Republic of Yemen

Emirates International University

Faculty of Medicine and Health Science
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The Surgical Outcome of Cataract Surgery in Diabetic Patients: A Comparative Study

A Study Submitted to Faculty of Medicine and Health Science in Emirates International University as partial fulfillment for MBBS

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Dedication

For our parents and our families who sacrificed everything; so, we could come this far.

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TABLE OF ABBRIVIATIONS

ABBRRIVIATION	MEANING
AGE	Advanced Glycation End-product
ARI	Aldose Reductase Inhibitor
BCVA	Best Corrected Visual Acuity
CVA	Cerebral Vascular Accident
DM	Diabetes Mellitus
HTN	Hypertension
HBA1c	Glycated Hemoglobin A
IOL	Intraocular Lens
logMAR	Log of Minimum Angle of Resolution
NSAID	Nonsteroidal Anti-Inflammatory Drugs
PHACO	Phacoemulsification
Pre-Op	Pre-operative
Post-OP	Post-operative
SICS	Small Incision Cataract Surgery
SCA	Sickle Cell Anemia
SLE	Systemic Lupus Erythmatosus
SOD 1	Superoxide Dismutase 1

Acknowledgments

*All praise to the most high, **Allah**, to who all thanks and gratitude are always for.*

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Abstract

- **Aim:**

  To determine the visual outcome of cataract surgery in patients with diabetes mellitus suffering from cataract in Sana'a, Yemen.

- **Design:**

  A retrospective comparative study conducted at three private centers in Sana'a (Al-Barraq Hospital, Yemen Consultants Center for Ophthalmology, and The Hospital for Eyes and Nose).

- **Materials and Methods:**

  A comparative study of 51 patients with diabetes and 102 patients in the non-diabetic group that underwent either Small Incision Cataract Surgery or Phacoemulsification with Intraocular Lens Implantation. Age, sex, surgical technique, follow up, pre- and postoperative best corrected visual acuity (BCVA) and post-op complications were evaluated.

- **Results:**

  Out of 153 patients, 51 were diabetic and 102 were non-diabetics. SICS or PHACO was done in all patients. Follow up duration was 1 month. The mean preoperative best corrected visual acuity in the diabetic group was 0.08±1.40 for right eye and 0.19±0.73 for left eye. And in non-diabetic group was 0.79±3.8 for right eye and 0.44±2.99 for left eye. The mean post-operative best corrected visual acuity in logMAR units in the diabetic group was 0.10±1.81 and 0.13±1.86 for right and left eye respectively; in the non-diabetic group was -0.05±2.48 and 0.07±2.2 for right and left eye respectively. The difference in pre and post operative visual outcome was not statistically significant. On comparing the best corrected visual acuity after 1 month of follow up in both groups, the result was statistically significant (p=0.0006) (p=0.0012) for right and left eye respectively. Post-operative complications included dry eye, conjunctivitis, and retinopathy, ocular hypertension, uveitis, and vitreous loss and hemorrhage. The incidence was overly higher in the diabetic group.

- **Conclusion:**

  Cataract surgery in diabetic patients yields similar visual outcomes as non-diabetics. Visual improvement was seen following surgery for advanced cataract in diabetics in this study population. There is a higher incidence of post-operative complications among diabetics. So extra care should be taken intra-operatively and during post-op follow up. Longer duration of post-operative monitoring after surgical treatment in diabetics may enhance visual outcome.

Chapter 1

INTRODUCTION

The prevalence of diabetes mellitus is rising with each day. The International Diabetes Federation estimating that there will be 439 million diabetic patients by 2030[1]. An aging population and longer patient life expectancy also means that the prevalence of DM will exceed 33% by 2050[2]. Diabetes mellitus can lead to pathologies in many tissues in the body; most notably, in the eye, with both a systemic chronic metabolic disease and a microangiopathic implications [3]. Cataract is one of those major causes of visual impairment in diabetic patients along with retinopathy.

A cataract is any opacity in the lens. Aging is the most common cause, but many other factors can be involved, including trauma, toxins, systemic disease (such as diabetes), smoking, and heredity [4]. Patients with DM are reported to be up to five times more likely to develop cataract, in particular, at an early age [5]. Development of cataract is the second ocular common complication of diabetes mellitus. Due to the increasing prevalence of DM, the incidence of diabetic cataracts has also risen. Therefore, cataract extraction has become one of the most common surgical procedures among the general population, and the number of surgeries performed each year has continued to increase globally. Up to 20% of all cataract surgeries in the United Kingdom is performed in diabetics[6].

Cataract surgery is considered to be the commonest single surgical procedure carried out in the developed world. In the developing world, cataract remains the commonest cause of blindness. In 1990 an estimated 37 million people were blind worldwide—40% of them because of cataract.[7] On annual estimation, an extra 1-2 million people go blind.[7] Every five seconds, one person in our world goes blind, and a child goes blind every minute.[7] In 75% of these cases, the blindness is treatable or preventable[7]. However, 90% of blind people live in the poorest sections of the developing world, and without proper interventions, the number of blind people has been predicted to have been increased up to 75 million by 2020[7].

Cataract surgical procedures are usually indicated for either visual improvement or to allow assessment and treatment of retinopathy. However, in older publications, principally from the 1990s, the visual outcomes after cataract surgery were reported to be less favorable in the presence of diabetes. Poorer visual outcome has been linked with

the severity of retinopathy and maculopathy prior to surgery[8]. The main culprit resides in the fact that diabetic patients rarely regain good enough of a sharp eye-sight to carry daily activity post-operatively due to either complication after surgery or the fluctuation of blood sugar; which in turn lead to the development of macular edema or proliferative retinopathy. These factors had been influencing specialists for years as exposing cataract patients with DM to the risks of surgical approach outweighs the benefits; resolving to conservative measures, or delaying surgical intervention until it is inevitable.

In recent years, major developments have occurred in cataract surgery, the treatment of diabetic retinopathy, and the management of diabetes. Cataract surgeries are often carried out earlier amongst diabetics in developed countries to allow diagnosis and treatment of retinopathy and maculopathy. Newer surgical techniques (eg, small-incision phacoemulsification) have been associated with improved postoperative outcomes.[9] Superior imaging modalities and modern laser treatments have enhanced the management of diabetic retinopathy.[10-11] Recommendations for tighter glycemic and blood pressure control have decreased the risk of diabetic complications.[12-13] These advances may have improved the potential for good visual outcomes after cataract surgery in individuals with diabetes. However, very few large-scale studies have evaluated the visual outcomes of people with diabetes after cataract surgery. This have risen the concerns among patients who choose to undergo the procedure; despite the early intervention.

On the other hand, in developing countries, treatment at a late stage is the rule rather than the exception. A large proportion of patients would not have had an ophthalmic examination until they present in the clinic with advanced cataract; thus preventing preoperative retinal assessment or treatment of retinopathy. The increasing incidence of diabetes in developing countries, such as Yemen, and the lack of any concrete reflection of the disease's burden on sight, necessitates an assessment of the surgical outcome of diabetic cataract among the study population, with the currently available modalities. The study was designed to investigate the outcome of surgery, and whether diabetic patients; especially those suffering from another co-morbid illness, would effectively benefit from operative intervention.

1.2 Importance of the Study:

The increasing incidence of diabetes in Yemen along with other developing countries dictates an assessment of the surgical outcome of diabetic cataract among the study population. The study was carried to investigate the outcome of surgery in this cohort with the intention of making recommendations for better directing decision-making and improve care.

1.3 Objectives

1.3.1 General objective:

To investigate the outcome of cataract surgery in diabetic patients compared with non-diabetic patients.

1.3.2 Specific objectives:

- Compare the Basal Visual Acuity among the study population, before and after the cataract surgery in the two study groups.
- Compare the outcome of cataract surgery between the two study groups.
- To measure the difference in the level of the outcome of cataract surgery between the two study groups.

Chapter 2

Review of Literature

CHAPTER 2: REVIEW OF LITERATURE

2.1 Clinical Overview:

Cataracts are a clouding of the lens of the eye. While they are common in the aging population, it is important to know that they can occur at a much earlier age when individuals who have diabetes. [14] Cataracts often develop slowly and can affect one or both eyes.[14] Symptoms may include faded colors, blurry or double vision, halos around light, trouble with bright lights, and trouble seeing at night.[14] This may result in trouble driving, reading, or recognizing faces.[15] Poor vision caused by cataracts may also result in an increased risk of falling, roads and traffic accidents, along with serious behavioral problems like depression.[16] Cataracts cause 51% of all cases of blindness and 33% of visual impairment worldwide.[17][18]

2.2 Causes:

As you age, the lenses of your eyes become less flexible, less transparent and thicker. When a person have diabetes, high blood glucose levels, over time, can lead to structural changes in the lens of the eye that can accelerate the development of cataracts.

If one have diabetes, they might be at greater risk for developing cataracts depending on how long said person have had it, the frequency of glucose levels above their target range and the presence of macular edema—fluid build-up in the macula (located in the center of the retina). Cataract cannot be recognized oftentimes. And since symptoms can be minor until clouding affects the center of the eye, at which point the cataract can progress rapidly. Other causes of cataracts [14]:

- Family history
- Eye injury

- Eye surgery
- Repeated eye injections.
- Spending a lot of time in the sun without UV sunglasses
- Using certain medications, such as corticosteroids

2.3 Pathogenesis of Diabetic Cataract:

The enzyme aldose reductase catalyzes the reduction of glucose to sorbitol through the polyol pathway, a process linked to the development of diabetic cataract. Extensive research has focused on the central role of the pathway as the initiating factor in diabetic cataract formation.

It has been shown that the intracellular accumulation of sorbitol leads to osmotic changes resulting in hydropic lens fibers that degenerate and form sugar cataracts [19, 20]. In the lens, sorbitol is produced faster than it is converted to fructose by the enzyme sorbitol dehydrogenase. In addition, the polar character of sorbitol prevents its intracellular removal through diffusion. The increased accumulation of sorbitol creates a hyperosmotic effect that results in an infusion of fluid to countervail the osmotic gradient. Animal studies have shown that the intracellular accumulation of polyols leads to a collapse and liquefaction of lens fibers, which ultimately results in the formation of lens opacities [20, 21]. These findings have led to the "Osmotic Hypothesis" of sugar cataract formation, emphasizing that the intracellular increase of fluid in response to AR-mediated accumulation of polyols results in lens swelling associated with complex biochemical changes ultimately leading to cataract formation.

Furthermore, increased glucose levels in the aqueous humor may induce glycation of lens proteins, a process resulting in the generation of superoxide radicals and in the formation of advanced glycation endproducts (AGE) [22]. By interaction of AGE with cell surface receptors such as receptor for advanced glycation endproducts in the epithelium of the lens further and H2O2 are generated [23].

