

Cystoid macular edema after cataract surgery. Aragua regional ophthalmological center and Maracay Central Hospital

Abstract

Cystoid macular edema (CME) is a late complication of cataract surgery.

Objective: To evaluate the frequency of cystoid macular edema after cataract surgery at the Regional Ophthalmology Center of Aragua and Hospital Central de Maracay during the period from March to August 2022. A quantitative investigation was developed, with a non-experimental, descriptive design. The study was prospective and longitudinal in a population of 148 patients for a sample of 45 eyes of 45 patients who presented cataracts and underwent surgery using extracapsular extraction and phacoemulsification techniques.

Results: 6 cases of CME were presented, representing a frequency of 13%. The average age was $66 \pm SD 12.49$ years, 50% of the cases were between 65 and 71 years. 67% corresponded to the female sex, with the same frequency of 50% for both eyes. 67% presented corrected visual acuity less than 20/80 at the fourth week, this frequency rising to 83% at the sixth week; 18% presented a central foveal thickness greater than $241 \mu m$ in the fourth week, maintaining this value in the sixth. 67% of the patients were operated on by the EECC technique and the rest by FACO.

Conclusion: CME is a post-surgical cataract complication, being higher in advanced age, female sex and with the application of the EECC technique. Patients with CME presented progressive deterioration of visual acuity and foveal thickening, observing that the lower the corrected visual acuity, the greater the foveal thickness.

Keywords: cystoid macular edema, cataract surgery, faco technique, extracapsular

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Introduction

Cataracts represent a worldwide public health problem, with important repercussions on the quality of life of people and on the economy of countries. Surgery by various techniques, either Extracapsular Extraction (EECC) or Phacoemulsification (FACO), is the treatment for the correction of cataracts, with some complications, of which one of the most frequent is cystoid macular edema.¹

It is the leading cause of treatable blindness in the world, accounting for 48% of cases of visual impairment and more than half of 38 million blind people. Cataract is defined as the development of opacity in the crystalline lens that causes a uni or bilateral decrease in visual acuity and is related to many causes.^{2,3}

According to their origin, cataracts have been classified according to their etiology, location of the opacity, maturity, age of onset, associated ocular and systemic diseases, those secondary to or as a consequence of toxic substances and ocular trauma.^{4,5} Advanced age is the main risk factor associated with the appearance of cataracts, due to the progressive and sequential changes that crystallin proteins undergo due to their denaturation during aging. However, there are also other risk factors associated with cataracts such as tobacco use, alcohol, nutritional factors, exposure to UV light, heat, myopia, diabetes mellitus, corticosteroid use, hormone replacement therapy, fat consumption and arterial hypertension.⁶

Cataract surgery is the most commonly used method, and consists of the surgical removal of the opaque crystalline lens with the implantation of an artificial intraocular lens (IOL) to correct the refractive error.⁷ In that sense, there are several surgical procedures for

the treatment of cataract, and of these, the main ones are Extracapsular Extraction and Phacoemulsification, which are the routine methods used in cataract surgery.⁸

ECCE involves the removal of the crystalline lens from its capsule, which is retained inside the eye and acts as a barrier between the anterior and posterior segment, being the most common site for replacement lens implantation. ECCE requires a large incision, ranging from 8 to 12 mm for total removal of the nucleus, and is associated with astigmatism due to the need for suturing.⁸

FACO is a widely used modern surgical technique in which the cataract is emulsified with an ultrasonic handpiece and aspirated through a 2.5 - 3.2 mm incision, generally requiring no suturing if a self-sealing incision is made. Moreover, it is less invasive, physical and visual rehabilitation is faster, produces less astigmatism induction, and provides better early refractive stability and less postoperative inflammation.⁹

Cystoid macular edema (CME) is a major cause of decreased vision that appears 4 to 6 weeks after cataract surgery. Most patients present with visual acuity loss and macular thickening, which can be seen in the posterior segment by ophthalmoscopy, fluorescein angiography and optical coherence tomography (OCT).¹⁰

