PSEUDOPHAKIC CYSTOID MACULAR EDEMA. ASSESMENT WITH OPTICAL COHERENCE TOMOGRAPHY

EDEMA MACULAR QUÍSTICO PSEUDOFÁQUICO. DETECCIÓN MEDIANTE «OPTICAL COHERENCE TOMOGRAPHY»

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ABSTRACT

Purpose: To determine the incidence of cystoid macular edema (CME) by means of clinical evaluation and subclinical assessment by means of ocular coherence tomography (OCT), and to compare the incidence between diabetic and non-diabetic groups of patients.

Methods: Prospective study of 260 consecutive cataract surgeries operated from September 2004 to March 2005. The procedures were performed by means of phacoemulsification plus intraocular acrylic lens implantation. Group A: 208 eyes of non-diabetic patients; Group B: 42 eyes of patients with diabetes and Group C: 10 eyes of diabetic patients with macular edema that received an intravitreal injection of triamcinolone at the end of surgery. Postoperative follow-up visits were performed 6 days (basal visit), 5 weeks and 12 weeks after surgery. Each visit included posterior pole biomicroscopy and OCT.

Results: Central macular thickness measured by OCT was significantly increased in group B compared with group A (241.6 versus 204.6 µm; p<0,001). No clinical evidence of CME was found in group A,

RESUMEN

Objetivo: Detectar la incidencia de edema macular quístico (EMQ) tras cirugía de catarata tanto clínico como subclínico, mediante «ocular coherence tomography» (OCT) y comparar dicha incidencia entre un grupo de pacientes diabéticos y otro de no diabéticos.

Material y métodos: Estudio prospectivo de 260 ojos intervenidos de forma consecutiva de catarata mediante facoemulsificación con implante de lente intraocular acrílica, desde septiembre de 2004 a marzo de 2005. Grupo A: 208 ojos de pacientes no diabéticos, grupo B: 42 ojos de pacientes diabéticos, grupo C: 10 ojos de pacientes diabéticos con edema macular y que recibieron triamcinolona intravítrea (TAIV) al finalizar la cirugía. En cada revisión efectuada a los 6 días (basal), 5 semanas y 12 semanas se realizó biomicroscopía de polo posterior y OCT.

Resultados: El espesor macular en la OCT, fue significativamente superior en el grupo B que en el grupo A (241,6 versus 204,6 µm p<0,001). En el grupo A no detectamos ningún paciente con EMQ clínicamente significativo, pero en cuatro ojos

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although 4 eyes (1.92%) showed macular thickness equal to or greater than 43.74 µm (2 standard deviations of the basal value for group A). In group B, clinical evidence of CME was found in 6 eyes, with decreased visual acuities (14.2%). The differences between these groups were statistically significant (p<0.001). The 10 eyes that received an intravitreal injection of triamcinolone after the surgical procedure showed a mean decrease in central retinal thickness of 77 µm after 12 weeks postoperative.
Conclusions: This study has shown a low incidence of clinical CME. OCT showed increased macular thickness in both groups of patients in a small percentage of cases, and significantly increased macular thickness in diabetic patients *(Arch Soc Esp Oftalmol 2006; 81: 147-154).*

Key words: Pseudophakic edema, OCT, cystoid macular edema.

(1,92%) detectamos aumento del espesor macular ≥ 43,74 µm (2 DE del valor basal del grupo A). En el grupo B, seis ojos presentaron EMQ clínicamente significativo, con disminución de agudeza visual (14,2%), en 12 ojos detectamos aumento del espesor macular (28,5%). Las diferencias entre grupos fueron significativas (p<0,001). En los 10 ojos que recibieron TAIV se observó una disminución media del espesor central de 77 µm a las 12 semanas.
Conclusiones: La incidencia de EMQ clínico ha sido muy baja en esta serie. La OCT detectó un aumento del espesor macular en ambos grupos en un pequeño porcentaje de pacientes y significativamente mayor en el grupo de pacientes diabéticos.

Palabras clave: Edema pseudofáquico, OCT, edema macular quístico.

INTRODUCTION

Aphakic or pseudo-phakic cystoid macular edema (CME) is a relatively frequent complication of cataract surgery. It has been described with greater frequency after complicated surgery or in patients with eye diseases, but also in normal eyes after uncomplicated surgery. The prevalence of angiographic cystoid macular edema (CMEA), without repercussion on visual acuity, has been rated up to 50% of cases (1,2). Clinical cystoid macular edema (CCME) produces a variable degree of eyesight deterioration, in a percentage between 0.2 and 13% of patients operated for cataract (3-6) with or without complications.