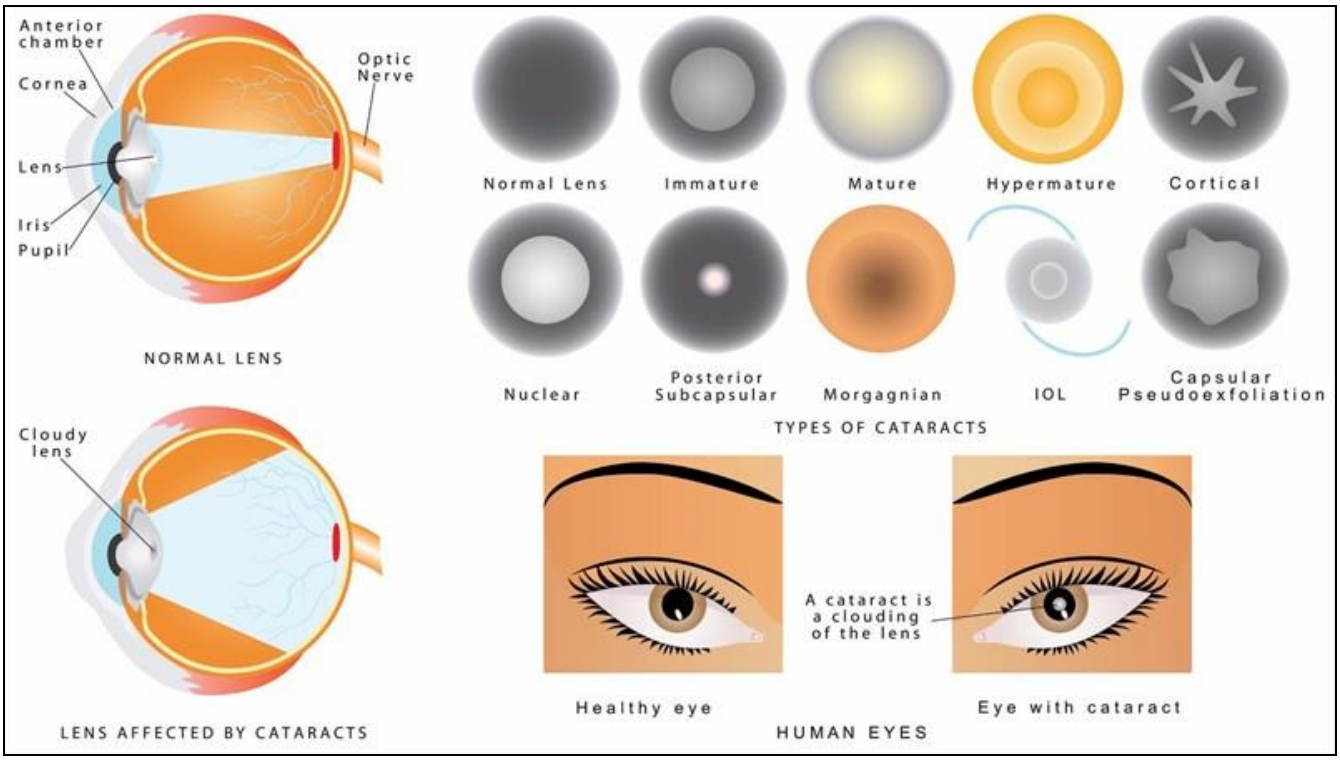

Figure 1: Clinical Picture of Cataract – credits to Mymed; www.mymed.com/diseases-

In addition to increased levels of free radicals, diabetic lenses show an impaired antioxidant capacity, increasing their susceptibility to oxidative stress. The loss of antioxidants is exacerbated by glycation and inactivation of lens antioxidant enzymes like superoxide dismutases [24]. Copper-zink superoxide dismutase 1 (SOD1) is the most dominant superoxide dismutase isoenzyme in the lens [25], which is important for the degradation of superoxide radicals into hydrogen peroxide (H2O2) and oxygen [26]. The importance of SOD1 in the protection against cataract development in the presence of diabetes mellitus has been shown in various in vitro and in vivo animal studies [27, 28].

2.4 Clinical Types of Cataract:

- **Mature cataract** is one in which all of the lens substance is opaque.

- **Immature cataract** has some transparent regions. If the lens takes up water, it may become intumescent.
- **Hypermature cataract** is one when cortical proteins have become liquid. This liquid may escape through the intact capsule, leaving a shrunken lens with a wrinkled capsule.
- **Morgagnian cataract** is a hypermature cataract in which the lens nucleus floats freely in the capsular bag.

2.5 Known Signs and Symptoms:

- Cloudy or blurry vision
- Seeing double in one eye
- Seeing halos around lights
- Being extra sensitive to light and glare
- Having trouble seeing well at night
- Bright colors seem faded

2.6 Diagnosis:

The Cataract Management Guideline Panel recommends reliance on clinical judgment combined with visual acuity as the best guide to the appropriateness of surgery but recognizes the need for flexibility, with due regard to a patient's particular functional and visual needs, the environment, and other risks, all of which may vary widely. Generally speaking, the decrease in visual acuity is directly proportionate to the density of the cataract. However, some individuals who have clinically significant cataracts when examined with the ophthalmoscope or slit-lamp see well enough to carry on with normal activities. Others have a decrease in visual acuity out of

proportion to the degree of lens Opacification. This is due to distortion of the image by the partially opaque lens.[29]

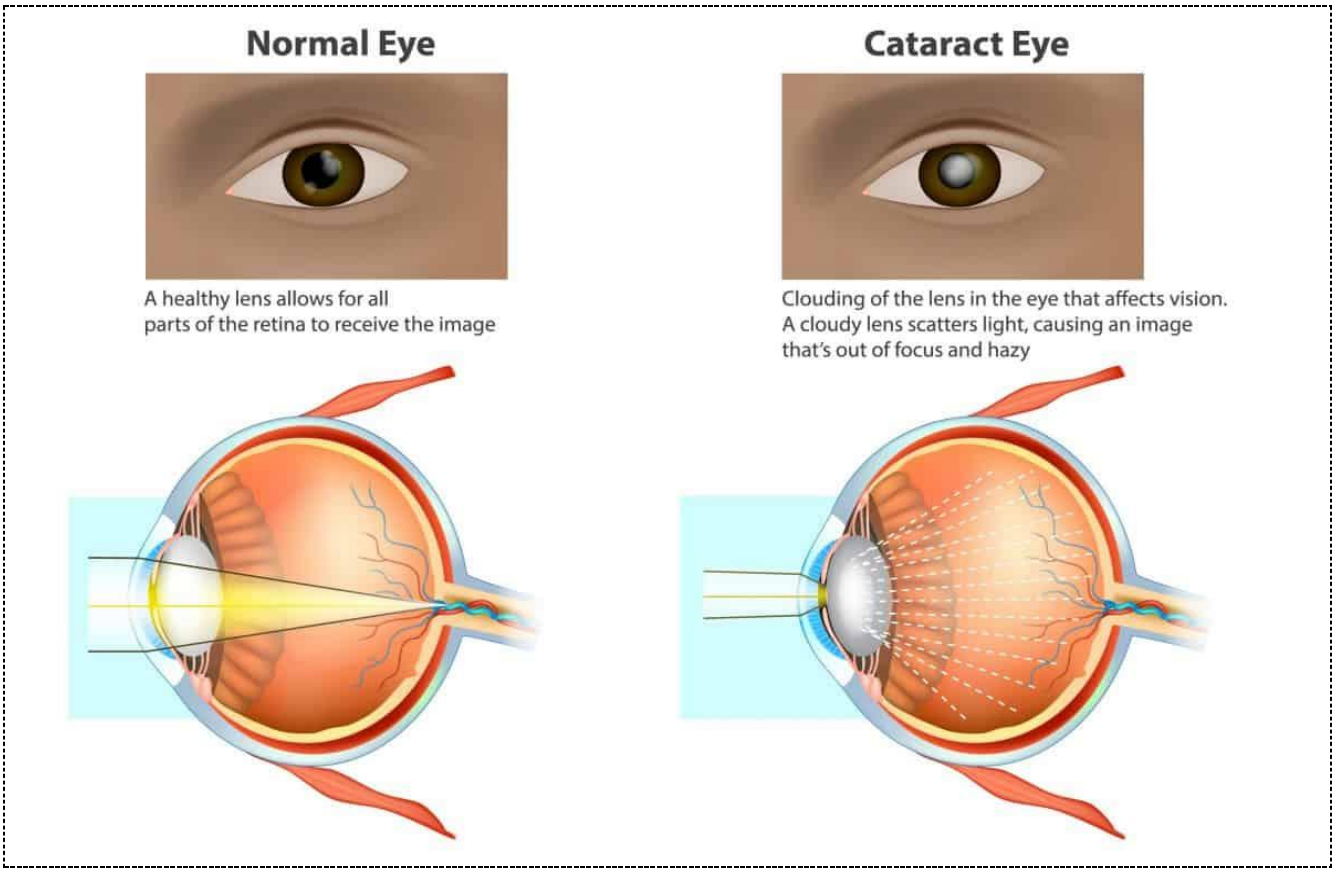

Figure 2: Characteristics of Cataract – credits to TheEyeHealthCenter.com

2.7 Treatment:

2.7.1 Aldose-Reductase Inhibitors:

Aldose reductase inhibitors (ARI) comprise a variety of structurally different compounds like plant extracts, animal tissues or specific small molecules. In diabetic rats, plant flavonids, such as quercitrin or the isoflavone genistein, have delayed diabetic cataract formation [30–31]. Examples of natural products with known AR inhibitory activity are extracts from indigenous plants like Ocimum sanctum, Withania somnifera, Curcuma longa, and Azadirachta indica or the Indian herbal Diabecon [32, 33]. Levels of polyol in the lenses of rats have been reduced by injection of intrinsic ARI containing extracts from

human kidney and bovine lenses [34]. Nonsteroidal anti-inflammatory drugs, such as sulindac [34], aspirin [35-36] or naproxen [37] have been reported to delay cataract in diabetic rats through a weak AR inhibitory activity.

2.7.2 Antioxidant Treatments of Diabetic Cataracts:

As oxidative damage occurs indirectly as a result of polyol accumulation during diabetic cataract formation, the use of antioxidant agents may be beneficial. A number of different antioxidants have been reported to delay cataract formation in diabetic animals. These include the antioxidant alpha lipoic acid, which has been shown to be effective in both delay and progression of cataract in diabetic rats [38]. *Yoshida et al.* demonstrated that the combined treatment of diabetic rats with vitamin E, a lipid-soluble and antioxidant vitamin, and insulin synergistically prevented the development and progression of cataracts in the animals [39].

2.7.3 Cataract Surgery:

Cataract surgery has undergone dramatic change during the past 30 years with the introduction of the operating microscope and microsurgical instruments, the development of intraocular lenses, and alterations in techniques for local anesthesia. Further refinements continue to occur, with automated instrumentation and modifications of intraocular lenses allowing surgery through small incisions. The generally preferred method of cataract surgery in adults and older children preserves the posterior portion of the lens capsule and thus is known as extracapsular cataract extraction. An incision is made at the limbus or in the peripheral cornea, either superiorly or temporally. An opening is formed in the anterior capsule (anterior capsulorhexis), and the nucleus and cortex of the lens are removed. An intraocular lens can then be placed in the empty “capsular bag,” supported by the intact posterior capsule [40].

2.7.4 Phacoemulsification: is now the most common form of extracapsular cataract extraction in developed countries. It utilizes a handheld ultrasonic vibrator to disintegrate the hard nucleus such that the nuclear material and cortex can be aspirated through a small incision of approximately 3 mm. This same incision size is then adequate for insertion of foldable intraocular lenses. If a rigid intraocular lens is used, the wound needs to be extended to approximately 5 mm. In developing countries, particularly rural

areas, the instruments for phacoemulsification are not available [40].