MCE consists of intra- or subretinal fluid accumulation in the macular region and is defined as an abnormal thickening of the macula associated with fluid accumulation in the extracellular space of the neurosensory retina.^{11,12}

It was initially described as a distinction by Irvine et al. in 1953, who first characterized macular edema after intracapsular cataract surgery,

followed by Gass in 1966, who angiographically characterized it as a flower petal; hence the name Irvine-Gass syndrome.¹²

Therefore, intracellular edema involving Müller cells is observed in some cases by histopathology.¹³ The classic pathology consists of wide cystoid spaces in the outer plexiform layer of Henle, as well as in various retinal layers depending on the underlying disease.¹³

Among the diagnostic methods is optical coherence tomography (OCT), which due to its sensitivity works well in the detection of CME. OCT can show hyporeflective lesions compatible with intraretinal fluid, loss of foveal depression, can quantify retinal thickening, macular volume and differentiate between eyes with or without CME.¹⁰

Treatment options for CMD include corticosteroids and topical nonsteroidal anti-inflammatory drugs, either as monotherapy or as combination therapy. When the therapeutic approach is ineffective, intravitreal application of corticosteroids and anti-vascular endothelial growth factor agents may be an option. In eyes with chronic CME and vitreomacular traction, pars plana vitrectomy may be considered.¹¹

Cystoid macular edema (CME) is a late complication of cataract surgery, its incidence is between 1% and 30%, however, a 1-2% incidence of CME is considered clinically significant in patients without risk factors. Although in most cases, CME is a condition that can be subclinical and self-limited, which can develop 4-6 weeks after cataract surgery, there are cases in which it can lead to long-term visual impairment that is difficult to treat.^{9,11}

Among its main causes are visual impairment due to metabolic, vascular and inflammatory diseases of the retina. It affects worldwide about 7 million subjects due to diabetes and 3 million subjects due to vein occlusions.² In addition, it accounts for 40% of visual impairment in patients with uveitis. In industrialized countries, 5% of people over 60 years of age have CME due to age-related neovascularization.¹¹

In Venezuela there is no official data reporting the morbidity of cystoid macular edema, according to the findings in the research of Siso et al. in 2005,¹² they found that 65.75% of blindness in the country is attributable to cataract, cataract surgery was 2.26% bilateral and 2.80% unilateral. Related to CME, Guarache et al, 2016¹³ reported 2% of CME in patients at the University Hospital of Caracas after cataract surgery. As stated by the WHO in 2019,¹⁴ visual impairment due to any cause can be prevented and controlled.

Likewise, in Aragua State, real data on the morbidity of the subject under study, its causes and severity are unknown. The aim of this study is to evaluate the frequency of cystoid macular edema after cataract surgery by extracapsular extraction and phacoemulsification at the Aragua Regional Ophthalmologic Center and Maracay Central Hospital during the period from March to August 2022.

Methodology

The study was based on a quantitative research, with a non-experimental, descriptive, prospective, longitudinal design.^{15,16} The patient was clinically assessed through optical coherence tomography (OCT) studies at 4 and 6 weeks after surgery.

The population was represented by 148 patients who underwent cataract surgery by EECC and FACO technique of the anterior segment consultation CORA - HCM, during the period from March - August 2022, a simple, non-probabilistic, purposive sampling was applied; being the sample represented by 45 eyes of 45 patients (30%).

There were selected those who voluntarily wanted to participate and agreed to sign the informed consent, of both sexes, who were

implanted with intraocular lens (IOL), who had no previous macular pathologies, without Diabetic Retinopathy and with mild or moderate non-proliferative Diabetic Retinopathy; without Hypertensive Retinopathy and with Hypertensive Retinopathy grade I or II; patients with no history of glaucomatous neuropathies or excavations less than 50%, with no history of previous intraocular surgeries and without operative complications such as expulsive hemorrhages, endophthalmitis, TASS, bullous keratopathy.

Data were collected through a medical record structured in two parts: sociodemographic information of the patients, evaluation of corrected VA, fundus and macular OCT which was applied to all patients in the study at the fourth and sixth week who met the above mentioned criteria.

