Optimizing Refractive Outcome of Cataract Surgery

Essay

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In Ophthalmology

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List of Contents

List of Abbreviations

IOL .....Intraocular Lens

OCT .....Optical Coherence Tomography

BSS.....Balanced Salt Solution

IOP .....Intra Ocular Pressure

CRVO.....Central Vein Occlusion

VES.....Viscoelastic Substance

FL ANG.....Fluorescein Angiography

I/A.....Irrigation/Aspiration

ICCE.....Intracapsular Cataract Extraction

ECCE.....Extracapsular Cataract Extraction

MICS.....Micro Incision

C-MICS .....Coaxial Microincisional Cataract

B-MICS .....Bimanual Micoincisional Cataract

CCC .....Continuous Circular Capsulorhexis

FLACS .....Femtolaser Assisted Cataract Surgery

PCO .....Posterior Capsule Opacificaiton

SA.....Spherical Aberrations

HOAS.....High Order Aberrations

PRK.....Penetrating Keratoplasty

MIOLS .....Multifocal Intraocular Lens

LAL.....Light Adjustable Lens

3-D CSI.....3 Dimensional Confocal Structure Illumination

U/S.....Ultrasound

List of Figures

Abstract:

Aim of the Work: Discuss different approaches to improve outcome of cataract surgery, through the following aspects, proper pre-operative examination including: Medical history, eye examination and diagnostic procedure, followed by advanced surgical steps, including the recent femtosecond laser assisted, finally by premium I.O.L selection.

In the past, when cataract surgery was performed with intracapsular or extracapsular techniques, patients underwent surgery when the level of lens opacity was severe (white or black cataract) and with levels of visual acuity below 6/60.

The techniques were not very refined and large incisions were required for the total extrusion of the crystalline lens. Optical rehabilitation was limited because of high levels of secondary astigmatism with large incisions and many sutures, as well as iatrogenic trauma in the cornea and iris tissue. Surgical aphakia was corrected only with 12-diopter spectacles, which were very heavy and quite uncomfortable. The resulting poor quality of life was a good reason to undergo surgery only when the opacity was significant.

Finally, the use of femtosecond lasers in cataract surgery is the last frontier of safer, more precise surgery that is highly reproducible and standardized. It offers surgeons the chance to center the capsulorhexis perfectly, which leads to optimal positioning of the artificial lens, and the precise location of corneal incisions (for access to the anterior chamber) and accurate incisions (for correction of preexisting astigmatisms). The fragmentation of the nucleus reduces manipulation procedures and the amount of ultrasound used during cataract removal.

Key word: Cataract Surgery, IOL, Femtolaser.

INTRODUCTION

Contemporary cataract surgery has evolved from a procedure with the simple focus of removing an obstruction of the visual axis to refractive procedure. Minimal spectacle dependence is expected by more and more patients. Control of Astigmatism and proper intraocular lens (IOL) selection are imperative to a good refractive result. Patient parameters and preference determine the refractive goal of the surgery ***(Lindstrom et al., 2004).***

Because technology is improving, the ability to create spectacle independence is improving as well. Multifocal, accommodating and toric intraocular lenses all require special testing and considerations but can leave patients much more functional without spectacles after cataract surgery ***(Berdahl and Robin, 2014).***

Multifocal IOL or accommodating IOL are very sensitive to even mild amounts of astigmatism and the surgeon needs to try to limit the postoperative astigmatism to less than 0.5 diopters. For mild astigmatism, the surgeon may simply choose to operate on the steep axis to reduce astigmatism to acceptable levels. If mild to moderate amounts of astigmatism are present, a concurrent limbal relaxing incision or astigmatic keratotomy can be performed to reduce astigmatism. In patient with high

amounts of astigmatism, the toric IOLs are the best option for achieving good distance vision. If residual astigmatism is present postoperatively, excimer laser treatment is the most accurate way to remove residual astigmatism ***(John and Robin, 2014).***

Surgical restoration of accommodation remains an elusive target. Current technology has made strides toward this goal and IOL design continues to evolve at an exciting pace. Good results and happy patients require the surgeon to set a realistic expectations perform accurate preoperative testing, execute skillful cataract surgery and address postoperative concerns thoroughly ***(Jessica and Priyanka, 2014).***

Light adjustable lens is a foldable, photosensitive, 3 piece silicone lens with PMMA haptics designed to achieve emmetropia after implantation. Approximately 1-4 weeks after surgery UV light is used to activate polymerization of silicon macromeres embedded in the lens matrix to adjust and subsequently lock the residual refractive errors ***(Chayet et al., 2008).***

Laser cataract surgery is a new use for femtosecond lasers that has promise in providing increased precision and accuracy to cataract surgery. A primary advantage of laser cataract surgery is the accuracy of the capsulorrhexis. This

in turn translates into an increased accuracy in the effective lens position and spherical component of the lens. The laser can also be used to treat astigmatism with accurate incisions at the same time as the cataract procedure ***(Stephen, 2014).***

Aim of the Work

Discuss different approaches to improve outcome of cataract surgery, through the following aspects, proper pre-operative examination including: Medical history, eye examination and diagnostic procedure, followed by advanced surgical steps, including the recent femtosecond laser assisted, finally by premium I.O.L selection.

THE PRE-OPERATIVE EXAMINATION

It is crucially important for good cataract surgery without complication to have the following 3 steps before surgery.