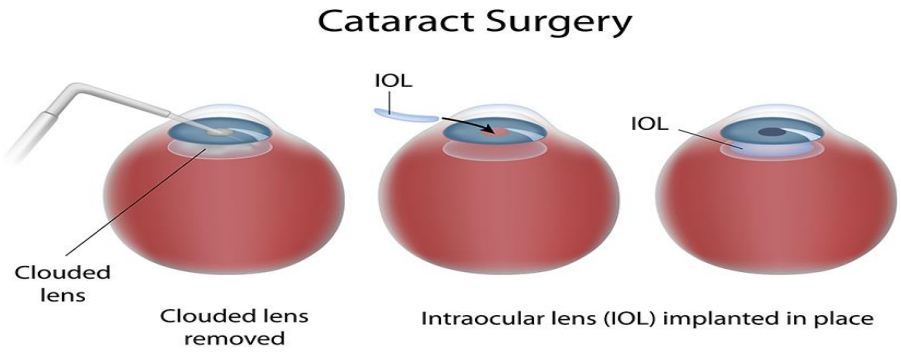

Figure 3: Phacoemulsification + IOL – credits to TheEyeHealthCenter.com

2.7.5 Manual sutureless small incision cataract surgery (MSICS): is based on the traditional nuclear expression form of extracapsular cataract extraction, in which the nucleus is removed intact, but utilizing a small incision. The cortex is removed by manual aspiration. MSICS may be indicated for dense cataracts unsuitable for phacoemulsification. The advantages of small-incision surgery, either phacoemulsification or MSICS, are:

1. More controlled operating conditions, avoidance of suturing.
2. Rapid wound healing with lesser degrees of corneal distortion.
3. Reduced postoperative intraocular inflammation contributing to more rapid visual rehabilitation.

The main intraoperative complication of extracapsular surgery is posterior capsular tear, for which the main predisposing factors include previous trauma, dense cataract, unstable lens, and small pupil, possibly leading to displacement of nuclear material into the vitreous (“dropped nucleus”) that generally necessitates complex vitreoretinal surgery. Postoperatively there may be secondary opacification of the posterior capsule that requires dissection using the neodymium:YAG laser [40].

- **Pars plana lensectomy or phacofragmentation**: is which the lens is removed via the pars plana in conjunction with posterior vitrectomy using automated lens and vitreous cutters, may be performed to facilitate vitreo-retinal surgery, although conventional phacoemulsification surgery is now more commonly undertaken under such circumstances, or to remove a completely dislocated lens or a partially dislocated lens that is not amenable to phacoemulsification. Whether phacofragmentation is required depends upon the severity of cataract.

- **Intracapsular cataract extraction**: consisting of removal of the entire lens together with its capsule, is rarely performed today. The incidence of postoperative retinal detachment and cystoid macular edema is significantly higher than after extracapsular surgery, but intracapsular surgery is still a useful procedure when facilities for extracapsular surgery are not available and occasionally for treatment of a dislocated lens.

2.7.6 Intraocular Lenses:

There are many styles of intraocular lenses, but most designs consist of a central biconvex optic and two legs (or haptics) to maintain the optic in position. The optimal intraocular lens position is within the capsular bag following an extracapsular procedure. This is associated with the lowest incidence of postoperative complications, such as pseudophakic bullous keratopathy, glaucoma, iris damage, hyphema, and lens de-centration. The newest posterior chamber lenses are made of flexible materials such as silicone and acrylic polymers. This flexibility allows the lens implant to be folded, thus decreasing the required incision size. Lens designs that incorporate multifocal optics or partially restore accommodation, have also been produced. The goal of these designs is to provide the patient with good vision for both near and distance without glasses, which current monofocal designs are less likely to do [40].

2.8 Postoperative Care:

The postoperative recovery period (after removing the cataract) is usually short. The patient is usually ambulatory on the day of surgery, but is advised to move cautiously

and avoid straining or heavy lifting for about a month. The eye is usually patched on the day of surgery and use of an eye shield at night is often suggested for several days after surgery.[41]

In all types of surgery, the cataractous lens is removed and replaced with an artificial lens, known as an intraocular lens, which stays in the eye permanently. Intraocular lenses are usually monofocal, correcting for either distance or near vision. Multifocal lenses may be implanted to improve near and distance vision simultaneously, but these lenses may increase the chance of unsatisfactory vision.[42] Temporary glasses can be used a few days after surgery, but in most cases the patient sees well enough through the intraocular lens to wait for permanent glasses (usually provided 4–8 weeks after surgery).

2.9 Complications of Adult Cataract Surgery:

Cataract surgery in adults has a very low rate (2%-5%) of complications that result in permanent impairment of vision. The rarest, but also most serious complications include intraocular infection (endophthalmitis, 0.1%) and intraocular hemorrhage (less than 0.5%), either of which can result in severe visual loss. Suspicion of endophthalmitis requires vitreous tap for microscopy and culture, and intra-vitreal injection of antibiotics. Vitrectomy is sometimes indicated. Other complications include retinal detachment, cystoid macular edema, glaucoma, corneal edema, and ptosis. The most common complication is posterior capsule Opacification but this is amenable to treatment.[40]

2.10 Posterior Capsule Opacification:

In the past, up to 50% of eyes developed opacification of the posterior capsule (“after-cataract”) after uncomplicated adult extracapsular cataract extraction. Improved surgical techniques and new intraocular lens designs, particularly sharp posterior edges on the optics, have significantly reduced the incidence. About 10% of eyes require treatment for posterior

capsule opacification following uncomplicated phacoemulsification surgery but the recorded incidence depends upon duration of follow-up.[40]

2.11 Complications in Diabetic Patients:

According to the majority of publications, diabetic retinopathy and maculopathy are the most eventful complications. The main postoperative concern about the retina of a patient with diabetes is the development or worsening of diabetic macular edema, which can lead to poor vision. In patients without macular edema preoperatively, the risk of postoperative visual compromise from the development of macular edema is greatest in people with preexisting diabetic retinopathy, and there should be special consideration given to using nonsteroidal antiinflammatory drugs (NSAIDs) eye drops in this group at the time of cataract surgery. In fact, regardless of the presence of retinopathy, patients with diabetes who do not have diabetic macular edema have a lower relative risk of developing said condition with the prophylactic use of NSAIDs in the perioperative period. This treatment, however, is not yet devoid of concerns.

2.12 Previous Related Studies:

- A retrospective study compared the incidence of macular edema after uneventful phacoemulsification between 240 patients treated for 4 weeks with topical prednisolone and 210 patients treated with a combination of prednisolone and nepafenac for the same time. The authors concluded that patients treated with topical prednisolone alone had a statistically significantly higher incidence of macular edema than those treated with additional nepafenac [42].

- Another Study was conducted in Correspondence to Dr. Emily Y Chew, National Institutes of Health, Bethesda, M.D, USA; aimed to evaluate visual acuity outcomes of cataract surgery, and factors associated with good visual outcomes, among a population with diabetes. And the result was in the sample of 1136 eyes, 762 eyes (67.1%) achieved good visual outcome of 20/40 or better. Factors predictive of good visual outcome were higher level of

educational attainment (college vs. some high school, OR 2.35 (95% CI 1.44 to 3.82)), bilateral cataract surgery (OR 1.55 (1.14 to 2.10)) and preoperative VA (20/20 or better vs. worse than 20/200, OR 10.59 (4.07 to 27.54)). Factors not significantly associated ($p>0.05$) included age, sex, race, smoking, diabetes duration, blood pressure, lipid levels and hemoglobin A1C (HbA1C). In the subsample of 362 eyes, absence of diabetic retinopathy was associated with good visual outcome.[43]

- A review article published in Clinical Compendia by Jill E. Bixler, MD in May 1st, 2019, titled Cataract and Their Treatment in Diabetic Patients concluded that the goal is to prevent the development of the early-onset cataracts that are associated with diabetes. The development of cataracts in younger people with diabetes is linked to hyperglycemia, so achieving tight glycemic control can help to slow the progression of cataracts.[44]

- A retrospective case control study conducted at the University College Hospital, Ibadan Nigeria. The aim of this particular study was to determine the visual outcome of cataract surgery in diabetes mellitus. It included twenty three consecutive patients with diabetes and 23 age and sex matched non-diabetic control patients who had extracapsular cataract extraction for advanced cataract between 2002-2005. The results showed improvement in preoperative visual acuity was noted in 70% and 90% in diabetics and non-diabetics respectively. Poor visual outcome in diabetics was mainly due to diabetic retinopathy, maculopathy or diabetes related surgical complications.[45]

- A comparative study conducted in India in 2020 by SowmyaCA and Vallabha of Shri B. M. Patil Medical College. The aim of the study was to compare the visual outcome following cataract surgery in diabetics and non-diabetics. Out of 116 patients, 58 were diabetic and 58 were non diabetics. Small incision cataract surgery with posterior chamber intraocular lens implantation was done in all patients. Follow up duration was 4 weeks. The study concluded

that Small Incision Cataract Surgery in diabetics without diabetic retinopathy yields similar visual outcomes as non-diabetics.[47]

Chapter 3

MATRIALS AND METHODS

CHAPTER 3: MATERIALS AND METHODS

3.1 Study Design:

The presented Retrospective Comparative Study was carried out through reviewing secondary data stored in the archives of private centers.

3.2 Study Area:

This presented study was carried out in three different private Ophthalmology centers in the Capital, Sana'a:

1. *Al-Barraq Hospital*
2. *Yemen Consultants for Ophthalmology*
3. *Eyes and Nose Hospital*

3.3 Study population:

Two groups representing the medical records of cataract patients with concurrent history of diabetes mellitus, and patients with cataract only.

3.4 Sample size and Data Collection:

3.4.1 Sample size:

The factor of calculating the sample size was (The visual outcome among the controls and cases). The result of previous study was conducted in University College Hospital, Ibadan Nigeria showed that the proportion of those who got good visual outcome after the surgical treatment among the controls and cases were (90% and 70% respectively).

By using Epi info version 7, unmatched case control sample size design with the following indicators:

- Two sided confidence level 95%,
- Power 80%,
- Ratio of controls (Group 2) to cases (Group 1) 2,
- Present of controls expected 90%,
- Odds ratio 0.25,
- Present of cases expected 70%

The sample size needed was 51 cases and 102 controls

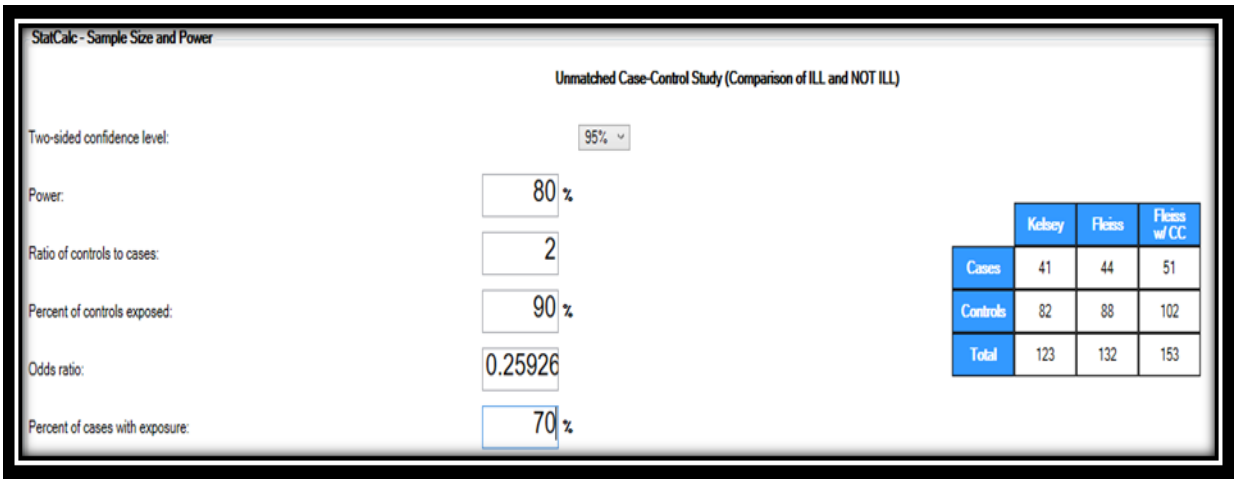

Figure 4: Sample Size and Power Calculation; Epi Info ver 7.0; www.cdc.gov/epiinfo/index.html

3.5 Inclusion and Exclusion Criteria:

- **Group 1 Criteria:**
  i. Patients age' between 35 - 55 years old.
  ii. Documented history of Cataract.
  iii. Documented history of diabetes mellitus confirmed by positive high readings in a fasting blood sugar test.
  iv. Underwent cataract surgery between January 1st, 2020 and January 31st, 2023.
- **Group 2 Criteria:**
  v. Patients of similar age and sex to Group 1 (between 35 - 55 years old).
  vi. Documented history of cataract.
  vii. Underwent cataract surgery in the same time interval as Group 1 (between January 1st, 2020 and January 31st, 2023).

