

Cataract surgery in patient with macular pathology

Essay

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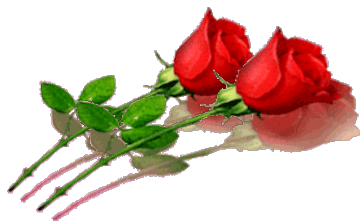
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Abbreviations

<i>AGEs</i>	advanced glycation end products
<i>AMD</i>	age related macular degeneration
<i>APC</i>	autologous platelet concentrate
<i>AREDS</i>	age related eye disease study
<i>BAB</i>	blood aqueous barrier
<i>BRB</i>	blood retinal barrier
<i>CAIs</i>	carbonic anhydrase inhibitors
<i>CME</i>	cystoid macular edema
<i>CNV</i>	choroidal neovascularization
<i>COX</i>	cyclooxygenase enzymes
<i>CSME</i>	clinically significant macular edema
<i>DHI</i>	diameter hole index
<i>DME</i>	diabetic macular edema
<i>ECCE</i>	extracapsular cataract extraction
<i>ERG</i>	electroretinogram
<i>ERM</i>	epiretinal membrane
<i>ETDRS</i>	Early Treatment Diabetic Retinopathy Study
<i>FA</i>	fluorescein angiography
<i>ICCE</i>	intracapsular cataract extraction
<i>ICG</i>	indocyanine green
<i>IL</i>	interleukin
<i>ILM</i>	internal limiting membrane
<i>IOL</i>	intraocular lens
<i>IOP</i>	intraocular pressure
<i>IRMA</i>	intraretinal microvascular abnormalities
<i>IVB</i>	intravitreal bevacizumab
<i>IVTA</i>	intravitreal triamcinolone acetonide
<i>MHI</i>	macular hole index
<i>MHS</i>	Macular hole surgery
<i>MSICS</i>	manual small incision cataract surgery
<i>Nd:YAG</i>	neodymium:yttrium aluminium garnet laser
<i>NSAIDs</i>	non-steroidal anti-inflammatory drugs
<i>OCT</i>	optical coherence tomography

<i>PAF</i>	platelet activating factor
<i>PEDF</i>	pigment epithelium derived factor
<i>PMMA</i>	polymethyl methacrylate
<i>RPE</i>	retinal pigment epithelium
<i>THI</i>	traction hole index
<i>VEGF</i>	vascular endothelial growth factor
<i>VINCE</i>	vitroretinal internal limiting membrane color enhancer
<i>WHO</i>	World Health Organization

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Introduction

In the past two decades, there have been tremendous advances in cataract surgery. Better technology and greater proficiency allow safer and faster surgery, with better visual outcomes and shorter recovery times. And a more active and optically demanding aging population has led to the increased need for cataract surgery.¹⁶⁸

Despite this good news about cataract surgery, there is a growing awareness of the effect of cataract surgery on a range of preexisting macular pathology, and the decision to perform cataract surgery in eyes with preexisting macular disease is often challenging.²⁵

Arguing for the removal of cataracts is the obvious fact that their presence can dramatically impair the patient's vision and, for the physician, can hinder the visualization and management of underlying retinal pathology.²⁵

Likewise, the ability to use optical coherence tomography for evaluating retinal thickness—a mainstay in today's management of many retinal diseases—can be markedly hindered by certain types of cataract. But cataract surgery can exacerbate retinal disease, and, ironically, some treatments for retinal disease, like intravitreal corticosteroids and pars plana vitrectomy, can themselves cause cataracts.²⁵

In this review of literature, the impact of cataract surgery on retinal diseases, namely, diabetic macular edema, cystoid macular edema, age related macular degeneration, macular hole, epiretinal membrane and vitreo macular traction, and it will discuss some perioperative measures that can enhance surgical outcomes.