Visual acuity was measured using the Snellen chart, projected at a distance of 20 feet (6 meters). The diagnosis of CME was established by indirect ophthalmoscopy with 78D lens and OCT study, for clinically significant CME and the presence of cysts plus foveal thickness greater than 220 microns respectively.

In compliance with the universal bioethical principles for research in Health Sciences, the request for approval of the project was made to the Bioethics Committee located in the context where the study was conducted. In addition, a commitment was made to maintain the confidentiality of the data included in the study, which were used exclusively for research purposes.

Results

During the investigation, 45 eyes of 45 patients underwent cataract surgery and 6 (13%) of them presented CME; showing that the most affected age group is 65 - 71 years old, represented by 3 (50%), followed by the group between 44 - 50, 58 - 64 years old and 72 - 78 years old reporting 1 patient, representing 16.7% for each one of them. It is important to mention that 39 patients did not present CME in the periods evaluated, the most predominant age group being 72 - 78 years with 23.1%. The mean age of the patients was 66 years \pm SD 12.49; that is, it is a heterogeneous population and a mode: 76, being the most repeated age. The female sex represents the majority of cases, 4 (66.7%) that presented this complication, with respect to the male sex with 33.3%, with equal frequency (50%) for both eyes (Table 1).

When evaluating the corrected visual acuity (CVA) after cataract surgery four weeks after the intervention, it was found that in patients with CME, two (2) representing 33.3% presented corrected VA between 20/20 - 20/40, 33.3% between 20/80 - 20/200 and 33.3% less than 20/400, decreasing the CVA to 20/20 - 20/200 by 50% at the sixth week. In patients without CME, 56.4% showed a corrected VA between 20/20 and 20/40 at week 4, increasing this range to 76.9% at week 6 (Table 2).

In the results it can be seen that through the evaluation of the fundus of eye in postoperative cataract patients by both techniques, 3 (6.7%) patients presented clinically significant cystoid macular edema at the fourth postoperative week, likewise it is appropriate to note 6 (13.3%) patients with this complication at six weeks, of which 3 (6.7%) presented in this period and 3 (6.7%) by persistence since its inception.

Through the study of macular optical coherence tomography (OCT), according to the pre-established ranges, at 4 weeks, 31 (68.9%) presented a foveal thickness less than 220 microns, which can be interpreted within normal limits, 6 (13.3%) in a range of 221 to 240 microns that represented patients with macular thickening

without the presence of morphological changes; for those larger than 241 microns, 8 (17.8%), of which 5 (11.1%) patients were diagnosed with cystoid macular edema. At 6 weeks postoperatively, 27 (60.0%) maintained a range of less than 220 microns, 9 (20.0%) in the range between 221 to 240 and for those over 241 microns. An average foveal thickness was obtained in patients of 232.77 ± 92.77 at 4 weeks and \bar{X} 230.77 ± 75.76 at 6 weeks (Table 3).

It should be noted that, of the 45 eyes of 45 patients studied, 20 (44.44%) were operated by the FACO technique and 25 (55.56%) were operated by the EECC technique. Two patients 2/20 (10.0%) postoperated with the FACO technique and 4/25 (16.0%) postoperated with the EECC technique presented cystoid macular edema, showing that there is a greater probability that the patient postoperated by the EECC technique presents this complication, in view of a p value = 0.02 (Table 4).

Table 1 Characterization of the population after cataract surgery in according to age group, sex and affected eye

Descriptive for age			
	\bar{X}	OF	Fashion
Age	66	12.49	76
Variables	EMC Yeah fa (%) n=6	EMC No fa (%) n=39	95% CI
Age group/years			
44 – 50	1(16,7)	5(12.8)	5.05 – 26.79
51 – 57	0(0,0)	7(18,0)	6.49 – 29.46
58 – 64	1(16,7)	7(18,0)	8.00 – 32.05
65 – 71	3(50,0)	4(10,3)	6.49 – 29.46
72 – 78	1(16,7)	9(23,1)	11.20 – 37.09
79 – 85	0(0,0)	5(12.8)	3.71 – 24.05
≥86	0(0,0)	2(5,1)	0.54 – 15.15
Total	6(100)	39(100)	
Sex			
Female	4(66,7)	23(59,0)	44.33 – 74.30
Male	2(33,3)	16(41,0)	25.70 – 55.67
Total	6(100)	39(100)	
Eye			
Right	3(50,0)	21(53,8)	37.87 – 68.34
Left	3(50,0)	18(46,2)	31.66 – 62.13
Total	6(100)	39(100)	