3.6 Sampling Technique:

The study used non-probability sampling based on convenience and availability of sample criteria.

3.7 Data collection Method:

The data was collected using printed-out questionnaire for recording information obtained from patients' documents in the centers' archive. All the study procedures were done at convenient access, green-lit and aided by the centers' employees. The procedures were regularly evaluated by the team's supervisor for quality assurance.

3.8 Data Collection:

US notation	6 meter notation	Decimal notation	MAR	logMAR	VAS
20/10	6/3	2.0	0.5	-0.3	115
20/12.5	6/3.8	1.6	0.63	-0.2	110
20/16	6/4.8	1.25	0.8	-0.1	105
20/20	6/6	1.0	1.0	0.0	100
20/25	6/7.5	0.8	1.25	0.1	95
20/32	6/9.5	0.63	1.6	0.2	90
20/40	6/12	0.50	2.0	0.3	85
20/50	6/15	0.40	2.5	0.4	80
20/63	6/18	0.32	3.2	0.5	75
20/80	6/24	0.25	4.0	0.6	70
20/100	6/30	0.20	5.0	0.7	65
20/125	6/38	0.16	6.3	0.8	60
20/160	6/48	0.125	8.0	0.9	55
20/200	6/60	0.10	10.0	1.0	50
20/250	6/75	0.08	12.5	1.1	45
20/320	6/95	0.06	16	1.2	40
20/400	6/120	0.05	20	1.3	35
20/500	6/150	0.04	25	1.4	30

Figure 5: Visual Acuity Measurement Conversion Table

Sample size of *Group 1* (Cases) is 51 individuals, while sample size of *Group 2* (Controls) is 102 individuals. Group 1 consisted of consecutive diabetic patients who underwent cataract surgical procedure between January, 1st, 2020 and January 31st, 2023. All surgeries were performed by consultant ophthalmologists. *Group 2* were age and sex matched non-diabetic patients who had cataract extraction during the same period by consultant ophthalmologists. The diagnosis of diabetes was based on positively high fasting blood sugar. Patients with traumatic, uveitic or senile cataracts were excluded. All patients routinely had preoperative fasting blood glucose analysis within one week of the surgery. Glycemic control level in Group 1 patients was regarded as good (<90mg/dl), moderate (90 -120mg/dl) or poor (>120mg/dl). Small Incision Cataract Surgery (SICS) or Phacoemulsification (PHACO) plus intraocular lens implantation (IOL) under peribulbar anesthesia was the procedure of choice.

For diabetic patients, method of treatment, systemic and ocular co-morbidities were recorded; with the last being emphasized for both groups. Preoperative best visual acuity, intra-operative and post-operative complications as well as post-operative visual acuity up to 1 month post cataract extraction was noted for all patients. The Snellen acuity was recorded and the values were converted to log MAR units for statistical analysis.

Data was digitized and analyzed using IBM SPSS version 26. Statistical significance was inferred at $p<0.05$ and p values were determined using T-tests, Chi-square, or ANOVA as appropriate.

3.9 Ethical Consideration:

Consents was taken from all private centers' management and staff, and they will be informed that participation is voluntary and that they can refuse this without stating any reason. **A feedback about the results of the study was given to the participants and contributors at the end of the study.**

3.10 Limitations:

Non-availability of valid medical records in public hospitals in order to obtain a much more holistic view of the target population.

Chapter 4

RESULTS

CHAPTER 4: RESULTS

Hundred and Fifty-Three patients, 51 diabetic and 102 age and sex matched non-diabetic constituted the study sample. The age and sex distribution patients were similar with a mean age of 49.90±5.345 years and 48.29±6.177 years in diabetics and non-diabetics respectively (Table 1). In this study, in diabetic group, 25 (16.3%) were males and 26 (17%) were females. Among non-diabetic 51 (33.3%) were males and 51 (33.3%) were females (Figure 6).

Table 1: Mean Age

		Frequency	Mean	Std. Deviation	Std. Error Mean
Age	Group 1	51	49.90	5.345	.748
	Group 2	102	48.29	6.177	.612

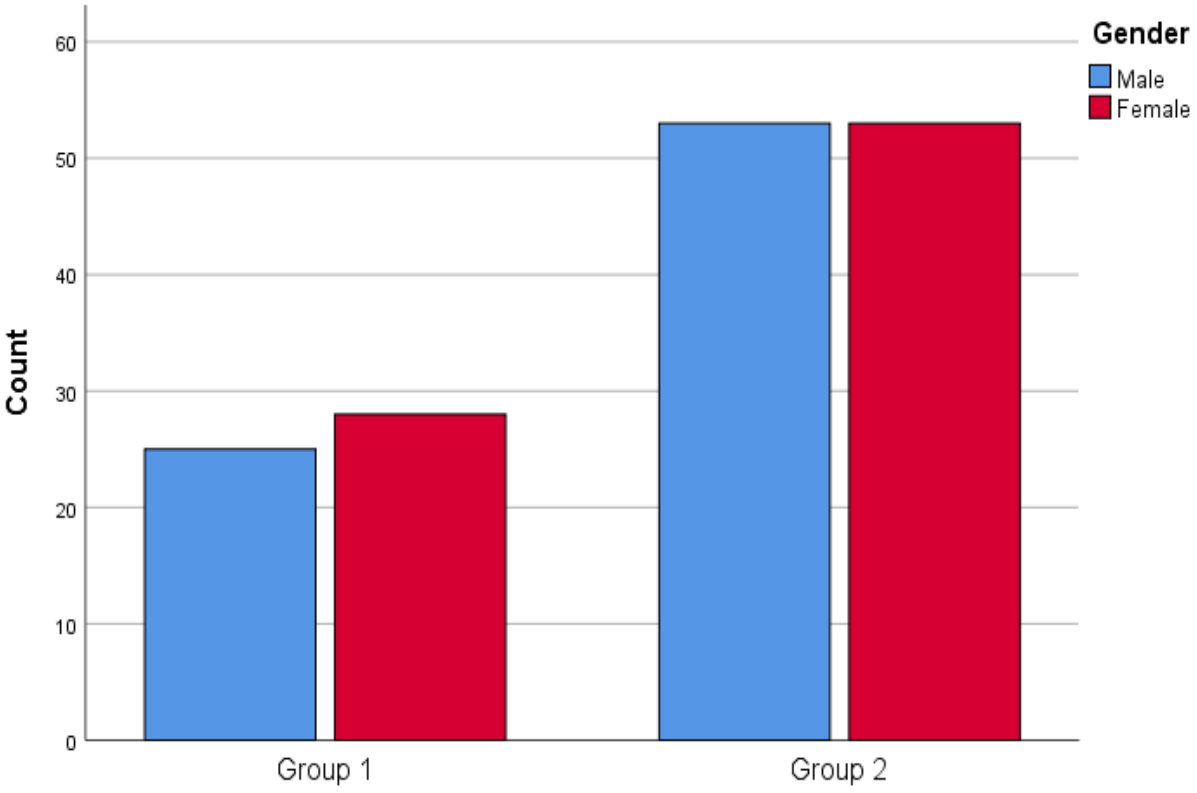

Figure 6: Distribution of Sample by Gender

4.1 Glycemic Control:

Out of 51 patients in the diabetic group, 27 (52.9%) had good glycemic control (FBS: <90mg/dl). Moreover, 11 patients (21.6%) had moderate glycemic control (FBS: 90-120mg/dl), while the remaining 13 (25.5%) patients had high blood sugar levels (>120mg/dl). Their blood sugar levels controlled eventually around before they were operated (Table 2). Oral hypoglycemic agent and Diet were the method of treatment in 37 (72.5%) patients, while insulin in 14 (27.5%) (Figure 7).

Table 2: Diabetes Control Total in Group 1

		Frequency	Percent from Overall Sample	Valid Percent in Group 1
Valid	Good	27	18.2	52.9
	Moderate	11	6.9	21.6
	Poor	13	8.2	25.5
	Total	51	33.3	100.0

Table 3: Frequency of Diabetes Control

DM Control State	Good	Frequency	27
		% of Total	52.9%
	Moderate	Frequency	11
		% of Total	21.6%
	Poor	Frequency	13
		% of Total	25.5%
Total		Frequency	51
		% of Total	100.0%

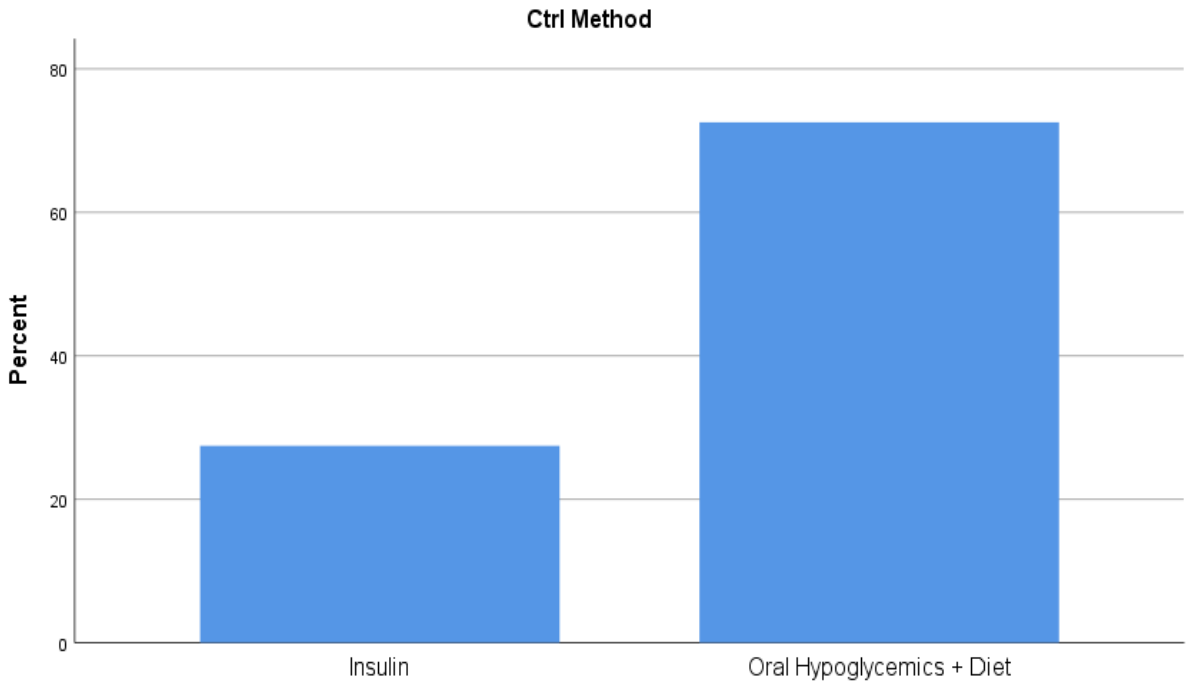

Figure 7: Percentage of Diabetes Control Method

4.2 Pre-Operative Assessment:

The mean best pre-operative visual acuity in both groups was calculated in Snellen and was converted to logMAR units for statistical analysis. The mean preoperative best visual acuity in the diabetic group was 0.08±1.40 for right eye and 0.19±0.73 for left eye. And in non-diabetic group was 0.79±3.8 and 0.44±2.99 for right and left eye respectively. When comparing the mean visual acuity of both group, the *p* value was (0.001) for right eye, and (0.003) for left eye (Table 4). Among Group 1, 22 eye (64%) were reported blind, 5 eyes (7.6%) were receptive to hand movement, and 5 eyes (9.4%) were receptive to light only.