Diabetes is the most common risk factor for cataract development in underdeveloped countries. Furthermore,

diabetic patients suffer lens opacities at an earlier age than individuals without diabetes.¹⁶⁹

Earlier cataract extraction in diabetes mellitus has contributed to an improved visual outcome. This approach facilitates panretinal photocoagulation therefore preventing progression of retinopathy and also enables timely treatment of underlying macular edema.³⁶

Visual outcomes are likely to be worse in studies in which surgery is deferred until it was not possible to identify or adequately treat clinically significant macular edema (CSME) prior to surgery. Additionally, if surgery is undertaken before lens opacity prevents the recognition of retinal thickening, the risk of CSME is decreased and the visual outcome may be improved considerably.⁴⁶

Macular hole formation is a rare complication of cataract extraction. Although the exact etiology is unclear, macular holes can be classified into pre-existing holes that may not have been visible prior to cataract surgery, early stage macular holes that progressed to a more advanced stage, symptomatic holes following cataract extraction, and de novo symptomatic macular holes. Antero-posterior (A-P) tractional forces as well as macular edema are thought to play a role in the pathogenesis of these macular holes. In the traction hypothesis, A-P forces are thought to induce either an acute detachment of the posterior cortical gel or significant traction of the vitreous gel around the fovea, resulting in formation, or rapid progression of, macular holes. In late reopening of macular holes after cataract extraction, subclinical macular edema and epiretinal membrane formation have been suggested as possible causes. Current treatment options, including combining cataract extraction with macular hole repair, are reviewed.¹⁶⁰

Age-related macular degeneration (AMD) and cataracts are the major entities contributing to vision loss in the elderly.¹⁷⁰

Since the earliest case series claimed post-operative exacerbation of AMD in 1979, several studies have been conducted to confirm whether or not cataract surgery accelerates the progression of AMD.

However, the results have been inconclusive and controversial, with most trials suffering from pronounced methodological deficiencies.¹²⁵

Ophthalmologists are still puzzled about whether or not cataract surgery increases a patient's risk for choroidal neovascularization (CNV), which is the primary symptom of neovascular AMD and predicts progressive loss of vision.¹⁷¹

Cystoid macular edema(CME) following cataract surgery was initially reported by Irvine in 1953 and demonstrated angiographically by Gass and Norton in 1966, so it is known as the Irvine-Gass syndrome.⁹⁶

Cystoid macular edema (CME) is a primary cause of reduced vision after cataract surgery even after uneventful surgery. The incidence of clinical CME following modern cataract surgery is 1.0–2.0 % but the high number of surgeries performed worldwide makes this entity an important problem. Pre-existing conditions such as diabetes and intra-operative complications increase the risk of developing CME post-operatively. CME is caused by an accumulation of intra-retinal fluid in the outer plexiform and inner nuclear layers of the retina, as a result of the breakdown of the blood–retinal barrier. The mechanisms that lead to this condition are not completely understood. However, the principal hypothesis is that the surgical procedure is responsible for the release of inflammatory mediators, such as prostaglandins. Optical coherence tomography is at present an extremely useful non-invasive

diagnostic tool. Guidelines for the management CME should be focused essentially on prevention and are based on the principal pathogenetic mechanisms, including the use of anti-inflammatory drugs.⁹⁶

Aim of the Work

The aim of this study is to highlight the impact of cataract surgery on retinal diseases and effect of macular pathology on timing, technique and outcome of cataract surgery.