* \bar{X} : mean. 95% CI: 95% probability confidence interval, CME: cystoid macular edema, fa: absolute frequency, (%): relative frequency, SD: standard deviation.

Table 2 Frequency distribution of corrected visual acuity after cataract surgery

Variables	EMC		Total	95% CI
	Yeah fa (%) n=6	No fa (%) n=39		
HCV 4th week				
20/20 - 20/40	2(33,3)	22(56,4)	24(53,3)	38.18 – 68.49
20/50 - 20/70	0(0,0)	11(28,2)	11(24,4)	11:39 – 37:50
20/80 - 20/200	2(33,3)	5(12,8)	7(15,6)	4.54 – 26.57
<20/400	2(33,3)	1(2,6)	3(6,7)	0.91 – 14.25
Total	6(100)	39(100)	45(100)	
HCV 6th week				
20/20 - 20/40	1(16,7)	30(76,9)	31(68,9)	59.90 – 86.77
20/50 - 20/70	0(0,0)	6(15,4)	6(13,3)	0.24 – 17.54
20/80 - 20/200	3(50,0)	2(5,1)	5(11,1)	1.56 – 20.66
<20/400	2(33,3)	1(2,6)	3(6,7)	0.91 – 14.25
Total	6(100)	39(100)	45(100)	

*95% CI: 95% probability confidence interval, CME: cystoid macular edema, fa: absolute frequency, (%): relative frequency, AVC: corrected visual acuity.

Table 3 Frequency distribution of the evaluation of the macula after cataract surgery through fundus examination and macular OCT

Variables	fa n=45	fr(%)	95% CI
EMCS (4th week)			
No	42	93.3	81.73 – 98.60
Yeah	3	6.7	1.40 – 18.27
Total	Four. Five	100	
EMCS (6th week)			
No	39	86.7	73.21 – 94.95
Yeah	6	13.3	5.05 - 26.79
Total	Four. Five	100	
fovea/ μm (4th week)			
Less than 220	31	68.9	53.35 – 81.83
221 – 240	6	13.3	5.05 – 26.79
Major - 241	8	17.8	8.00 – 32.05
Total	Four. Five	100	
Descriptive Mean ± SD	232.77 ± 92.77		
fovea/ μm (6th week)			
Less than 220	27	60	44.33 – 74.30
221 - 240	9	20	9.58 – 34.60
Major - 241	9	20	9.58 – 34.60
Total	Four. Five	100	
Descriptive Mean ± SD	230.77 ± 75.76		

*95% CI: 95% probability confidence interval, CMS: clinically significant macular edema, fa: absolute frequency, fr(%): relative frequency, SD: standard deviation.

Table 4 Frequency of Cystoid Macular Edema after cataract surgery according to the surgical technique performed

Variables	Techniques				p-value
	PHACO n=20/45		EECC n=25/45		
	Yeah fa (%)	No fa (%)	Yeah fa (%)	No fa (%)	
EMC	02(10,0)	18(90,0)	04(16,0)	21(84,0)	0.02

PHACO: phacoemulsification, EECC: extracapsular extraction, CME: cystoid macular edema, fa: absolute frequency, (%): relative frequency.

Discussion

Cystoid macular edema is a disorder that can be subclinical and self-limited, usually occurring 4 to 6 weeks after cataract surgery; there are cases in which it can lead to long-term visual impairment that is difficult to treat;^{10,11} in this research 45 eyes of 45 patients undergoing cataract surgery who were in the fourth postoperative week were evaluated. It is known that advanced age is the main risk factor associated with the appearance of cataracts, due to the progressive and sequential changes that crystallin proteins undergo due to their denaturation during aging,⁶ most of the patients were between 72 and 78 years old. Although the presence of cataracts has been found to be associated with the male sex, in this research the most affected sex was female.