CHAPTER 4: RESULTS

Table 4: *Pre-Operative BCVA* ***Independent T-test***

				t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pre_OP VA Right	Equal variances assumed	11.149	.001	1.560	151	.121	.875	.561	-.233	1.984
	Equal variances not assumed			2.030	141.323	.044	.875	.431	.023	1.728
Pre-Op VA Left	Equal variances assumed	9.147	.003	1.475	151	.142	.629	.426	-.214	1.472
	Equal variances not assumed			2.003	123.153	.047	.629	.314	.007	1.251

Table 5: Pre-Operative BCVA

		Frequency	Mean	Std. Deviation	*P* Value
Pre_OP VA Right	Case	51	.08	1.405	0.001
	Control	102	-.79	3.877	
Pre-Op VA Left	Case	51	.19	.735	0.003
	Control	102	-.44	2.996	

CHAPTER 4: RESULTS

The co-morbid diseases were present in both groups with 67% of patients in Group 2 were free from any additional disease, whereas only 2% of Group 1 did not have co-morbidities. Hypertension was the most frequent systemic co-morbid disorder in both groups (11.8%) (Table 5).

Table 6: Co-morbidities

Co-morbidity(s)		Sample Group 1	Sample Group 2	Total
Allergic Diseases	Frequency and % within Sample	1 (2.0%)	1 (1.0%)	1 (1.4%)
Bronchial Asthma	Frequency and % within Sample	1 (2.0%)	2 (2.0%)	3 (2.0%)
Diplopia	Frequency and % within Sample	1 (2.0%)	0 (0.0%)	1 (0.7%)
Heart Failure	Frequency and % within Sample	1 (2.0%)	1 (1.0%)	2 (1.3%)
Other Medical Disease	Frequency and % within Sample	2 (3.0%)	6 (4.0%)	7 (5.6%)
HTN	Frequency and % within Sample	6 (11.8%)	12 (11.8%)	18 (11.8%)
HTN & another disease	Frequency and % within Sample	4 (6.0%)	3 (3.0%)	5 (5.5%)
Hypothyroidism	Frequency and % within Sample	1 (2.0%)	1 (1.0%)	2 (1.3%)
Ischemic Heart Disease	Frequency and % within Sample	2 (3.9%)	1 (1.0%)	3 (2.0%)
Red Eye	Frequency and % within Sample	0 (0.0%)	2 (2.0%)	2 (1.3%)
Retinopathy	Frequency and % within Sample	2 (3.9%)	0 (0.0%)	2 (1.3%)
Rheumatoid Arthritis	Frequency and % within Sample	0 (0.0%)	4 (3.9%)	4 (2.6%)
None	Frequency and % within Sample	1 (2.0%)	65 (67%)	70 (45.8%)
Total	Frequency and % within Sample	51 (100.0%)	102 (100.0%)	153 (100.0%)

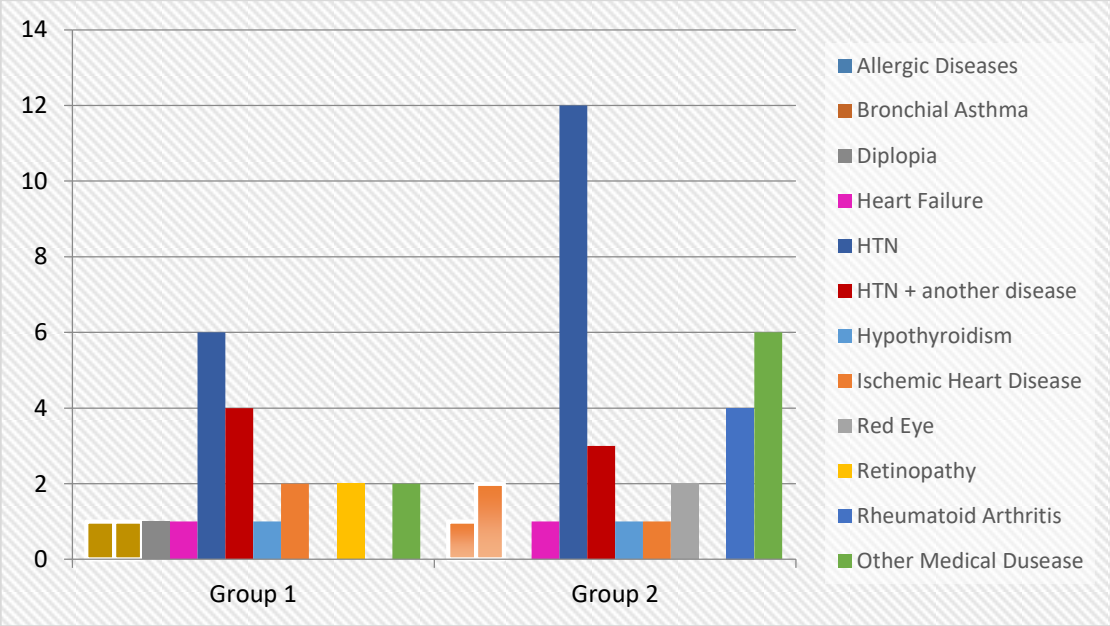

Figure 8: Co-morbidities Frequencies

4.3 Surgical Procedure:

PHACO+IOL was the procedure of choice for 37 individuals (96.1%) of Group 1, while the remaining 14 (3.9%) had gone with SICS. Meanwhile, in Group 2, 87 individuals (86%) chosen to undergo PHACO+IOL, with 12 (14%) patients had SICS. Forty-seven patients among both group (47%) from whom undergone PHACO+IOL were reported recovered, with 25 (16.3%) partially recovered, and 28 (17.6%) only being reported as not recovered after the surgery. From those whom SICS were the procedure undertaken, 14 (8.8%) recovered, one patient (0.6%) partially recovered, and 11 (7.2%) did not recover.

Table 7: Post-surgical Results for Each Procedure Separately

Comment			Study Groups Group 1	Group 2	Total
Recovered	Op-Title	Phaco+IOL	19	55	74
		SICS	6	8	14
	Total		25	63	88
Not Recovered	Op-Title	Phaco+IOL	6	22	28
		SICS	7	4	11
	Total		13	26	39
Partially Recovered	Op-Title	Phaco+IOL	12	13	25
		SICS	1	0	1
	Total		13	13	26
Total	Op-Title	Phaco+IOL	37	90	127
		SICS	14	12	26
	Total		51	102	153

4.4 Outcome:

There were a higher percentages of recovered patients' reports among Group 2 with 63 (61.7%) being fully regained near-normal sight, while 26 (25.4%) had not recovered, and only 13 (12.6%) were partially recovered (Table 8). The following table shows that, around half of Group 1 (49.1%) recovered totally after the treatment and 25.49% were partially recovered, while only 25.49% did not recover after treatment. There was some difference in the result of the treatment between the two groups, but this difference was small and not statistically significant (*p* value =0.12).

Table 8: Post-surgical Outcome using Chi-Square

Result of the treatment	Study group		P value
	Group 1	Group 2	
Recovered	25 (49.1%)	63 (61.7%)	0.12
Partially Recovered	13 (25.49%)	13 (12.6%)	
Not Recovered	13 (25.49%)	26 (25.4%)	
Total	51 (100%)	102 (100%)	

Table 9: Chi-Square Tests for Recovery

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.210[a]	2	.120
Likelihood Ratio	4.049	2	.132
Linear-by-Linear Association	3.778	1	.052
N of Valid Cases	153		

Table 10: Re-Treatment Frequency

		Frequency	Percentage
Re-treatment	Yes	32	47.1
	No	36	52.9
	Total	68	100.0

Along those who were partially recovered or did not recover at all, only 47% were admitted for a re-treatment (Table 8).

The most common complications recorded after operation in Group 1 were either Retinopathy or Anterior Segment implications, such as Conjunctivitis, Keratitis, or Dry Eye.

Ocular Hypertension, which was among 4% of patients in Group 1, was the second most noted complication.