Chapter 1

Cataract Surgery

Cataract is characterized by clouding that develops in the crystalline lens of the eye or its envelope and varies from a slight to a complete opacity that can obstruct the passage of light. Cataracts are specifically defined as any opacification in one or more layers of the crystalline lens that diffracts light and causes impaired vision.¹

Cataract is the main cause of curable blindness and represents a public health problem that negatively affects patient quality of life.^{2,3}

The blindness caused by cataract incapacitates the individual, increases dependency, decreases the patient's social condition, and results in early professional retirement, vision recovery facilitated by cataract surgery results in social and economic benefits to the individual, their family, and the community as a whole.⁴

The World Health Organization (WHO) recently reported that age-related cataract is now responsible for 48% of world blindness, which represents about 18 million people. It was estimated that there were 37 million people worldwide who were blind in 2002.^{5,6}

Age-related cataract remains the leading cause of blindness globally, except in the most developed countries. More than 82% of all blind people are 50 years of age or older, it is estimated that the present number of 20 million cataract blind will double by the year 2020. The global initiative "Vision 2020: The Right to Sight" has suggested various strategies to reduce cataract blindness.⁷

The WHO has called for a dramatic increase in surgical volumes worldwide, but the outcomes of cataract surgery are not always good and may depend on the surgical technique used.⁸

History and progression of cataract surgery

Cataract surgery is one of the oldest surgical procedure known, first documented in the fifth century B.C. In ancient times, cataracts were treated with a technique called couching, which could only be performed when the lens had become completely opaque, rigid, and heavy to the point that the supporting zonules had become fragile. The eye would then be struck with a blunt object with sufficient force to cause the zonules to break so that the lens would dislocate into the vitreous cavity, restoring limited but completely unfocused vision. Centuries later, the technique was modified so that a sharp fine instrument was inserted into the eye to break the zonules to cause the dislocation.⁹

The first reported surgical removal of a cataract from the eye occurred in Paris in 1748. The advent of topical anesthesia made this procedure more practical. The early techniques involved removing the entire opaque lens in one piece using an incision that went halfway around the circumference of the cornea. It was critical that the lens remained intact as it was being removed, so surgery was restricted to so-called ripe lenses: cataracts so hardened that they would not break into pieces as they were being removed. This limited the surgery to only the most advanced cataracts. Since fine sutures did not exist at that time, patients were kept immobilized with sandbags around their head while the wound healed.⁹

The improvements in cataract surgery and the corresponding results over the past few decades have been astonishing. The first major advance was the development of techniques allowing the removal of the lens while leaving the lens capsule behind. The intact capsule acted as a barrier preventing lens material from falling into the vitreous cavity. This allowed the less advanced cataracts to be removed since any residual fragments could be removed at the time of surgery with aspiration

and would not be retained in the vitreous, where they would incite inflammation. This change also resulted in the reduction of the wound down to approximately a quarter of a corneal circumference. The introduction of fine sutures around this time greatly enhanced the safety and quality of results.¹⁰

Before the widespread acceptance of extracapsular techniques, the majority of cataract surgery involved removal of the cataractous lens, including its capsule, using the intracapsular cataract extraction (ICCE). Experience of extracapsular cataract extraction (ECCE) had shown that if the posterior lens capsule was preserved then it was likely to become opaque, necessitating further surgery to restore vision.

Extracapsular cataract extraction (ECCE)

Extracapsular cataract extraction (ECCE) was introduced with the development of microsurgical instrumentation in the early 1980s. The lens content is removed through a large 12 mm incision leaving the posterior lens capsule intact. A posterior chamber IOL can then be placed in the capsular bag. If no IOL is implanted, aphakic glasses or contact lenses must be used.

Although phacoemulsification is regarded as the technique of choice for the bulk of cataract surgical procedures, there are nonetheless certain clinical contexts in which the extracapsular approach may be preferred. These include significant corneal opacity that may preclude safe capsulorhexis or phacoemulsification; marked endothelial cell loss, in which postoperative corneal decompensation may result; anterior capsular fibrosis preventing capsulorhexis; and white or dark brown lenses, which may be refractory to phacoemulsification. In addition, if capsular complications or corneal decompensation occur during phacoemulsification surgery, then conversion to an extracapsular approach may provide the best means of safely completing the procedure. For these reasons, the extracapsular technique represents an essential skill for both trainee and trained surgeons.¹¹