A. Medical History:

B. Eye Examination

C. Diagnostic Procedures

A. Medical History:

It is important to know (or to exclude) the presence of diabetes mellitus[0] ***(Caird et al., 1964).*** If the it patient is diabetic, then it is useful to know if the condition is insulin dependent or non-insulin-dependent[0] ***(Drel et al., 2008),*** for how long the patient has been affected; if the currently used therapy is effective; and if the disease has damaged organs such as the kidneys, heart, and peripheral vascular system. The patient's glycemic conditions can affect the surgery. Stress can cause glycemic to rise, so the administration of a mild tranquilizer can help these patients[0] ***(Gothwal et al., 1996).*** Being aware of these elements enables ophthalmologists to assess the stage of the disease in terms of severity in order to assess possible intraoperative complications and risks[0] ***(de Fine et al.,***

2011). It is also crucial to know about systemic effects of the disease in order to formulate a prognosis on the positive effects (in terms of visual improvement) the patient may have after cataract surgery. Obviously, the postoperative recovery of vision of a patient with long-term diabetes() ***(Pollreisz and Schmidt-Erfurth, 2009),*** with poor glycemic compensation, and with signs of advanced damage to retinal circulation will be very limited. On the other hand, a patient who has been suffering from diabetes for only a few years, whose glycemic compensation is good, and who has no alteration in retinal circulation can be expected to recover as well as a healthy person() ***(Dedov et al., 2009).*** It is also important to remember that operative risks will be much lower in the second situation that in the first. The quality of glycemic control and the kind of current therapy (oral antidiabetic drugs or insulin therapy) in patients with diabetes must be documented like the patient's medical history includes previous retinal a argon laser treatment for complications caused by diabetic retinopathy, retinal angiography and preoperative optical coherence tomography (OCT) are required() ***(Hartnett et al., 2009)*** in order to understand postoperative prognosis. If the patient has poorly compensated diabetes, satisfactory glycemic control should be established before surgery() ***(Kim et and Kim, 2006).***

Another condition that requires investigation is hypertension. It is necessary to check that patients with hypertension are at the time of surgery, taking effective medication that keeps blood pressure levels in a normal range, without wide oscillations in systolic and diastolic-values() ***(Glynn et al., 2009).*** High intraoperative blood pressure can cause intraocular hemorrhage and the ocular pressure that follows can make cataract surgery difficult. Sometimes, in this situation, surgery must be stopped and postponed until the intraocular pressure and blood pressure have returned to normal levels. The use of phenylephrine drops for pupillary dilation (used during patient preparation) must be limited in hypertensive patients. If anxiety causes blood pressure levels to rise above 180/100 mmHg. The administration of a tranquilizer can be useful.. if values fail to return to normal, an antihypertensive drug can be administered via the oral or sublingual route. In patients with cardiovascular diseases or vasculopathies, it is important to request an accurate cardiovascular examination (which assess the operative risk and the anticoagulant therapy used by the patient() ***(Lira et al., 2010).*** In most cases, although the surgical procedure is performed with topical anesthesia, the examination is important because sometime local regional anesthesia (peribulbar injection of the anesthetic) is required, especially if the patient is not cooperating. In the case of

retinal vascular disease (such as partial retinal vein occlusion or central retinal vein occlusion), surgeons should check the clinical status of the retina and, if necessary, perform argon laser treatment before cataract surgery .

Fig. (1): Effect of amiodarone ***(Friedman et al., 2013)***

Heart conditions such as cardiac arrhythmia or atrial fibrillation must be investigated not just to assess intraoperative risks but also because the medication used to treat these conditions can have specific side effects: for example the chronic use of drugs, such as amiodarone, can cause the formation of intracorneal deposits (fig. 1). The formation of cloudy areas in the cornea makes it more difficult to see the anterior capsule during capsulorhexis. If doctors know of this condition in advance, they can plan to use trypan blue (dye) on the anterior capsule, which makes the excaution of capsulorhexis easier. There is no need to stop or change the therapy of patients on anticoagulants,

but it is useful to plan surgery so that it is performed with local topical anesthesia and that clear corneal incisions are used to avoid bleeding. However, if surgery needs to be performed with deeper local regional anesthesia, with bulbar block, the dose of anticoagulants taken by the patient must be reduced. Patients with respiratory problems must be assessed for coughing symptoms, which can cause complications during surgery. In these cases, administering a cough sedative before surgery is recommended.

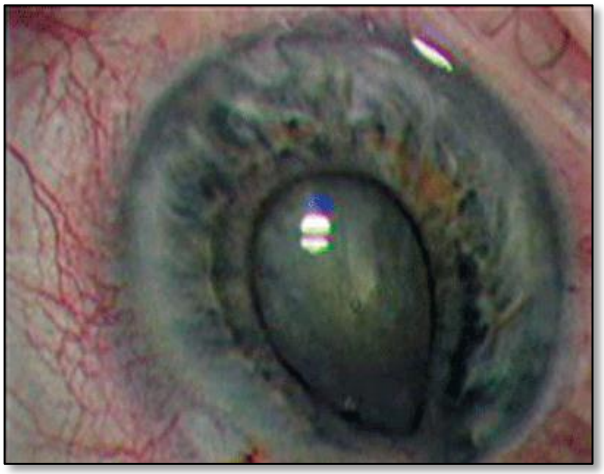

Fig. (2): Floppy Iris syndrome ***(Schwinn, 2010)***

With regard to other drug therapies, there are other drugs that can make some surgical procedures more difficult if surgeons do not know about them in advance for example, therapies for treating prostatic hyperplasia[0] ***(Gani et al., 2012),*** induce a permanent alteration in the iris that causes the floppy iris syndrome (fig. 2). which, if not diagnosed before starting can cause complications during