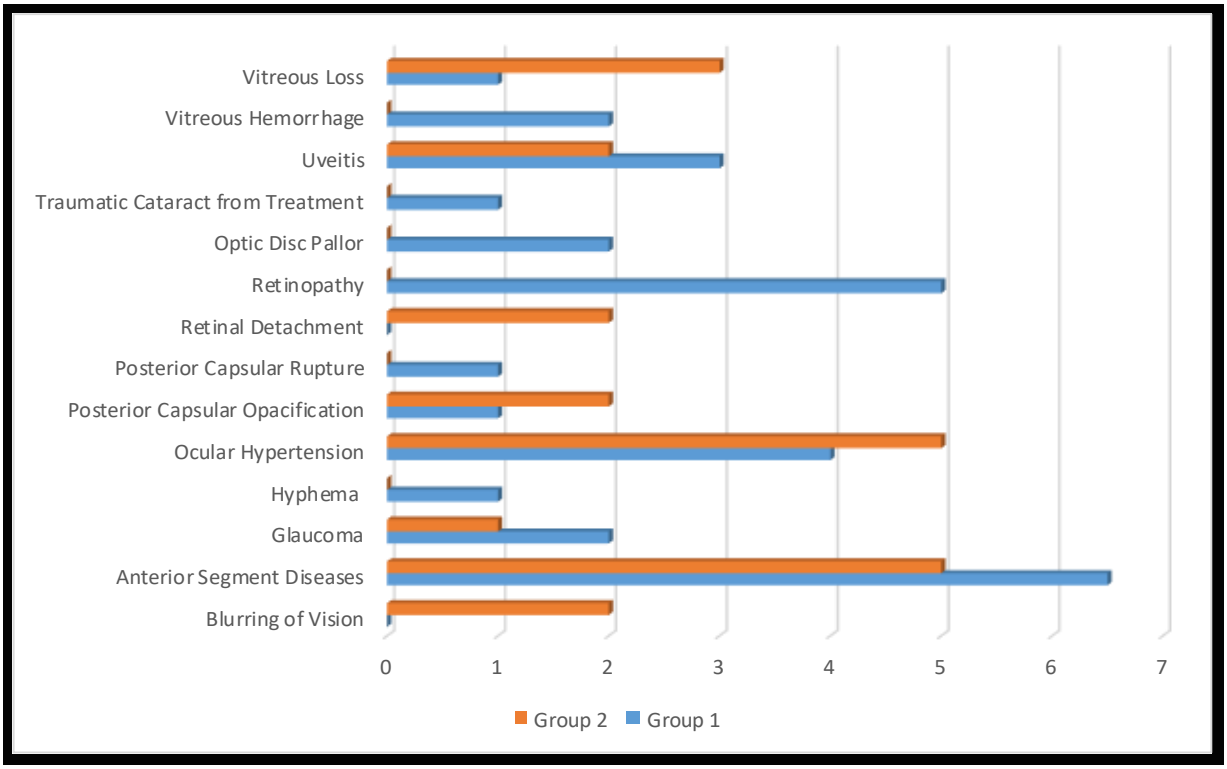

Figure 9: Post-operative Complications Frequencies

Table 11: Post-Operative Complications

			Sample		
			Group 1	Group 2	Total
Post-Op Comp.	Blurring of Vision	Frequency	0 (0.0%)	2 (1.3%)	2 (1.3%)
	Anterior Segment Diseases	Frequency	6 (6.5%)	9 (5%)	15 (10.5%)
	Glaucoma	Frequency	2 (0.7%)	1 (0.7%)	3 (2%)
	Hyphema	Frequency	1 (0.7%)	0 (0.0%)	1 (0.7%)
	Ocular Hypertension	Frequency	4 (4%)	5 (2.0%)	9 (6%)
	Posterior Capsular Opacification	Frequency	1 (0.7%)	2 (0.7%)	3 (2%)
	Posterior Capsular Rupture	Frequency	1 (0.7%)	0 (0.0%)	1 (0.7%)
	Retinal Detachment	Frequency	0 (0.0%)	2 (0.7%)	2 (1.4%)
	Retinopathy	Frequency	5 (4.6%)	0 (0.0%)	5 (3.5%)
	Optic Disc Pallor	Frequency	2 (0.7%)	0 (0.0%)	2 (1.4%)
	Traumatic Cataract from Treatment	Frequency	1 (0.7%)	0 (0.0%)	1 (0.7%)
	Uveitis	Frequency	3 (1.3%)	2 (1.3%)	5 (3.5%)
	Vitreous Hemorrhage	Frequency	2 (0.7%)	0 (0.0%)	2 (1.4%)
	Vitreous Loss	Frequency	1 (0.0%)	3 (2.0%)	4 (2.7%)
Total			51 (33.3%)	102 (66.7%)	153 (100.0%)

4.5 Post-operative Evaluation:

The mean post-operative best corrected visual acuity in log-MAR units in the diabetic group was 0.10±1.81 and 0.13±1.86 for right and left eye respectively; in the non-diabetic group was -0.05±2.48 and 0.07±2.2 for right and left eye respectively (*p= 0.176)*. On comparing the post-operative values in both groups the *p* values for each eye separately was (-0.033) and (-0.16) which was statistically significant (Table 10). On comparing the pre-operative and post-operative visual acuity in both groups, the *p* value results (0.99) and (0.21) were not statistically significant.

Table 12: Post-operative BCVA

	Name	Frequency	Mean	Std. Deviation	p Value
Post-Op VA Right	Case	51	.10	1.819	-.033
	Control	102	-.05	2.488	
Post-Op VA Left	Case	51	.13	1.861	-.16
	Control	102	.07	2.224	

Table 13: Comparing Pre- and Post-Operative BCVA

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval Lower	95% Confidence Interval Upper	t	df	Sig. (2-tailed)
Pair 1	Pre_OP VA Right - Post-Op VA Right	-.501	3.737	.302	-1.098	.096	-1.658	152	.099
Pair 2	Pre-Op VA Left - Post-Op VA Left	-.315	3.123	.252	-.814	.184	-1.247	152	.214

CHAPTER 4: RESULTS

The mean post-operative best corrected visual acuity after one month of follow up in the diabetic group was 0.39±0.96 and -0.23±0.56 for right and left eyes respectively; p value was (0.88). In addition, in the non-diabetic group, it was 0.44±1.13 for right eye, and 0.38±2.16 for left eye; p value was (0.22). On comparing these readings to the aforementioned post-operative outcomes, the results were statistically significant (p=0.0006) and (p=0.0012).

Table 14: Comparing Pre- and Post-Operative BCVA with readings recorded after 1 month of follow-up

	Category				
	Group 1		**Group 2**		
	Mean	Standard Deviation	Mean	Standard Deviation	*p* Value
Pre-Op VA Right Eye	.082031	1.404668	-.793354	3.876591	.001
Pre-Op VA Left Eye	.193116	.734725	-.435890	2.996460	.003
Post-Op VA Right Eye	.103771	1.818963	-.053070	2.488450	-.033
Post-Op VA Left Eye	.134947	1.861039	.065349	2.223798	-.16
Follow-Up-Right Eye	.392882	.960266	.441235	1.129704	.0006
Follow-Up-Left Eye	-.228294	2.559920	.378725	2.166868	.0012

Table 15: Comparing Pre-Operative BCVA and readings recorded after 1 month of follow-up for Right Eye

Sample		Pre-OP VA Right Eye	Follow-Up-Right Eye	P Value
Group 1	Mean	.08	.39	
	N	51	51	0.008
	Std. Deviation	1.405	.960	

Table 16: Comparing Pre-Operative BCVA and readings recorded after 1 month of follow-up for Left Eye

Sample		Pre-Op VA Left Eye	Follow-Up-Left Eye	P value
Group 1	Mean	.19	-.23	
	N	51	51	0.99
	Std. Deviation	.735	2.560	

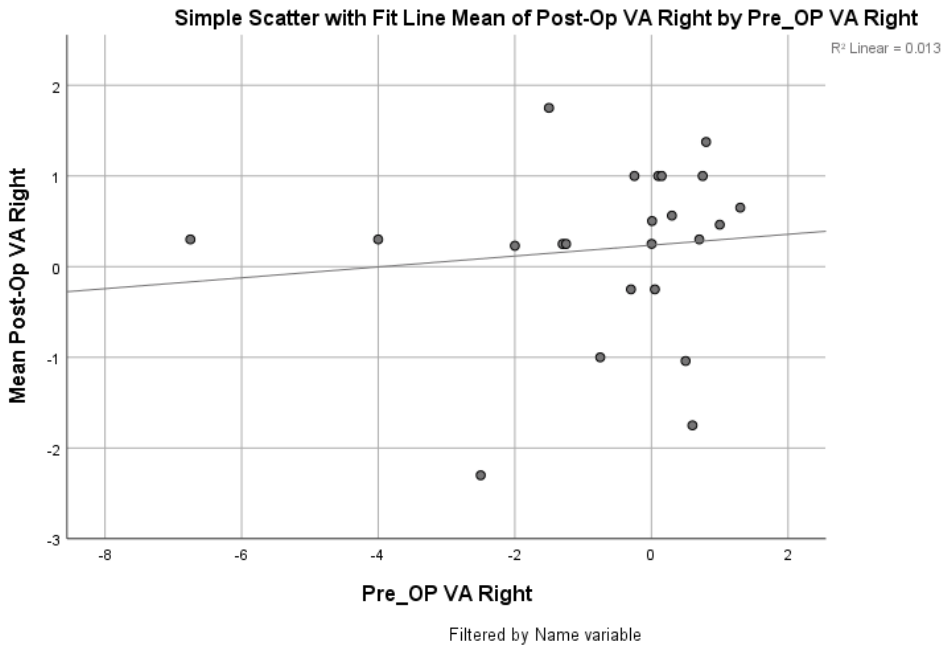

Figure 10: Comparing Means of Pre and Postoperative Visual Acuity in the Right Eye of Group 1.

CHAPTER 4: RESULTS

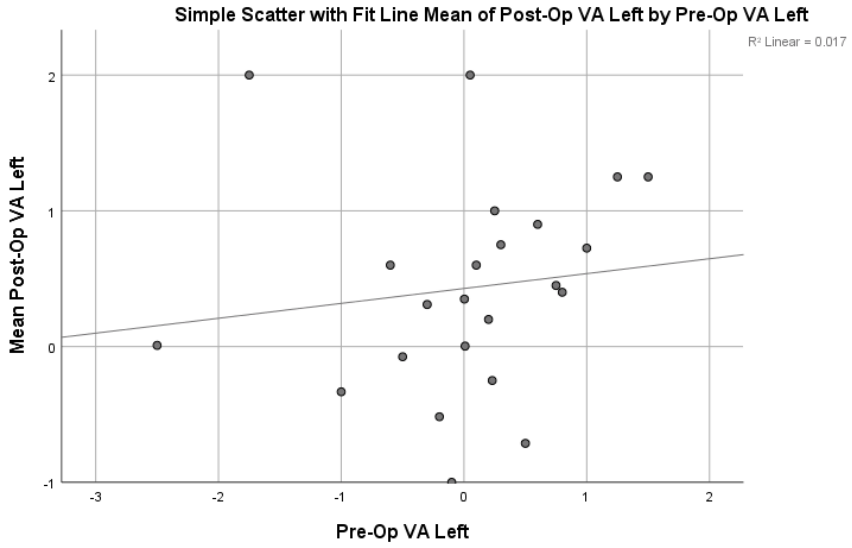

Figure 11: Comparing Means of Pre and Postoperative Visual Acuity in the Left Eye of Group 1.

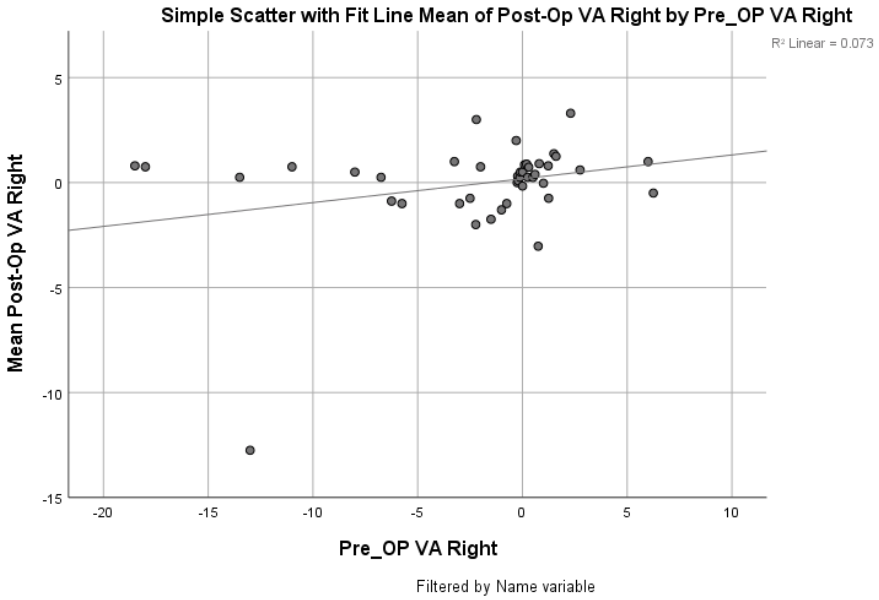

Figure 12: Comparing Means of Pre and Postoperative Visual Acuity in the Right Eye of Group 2.