The technique used for cataract removal is important in the development of complications. The incidence of CME used to range from 0.2 to 20% depending on whether the diagnosis is confirmed by clinical examination alone or by OCT study.¹⁷ With the advent of phacoemulsification techniques, the incidence has been reduced to around 0.2 to 2.35%.^{18,19} However, in most cases the extracapsular extraction technique was applied because more cases with dense cataracts were presented.

The frequency of EMC found in the sample was 13.3%, a result that differs from those obtained in the studies by De Silva et al²⁰ of 2.75%, Chu et al²¹ of 1.7%; 2.0% by Guarache et al,¹³ Van Nuffel et al²³ with 2.77% and 0.02 by Erikitoila et al.²²

The mean age of patients with CME was 66 ± SD 12.49 years, 50% of patients were between 65 and 71 years, findings that differ from the study of Erikitoila et al,²² since they reported a mean of 74.9 ± SD 10.2 years, confirming age as an important risk factor.¹⁶ The sex most affected was female with 66.7%, compared to male with 33.3%; contrary to the findings of Chu et al²¹ and Erikitoila et al,²² who reported a higher frequency of cases in the male sex.

Of the total number of cases, most were performed by EECC (66.7%), as reported by De Silva et al.,²⁰ which confirms the higher risk of this complication due to the invasiveness of the technique applied and the longer recovery time,^{8,9} being statistically significant with a p=0.02 value.

Most patients with CME have overt vision loss and macular thickening between four and six weeks after cataract surgery.¹⁰ In this investigation, patients with CME showed CVA less than 20/80 in the majority (66.6%) at the fourth week evaluation, decreasing to 83.3%

at the sixth week; this result agrees with that obtained by Chu et al²¹ who found a decreased CVA after surgery, but contrasts with that obtained by Guarache et al¹³ who reported 90% of the eyes studied with CVA between 20/20 and 20/40. However, patients without CME showed improvement in CVA by week 6.

Regarding foveal thickness, an increased thickness of more than 220 μm was observed in the group with EMC in the fourth week, which is maintained until the sixth week; the average values for the fourth and sixth week of the sample studied were $232.77 \pm \text{SD } 92.77 \mu\text{m}$ and $\bar{X} 230.77 \text{ SD } \pm 75.76 \mu\text{m}$ respectively; these levels were higher than those of Guarache et al¹³ who reported a mean of $172 \pm 13 \mu\text{m}$ of the total patients in the study. In the group without EMC, there was a higher percentage of patients with a thickness less than 220 μm at the fourth week with a tendency to maintain it at the sixth week; therefore, it is concluded that EMC is a post-surgical cataract complication that affected 13.3% of the studied sample, being higher in advanced age, female sex and with the application of the EECC technique. Patients with CME presented progressive deterioration of visual acuity and foveal thickening, and it was observed that the lower the corrected visual acuity, the greater the foveal thickness. Therefore, it is recommended to perform a prospective study to determine the frequency of CME in ophthalmologic centers in Aragua state, including the time in which the complication occurred, its presentation at the ophthalmologic consultation and to follow up the clinical evolution of the patients, to determine the prognosis and possible complications after CME. To develop new research that includes the treatment applied to postoperative cataract patients with cystoid macular edema and to perform a follow-up of more than 6 weeks to evaluate the type of treatment, its efficacy and the patient's resolution. Establish guidelines and protocols in ophthalmologic consultations for cataract postoperative patients, with the implementation of OCT and angio-OCT studies at 4 weeks, since they are non-invasive procedures and it has been demonstrated that approximately 50% of patients who undergo cataract surgery without visual acuity affectation and without complications, develop angiographic CME; diagnosing in a timely manner cystoid macular edema, minimizing the affectation in visual acuity and optimizing the patient's quality of life.

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Conflicts of interest

The authors declare that they have no competing interests.

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