: 1.Ndio 2. Hapana	
6.	Kuumia jicho: 1. Ndio 2. Hapana	

KIPENGELE C: TAARIFA KABLA NA WAKATI WA UPASUAJI

Na.	VITU VYA KUANGALIA	
7.	Kiwango cha kuona :	
8.	Kiasi cha presha ya jicho:.....mmHg	
9.	Kioo cha mbele : 1.Kawaida 2. Nyenginezo	
10.	Chemba ya mbele: 1. kawaida 2. Kina kirefu 3. Kina kifupi 4. mengine	
11.	Iris : 1. Kwaida 2. Nyenginezo	
12.	Mboni: 1. Kawaida 2. Nyenginezo	
13.	Aina ya mtoto wa jicho: 1. hajakomaa 2. kakomaa 3.kakomaa zaidi 4 nyengine	
14.	Aina ya upasuaji: 1.MSICS 2. Phacoemulsification	
15.	Uwekaji wa lens bandia: 1. Mfuko wa numa 2. Kwenye sulcus 3. Kwenye chemba ya mbele ya jicho. 4. Haijawekwa	

KIPENGELE D: MATOKEO BAADA YA UPASUAJI

Na.	VITU VYA KUANGALIA	SIKU YA KWANZA	WIKI 6
1.	Kiwango cha kuona 5 6/6-6/18 6 6/24-6/60 7 5/60-3/60 4 3/60-LP
	Kiasi cha presha ya jichommHgmmHg
	Kioo cha mbele : 1.Kawaida 2. Nyenginezo		
	Chemba ya mbele: 1. kawaida 2. Kina kirefu 3. Kina kifupi 4. mengine		
	Iris : 1. Kwaida 2. Nyenginezo		
	Mboni: 1. Kawaida 2. Nyenginezo		
	Fundus (CDR) 1 <0.4 2 0.5-0.7 3 0.8-1		

Appendix IV: Fomu ya ridhaa ya kushiriki katika utafiti

Salaam, mimi ni Dr Jasmine Juma Kachemela, mwanafunzi wa shahada ya uzamili ya udaktari, Idara ya macho, chuo kikuu cha Afya Muhimbili. Nafanya utafiti Kuangalia kiwango cha presha ya macho baada ya kufanyiwa upasuaji wa kutoa mtoto wa jicho kwa wagonjwa wanaokuja MNH au CCBRT hospitali katika kipindi cha utafiti.

Lengo la utafiti: Kusaidia kujua njia nzuri ya kutoa mtoto wa jicho kwa wagonjwa wenye mtoto wa jicho wenye presha ya macho iliyo panda na inaweza kusaidia kutibu wagonjwa wenye ugonjwa wa presha ya macho.

Usiri: Majina ya washiriki wa utafiti huu hayata hitajika badala yake zitatumika namba, za utambuzi. Habari zote zitakazo kusanywa wakati wa utafiti zitatumika kwa wahusika wa utafiti tu na si vinginevyo.

Madhara: Hakuna madhara yanayo tarajiwa kwa washiriki wa utafiti.

Faida: Matokeo ya utafiti huu ya tasaidia kuboresha huduma za macho kwa wagonjwa wenye mtoto wa jicho wenye ongezeko la presha ya jicho na jamii kwa ujumla.

Hakiyakujitoea; Ushiriki katika utafitini wa hiyari, mshiriki yoyote anahaki ya kuamua kujitoea katika utafiti wakati wowote kujitoea hakuta athiri kiwango cha huduma kwa mgonjwa.

Kwa mawasiliano zaidi

Dkt. Jasmine Kachemela

Mtafiti mkuu

Chuo cha afya Muhimbili

Simu: 0768 327 758

AU

Dkt. Suzan Mosenene

Msimamizi mkuu wa utafiti.

Chuo kikuu cha afya Muhimbili

S.L P 65001 Dar es Salaam.

Simu: 0764156819

AU

Dkt. Bruno Senguya,

Mwenyekiti kamati ya utafiti na uchapishaji

S.L. P 65001 Dar es Salaam.

Simu: +255 022 2152489

Tamko la mshiriki

Miminimesoma na kuelewa maelezo yaliyo kwenye fomu hii na maswali yangu ya mejibiwa na ninakubali kushiriki kwenye utafiti huu.


Sahihi ya mshiriki.....tarehe

Sahihi ya mtafiti/mtafiti msaidizi.....tarehe

Appendix V: Ethical clearance

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23rd April, 2020

Ref. No. HD/MUH/T.150/2018
IRB#: MUHAS-REC-04-2020-221

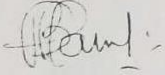
Jasmine J. Kachemela
MMed. Ophthalmology,
School of Medicine,
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: " INTRAOCULAR PRESSURE CHANGES FOLLOWING CATARACT SURGERY AMONG PATIENTS WITH HIGH INTRAOCULAR PRESSURE ATTENDING SELECTED EYE CLINICS IN DAR ES SALAAM".

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from 23rd April, 2020 to 22nd April, 2021. In case you do not complete data analysis and dissertation report writing by 22nd April 2021, you will have to apply for renewal of ethical clearance prior to the expiry date.



Dr. Bruno Sunguya
ACTING: DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Medicine, MUHAS