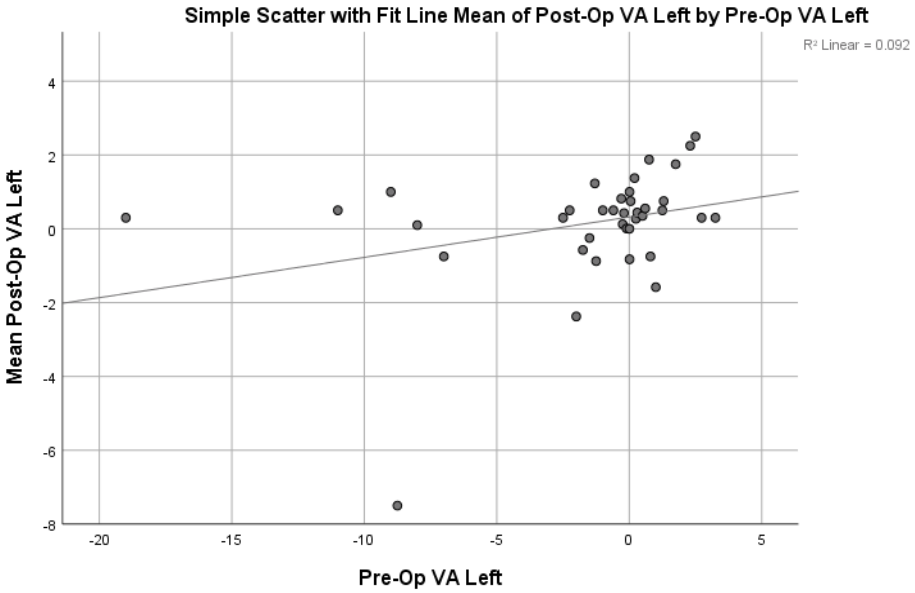

Figure 13: Comparing Means of Pre and Postoperative Visual Acuity in the Left Eye of Group 2.

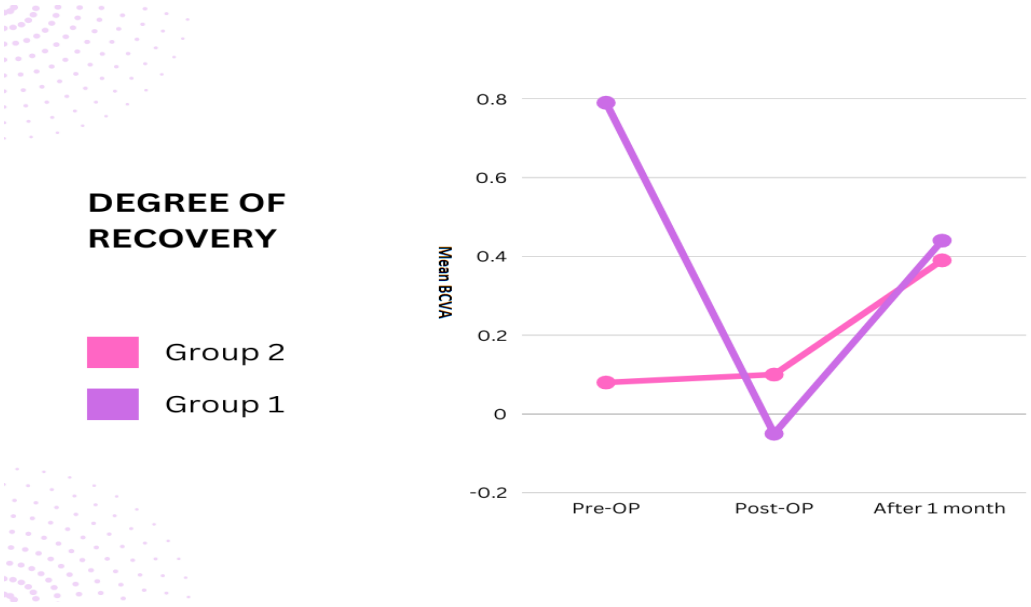

Figure 14: Changes in Visual Acuity Readings throughout Treatment and Follow up.

Chapter 5

Discussion

CHAPTER 5: DISCUSSION

In this study, 153 Patient were divided into 51 Cases (Group 1) and 102 age and sex matched Controls (Group 2). The mean age group of the patients in diabetic group was 49.90±5.345 years, and in non-diabetics was 48.29±6.177 years. Framingham and other eye studies indicate a 3-4 fold increased prevalence of cataract in patients with diabetes under 65 years and up-to a two-fold excess prevalence in patients above 65 years. In this study, in diabetic group, 25 (16.3%) were males and 26 (17%) were females. Among non-diabetic 51 (33.3%) were males and 51 (33.3%) were females. Various studies have proven the prevalence of cataract itself is more common in females than males. In the Framingham eye study also, senile lens changes were more common in women.

Glycemic control was assessed using fasting blood sugar levels at the time of admission. Due to lack of much more concise method such as HbA1c, we raised the range for assessment of good blood sugar control to less than 90mg/dl instead of 70mg/dl. 51 patients in the diabetic group, 27 (52.9%) had good glycemic control (FBS: <90mg/dl). Moreover, 11 patients (21.6%) had moderate glycemic control (FBS: 90-120mg/dl), while the remaining 13 (25.5%) patients had high blood sugar levels (>120mg/dl).). Oral hypoglycemic agent and Diet were the method of treatment in 37 (72.5%) patients, while insulin in 14 (27.5%).

Hypertension was the most frequent co-morbid disease in both the groups, its more frequent amongst diabetics as seen in this study, that is 6 (3.9%) coupled with diabetes, 1 (0.7%) coupled with diabetes and CVA, and 2 (1.4%) coupled with diabetes and rheumatoid arthritis, and 1 (0.7%) coupled with diabetes along with both heart and real diseases; with an overall percentage (11.8%). On the other hand, the control group only counts for 12 patents with hypertension (7.8%). On the contrary, a higher incidence was seen in a study by Onakpoya H Oluwatoyin et al [46], in which hypertension was seen in 60.9% compared with 26.1% in non-diabetic group. That result indicates mostly the lack of patient's awareness of having blood pressure irregularities, and they usually get the diagnosis for the first time once they are admitted for surgery.

CHAPTER 5: DISCUSSION

In Group 1, retinopathy and ischemic heart disease come as the second most common co-morbidities in this study with a score of 1.3% for each. In Group 2, rheumatoid arthritis and red eye come in second place, scoring 2.6% and 1.3% respectively.

In this study, majority of the patients had poor preoperative visual acuity. The mean best corrected preoperative visual acuity in both the groups was calculated Snellen's chart and was converted to logMAR units. The mean preoperative best visual acuity in the diabetic group (Group 1) was 0.08±1.40 for right eye and 0.19±0.73 for left eye. And in non-diabetic group (Group 2) was 0.79±3.8 and 0.44±2.99 for right and left eye respectively. When comparing the mean visual acuity of both group, the *p* value was (0.001) for right eye, and (0.003) for left eye. This was much less than the results of a previous study by Sowmya CA and Vallabha K from the Dept. of Ophthalmology, B.L.D.E, India in 2020[47], where the mean preoperative best corrected visual acuity in the diabetic group was 1.60±0.81 and that in non-diabetic group was 1.62±0.87. These low readings in this study reflect the lack of early assessment of vision in diabetic patients. Frankly, most of said patients present to clinics at very late stages of disease. As a matter of fact, in this study, Group 1 constituted 22 eye (64%) which were reported blind, 5 eyes (7.6%) were receptive to hand movement, and 5 eyes (9.4%) were receptive to light only.

All patients underwent cataract extraction, by either SICS or PHACO with IOL. All procedures had taken place within the study time frame (between January 1st 2020 and January 31st 2023), and performed by consultant ophthalmologist. 37 patient (96.1%) in Group 1 chose PHACO, while the remaining 14 (3.9%) had gone with SICS. Meanwhile, in Group 2, 87 (86%) chosen to undergo PHACO, with 12 (14%) patients had SICS. All of the operations had proceeded successfully with variation in the outcome. On examining the patients on the following 3 days, the degree of recovery of normal eyesight was recorded based on clinical tests and patients' subjective reports. In diabetics (Group 1), 25 person (49.1%) were reported to achieve full recovery with 13 (25.49%) only reaching partial recovery and 13 (25.49%) did not reach any recovery at all. On the contrary, Group 2 had achieved slightly better results with 63 (61.7%) being fully regained near-normal sight, while 26 (25.4%) had not recovered, and only 13 (12.6%) were partially recovered. On comparing the initial outcome in both groups, the result

was not statistically significant (p = 0.12); which indicate the narrow difference in outcome between diabetics and non-diabetics.

The surgical procedure chosen had also an effect on the postoperative visual outcome. Among the 37 person of Group 1 whom PHACO was performed, 19 of them recovered their vision the way it was prior to the disease, while 12 patients reported to be partially recovered, and only 6 patients did not recover. Those who underwent SICS in Group 1 achieved less favorable results with 6 patients reported to be recovered, 7 individuals did not recover, and one person only partially recovered. That denotes the efficacy of Phacoemulsification procedures in achieving much favorable results in diabetic patients quicker when compared to alternative methods.

For a much more objective evaluation of the surgical outcome in this study sample, we recorded the best visual acuity in both groups, which was taken between the second and the 7th day postoperatively. The final visual outcome was recorded using Snellen's visual acuity chart and the values were converted to logMAR units for statistical analysis. The mean post-operative best corrected visual acuity in log MAR units in the diabetic group was 0.10±1.81 and 0.13±1.86 for right and left eye respectively, and in the non-diabetic group was -0.05±2.48 and 0.07±2.2 for right and left eye respectively. On comparing the post-operative values of both groups the p values for each eye separately was (-0.033) and (-0.16) which was statistically significant; denoting the slight difference in outcome after the operation. Non-diabetic patient had achieved higher rates of satisfactory results regarding quality of vision when compared to their diabetic counterparts. With the average Sellen's score in Group 1 was 6/7.5, and in Group 2 was 6/6. On comparing the pre-operative and post-operative visual acuity in both groups, the p value results were (0.99) and (0.21), which were not statistically significant. This indicate the similarities in post-surgical outcome in both groups, which reflects the great degree of benefit diabetic patients may gain would they choose to undergo surgical cataract extraction.

This result opposes the common opinion of most Ophthalmologists who discourage diabetic patients from going for the surgical route, as it has no benefit for their well-being. This finding, however, supports previous reports that diabetic patients, those with risks of developing maculopathy and retinopathy, may have valuable visual improvement after cataract surgery[45].

CHAPTER 5: DISCUSSION

Group 1 patient were the ones who suffered the most complications after operation. On the contrary to the mainstream research results where macular edema or retinopathy were the most common post-operative complications, this study elucidated that anterior segment's illnesses have the highest percentage amongst both groups. Diseases such as Keratitis, Conjunctivitis, Corneal Haziness, and post-operative Dry Eye were amongst the most noted complications in Group 1 coupled with retinopathy. The same collections of implications were as well recorded in Group 2; albeit, slightly less frequent. In Group 1, ocular hypertension scored 4%, with 0.7% coupled with Red Eye. This was also followed by uveitis, which scored 1.3%. Similar observations were made in following studies "*Onakpoya H Oluwatoyin et al., N.D George et al. and Mechini et al. reported intraocular inflammation and its sequelae as the most common complication of their study*"[47]. Ivancic et al[50]. reported inflammatory reaction fibrinous uveitis & PCO as two of the most common complications of cataract surgery among diabetics.

Similar to previous studies[48], those patients whom re-treatment was assigned for did not show any difference in the rate of postoperative complications following their second round of intervention. Fibrinous exudates & posterior synaechiae was not found in this study compared to previous study. None of the patients in this study had anterior segment neovascularization, as reported in previous studies [51].

Improvements in the visual outcome was noted after a month of follow up. Patients in Group 1 were observed to have achieved better readings on visual acuity tests. Among diabetics, the mean best corrected visual acuity was 0.39±0.96 for right eye and -0.23±0.56 for left eye, while in the non-diabetic group, it was 0.44±1.13 for right eye, and 0.38±2.16 for left eye. Moreover, on comparing the latest results to the ones recorded on a much earlier post-operative period, the correlation was significant for each group (Right Eye p=0.0006 and Left Eye p=0.0012). This findings also support Sowmya and Vallabha' study[47], where in a sample size of 116 (58 eye in diabetic group and 58 non-diabetic), majority of the patients 36 (62.1%) in the diabetic group and 40 (69%) in the non-diabetic group had visual acuity of 6/12 or better at the end of 4 weeks of follow up. The mean post-operative best corrected visual acuity in log MAR units in the diabetic group was 0.39±0.32 and in the non-diabetic group was 0.32±0.27. This was

also similarly done by Raj Kumar Gupta et al[48] consisting of 50 diabetics and 50 non-diabetics, the post-surgical visual acuity in the diabetic and non-diabetic group was found to be 0.30 and 0.37 respectively at one month post-op. On comparing the post op values in both groups, the p value was 0.23, which was not statistically significant. On comparing the pre-operative and post-operative visual acuity in both the groups the p value (<0.001) was statistically significant indicating that both the groups had good visual outcomes following surgery. This indicate that cataract surgery in diabetics without retinopathy led to favorable and comparable visual outcomes to that of non-diabetics.

Chapter 6

CONCLUSION AND RECOMMENDATION

CHAPTER 6: CONCLUSION AND RECOMMENDATION

6.1 Conclusion:

The study reports cataract surgery in diabetic patients as producing good visual outcome. The study sample consisted of 51 diabetic cases suffering from cataract and 102 controls. Among the cases (Group 1), females counted more than males; which indicates that women suffer from diabetes and its ocular complication more frequently than males. Further research with a bigger sample size is suggested to investigate the implications of diabetes on women specifically.

In this comparative retrospective study, the preoperative best corrected visual acuity was compared to the postoperative best corrected visual acuity, which in turn, was not statistically significant (Right Eye p=0.099 and Left Eye p=0.21). This denotes how similar the post-surgical outcome between the groups and diabetic patients still benefit from the operation despite conventional opinions.

Small Incision Cataract Surgery and Phacoemulsification with Intraocular Lens Implantation were the either procedures this study sample had to undergo. Patients whom phacoemulsification was performed achieved overall better outcome, and recovered their eyesight with the slimmest complications. We recommend that diabetic patients with cataract choose PHACO as it has quicker and more satisfying results.

The post-operative complications noted within the period of study in both groups were mainly anterior segment's diseases, including corneal haziness, keratitis, conjunctivitis, and dry eye. Retinopathy was noted in diabetics, and ocular hypertension was prominent in both study groups. These were followed by uveitis without synaechiae in diabetics, and vitreous loss plus hemorrhage in non-diabetics. These results differed from the majority of existing literature where macular edema or retinopathy were the most frequent findings. This may entail to the higher chances of presence of other undiagnosed co-morbidities, the lack of appropriate intra-operative handling of high risk patients which raised the likelihood of more immediate complications, or rather, the lack of proper post-operative follow up, as most secondary data included in this study showed patients not resuming any follow up within 2 months post-treatment. We suggest a prospective study in the future that may focus on patients' follow up for much longer periods to ensure the long-term quality of life after treatment. However, there is still a

higher incidence of postoperative complications among diabetics, so extra care should be taken intra-operatively and during post-op follow up.

After a month of follow up, the majority of patients in both groups of this study sample had shown positively satisfactory results. The improvements on visual acuity results in the diabetics patients was statistically significant (Right Eye p=0.0006 and Left Eye p=0.0012). That further opposes the popular belief of cataract patients with diabetes not regaining their vision after surgery. Various previous studies had also reached this conclusion, and advocate diabetic patients to undergo surgical treatment quite early to avoid macular and retinal damage in future.

Overall, a good general outcome was prominent from operative intervention in diabetic patients suffering from advanced cataract; and therefore, surgery in such patient should not be denied. However, cataract surgery still presents a significantly higher risk; implying that postoperative follow-up should last at least three to 6 months as the few macular edemas reported in the present material all suggest their probable appearance after more than 1 month of observation. Thus, extra precaution needs to be taken pre and intra-operatively as well as adequate post-operative monitoring, is recommended.

6.2 Recommendation:

1. Good general outcome was prominent from operative intervention in diabetic patient suffering from advanced cataract; so, Surgery in these patients should not be refused.
2. Post-operative follow-up should be at least from 3 – 6 months.
3. PHACO techniques are much more suitable operation of choice for diabetic patients as it yields quicker and more satisfying results.
4. Extra precaution needs to be partaken pre and intra-operative with post-operative monitoring is mandatory.

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الخلاصة

الهدف:

تحديد النتيجة المرئية لـجراحة المياه البيضاء في المرضى الذين يعانون من داء المياه البيضاء بالعين المترافق مع مرض السكري في صنعاء، اليمن.

التصميم:

دراسة مقارنة بأثر رجعي أجريت في ثلاثة مستشفيات خاصة بصنعاء (مستشفى البراق، مركز الاستشاريون لطب وجراحة العيون ومستشفى العين والأنف).

المنهجية:

دراسة مقارنة لمجموعة من ٥١ مريضا بداء السكري و ١٠٢ شخصا في مجموعة أخرى غير مصابة بالسكري و كلتا المجموعتين خضعت لعملية إزالة المياه البيضاء اما بشق صغير في عدسة العين او عن طريق جهاز الفاكو مع زرع عدسة داخل العين و تم تقييم حدة النظر قبل و بعد العملية و أيضا بعد شهر من المتابعة بالإضافة الى العمر – الجنس – التقنية الجراحية و مضاعفات ما بعد العملية لكلا المجموعتين

النتائج:

من بين ١٥٣ مريضا ٥١ بالسكري و ً كان مصاباً ً شخصا ١٠٢ لم يكونوا مصابين بالسكري. كل المرضى خضعوا إما ل SICS او PHACO . المتوسط الحسابي لقياس حدة النظر قبل ً واحدا ً و فترة المتابعة كانت شهرا العملية في مجموعة مرضى السكري كان 1.40±0.08 للعين اليمنى و 73.0±19.0 للعين اليسرى. و نتيجة قياس حدة النظر بعد العملية بوحدات logMAR لمجوعة مرضى السكري كانت 1.81±0.10 للعين اليمين و 1.86±0.13 للعين اليسار و نتائج المجموعة الغير مصابة بالسكري كانت 0.70±2.2 للعين اليسار و -48.2±05.0 للعين اليمين دون العثور على اهمية احصائية. و اختلاف القراءات قبل و بعد العملية لم تكن لها دلالة احصائية. عند مقارنة القراءات لقياس حدة النظر بعد شهر من المتابعة للمجموعتين كانت النتائج ذات دلالة احصائية (P=0.0012) (P=0.0006) للعين اليمنى و اليسرى على التوالي .تتضمن مضاعفات ما بعد العملية: جفاف في العين - التهاب القزحية - اعتلال الشبكية - ازدياد ضغط العين - فقدان الجسم الزجاجي - نزيف داخلي في العين. كانت نسبة حدوث المضاعفات اكبر في مرضى السكري.

خاتمة:

في جراحة المياه البيضاء للعين لمرضى السكري كانت النتائج البصرية متقاربة لغير مرضى السكري، لوحظ تحسن بصري بعد الجراحة للمياه البيضاء المتقدمة في العين لمرضى السكري في مجتمع الدراسة. أيضا هناك معدل ارتفاع لحدوث مضاعفات بعد الجراحة عند مرضى السكري.

لذلك يجب توخي الحذر الشديد اثناء الجراحة وأثناء المتابعة بعد الجراحة حيث قد يؤدي طول فتره المراقبة بعد العلاج الجراحي لمرضى السكري الى تعزيز النتيجة البصرية.

Data Survey

<<CONTROL>>

- ***Personal Data:***
  - *Name:.....*
  - *Age:.....*
  - *Gender:.....*
  - *Address:.....*
  - *Occupation:.....*
  - *Date of Entry: / /*
- ***Pre-Operative Data:***
  - *Basal Visual Acuity:*
  - *Date of Measurement(s):*
    - */ /*

      Result:.....
    - */ /*

      Result:.....
    - */ /*

      Result:.....
  - *Diagnosis :.....*

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    .....
  - *Indication for Operation: .....*

.....

- *Co-morbidities:.....*

- ***Intra-Operative:***

  - *Operation Title:.....*
  - *Date of Operation: / /*

Complication(s):

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- ***Post-Operative:***

  - *Date(s)ofFollowup:*
    - *Follow-up#1: / /*
    - *Follow-up#2: / /*
    - *Follow-up#3: / /*
    - *Follow-up#4: / /*
    - *Follow-up#5: / /*
  - *Basal Visual Acuity:*
    - *Date of Measurement(s):*
      - */ /*

        Result:.....

APPENDICIES

- / /

  Result:.....

- / / *Result:.....*
- / / *Result:.....*
- / /

  Result:.....

Comments about Recovery:

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Recorded complication(s):

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Data Survey

<<Case>>

- ***Personal Data:***
  - *Name:.....*
  - *Age:.....*
  - *Gender:.....*
  - *Address:.....*
  - *Occupation:.....*
  - *Date of Entry: / /*
- ***Pre-Operative Data:***
  - *Basal Visual Acuity:*
  - *Date of Measurement(s):*
    - */ /*

      Result:.....
    - */ /*

      Result:.....
    - */ /*

      Result:.....
  - *Diagnosis :.....*

    ....

    .....
  - *Indication for Operation: .....*

.....

- *Co-morbidities:.....*
- *Diabetes Control:*
  - *Good (<90mg/dl)* ☐
  - *Moderate (90-120mg/dl)* ☐
  - *Poor (>120mg/dl)* ☐
  - *Method of Control:*
  - *Insulin Injection:*
    - *Diet:*
    - *Oral Hypoglycemic Drugs:*
    - *Medication For Diabetes Control:.....*

      .....

      ...

- ***Intra-Operative:***
  - *Operation Title:.....*
  - *Date of Operation: / /*

Complication(s):

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- ***Post-Operative:***
    - *Date(s)ofFollowup:*
        - *Follow-up#1: / /*
        - *Follow-up#2: / /*
        - *Follow-up#3: / /*
        - *Follow-up#4: / /*
        - *Follow-up#5: / /*
    - *Basal Visual Acuity:*
        - *Date of Measurement(s):*
            - */ /*

              Result:.....
            - */ /*

              Result:.....
            - */ / Result:.....*
            - */ / Result:.....*
            - */ /*

              Result:.....

Comments about Recovery:

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APPENDICIES

Recorded complication(s):

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الجمهورية اليمنية
الجامعة الامارتية الدولية

كلية الطب والعلوم الصحية
قسم طب المجتمع

النتيجة الجراحية لعملية المياه البيضاء عند مرضى السكري: دراسة مقارنة

بحث مقدم لقسم طب المجتمع - كلية الطب والعلوم الصحية - الجامعة الامارتية الدولية
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تحت اشراف

د\ معمر بادي

أستاذ مساعد في طب المجتمع

جامعة صنعاء

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