Although the etiology of CME is unknown, intraocular inflammation seems to play an important role in its development. Modern cataract surgery with phacoemulsification, self-sealed corneal incision and implant of folding intraocular lens (IOL) in the capsular sac seem to have reduced considerably the prevalence of angiographic as well as clinical aphakic CME (7-9).

Although angiography with fluorescein (AGF) is usually utilised to confirm the diagnostic of CME, it is a painful procedure which can cause severe complications and there is not always a correlation between the degree of hyper-fluorescence and visual loss. In recent years a new technology has been developed, i.e, «optical coherence tomograph» (OCT), which quantifies the thickness of the retina and can differentiate between eyes with and without macular edema (10-12). OCT has proved to be as effective as AGF to detect CME (13) and has evidenced good reproducibility.

According to some studies, patients with diabetes mellitus are at greater risk of developing aphakic CME (14,15).

The purpose of this study is to detect the prevalence of clinical and subclinical cystoid macular edema (CME) after cataract surgery by means of OCT in a group of patients operated for cataract with phacoemulsification and IOL implant in capsular sac and comparing said prevalence in a group of diabetic and non-diabetic patients with or without retinopathy.

SUBJECTS, MATERIAL AND METHODS

A prospective study of 286 eyes operated for cataracts by three surgeons utilising similar surgical techniques between September 2004 and March 2005 in our hospital.

The operations were carried out with topical anesthesia (oxibuprocaine 0.4% and tetracaine 0.5%: Colircusí double anesthetic®, Alcon-Cusí,

Barcelona, Spain), and comprised phacoemulsification with IOL implant in capsular sac by means of an injection via a 3-mm self-sealing corneal incision. For each patient, we assessed a history of diabetes mellitus, morphology and hardness of the cataract, duration of the surgery, time and mean power of phaco, intraop complications and administration of intra-vitreous triamcinolone (TAIV) at the end of the surgery.

Twenty-three eyes were excluded from the study due to previous eye surgery or macular pathology (excepting diabetic retinopathy) which could interfere in the results or in the measurement of OCT macular thickness, and three additional eyes which did not complete the minimum 3-month follow-up period.

The remaining 260 eyes were divided in three groups: group A, with 208 eyes of nondiabetic patients, group B with 42 eyes of diabetic patients with or without retinopathy, group C with 10 eyes of diabetic patients with persistent macular edema in spite of laser treatment and who received TAIV (± 20 mg in 0.1 ml of Trigon depot® Bristol-Myers Squibb - Madrid) at the end of the surgery. For obtaining this dosage, 0.9 ml of the solvent were extracted after decanting the vial for several hours, the rest of the vial was shaken energetically to obtain a suspension as homogeneous as possible and immediately injected with a 28 G needle to avoid crystallization.

In each checkup, performed six days postop (considered as baseline), 5 weeks and 12 weeks, we determined the visual acuity with and without correction (Snellen-type standard types), applanation tonometry, inflammatory activity in anterior chamber, corneal transparency, biomicroscopy of posterior pole with 78 diopter lens and measure of macular thickness by means of Stratus OCT 3000 (Zeiss Meditec, Jena-Germany). In all cases the checkup was made by the same technician utilising the fast macular thickness map protocol which provides six radial tomograms, acquired almost simultaneously. In the analysis, we considered the value of the macular thickness in a 1 mm central circle. When possible, the contralateral eye was utilised as control.

All the patients were treated with a combination of antibiotic, steroid anti-inflammatory (Tobramicine + dexametasone, Tobradex®, Alcon-Cusí, Barcelona, Spain) and topical non-steroids (Sodium Diclophenate, Voltaren®, Novartis, Barcelona, Spain) in decreasing dosages during one month: one drop four times a day the first week, three times a day the second week, twice a day the third week and once a day the fourth week.

In the cases in which we objectively identified increase of macular thickness, topographic image of biomicroscopy exploration compatibility with CME, with reduction of VA, we performed AGF.

The results were analysed with the SPSS 12.0 for Windows® (SPSS Inc. Chicago, USA) statistical programme, utilising «t for student» in the study of quantitative data and the C square test for qualitative variables. The value of $p<0.05$ was considered as significant.

RESULTS

The demographic characteristics, the intervened eyes, the type of cataract as well as the duration of the surgery, percentage of phacoemulsification and surgery complications (iris damage), can be seen in tables I and II.

In group B, 28 of the 42 eyes exhibited diabetic retinopathy, ten of them with macular edema previously treated with focal laser in 3 cases and horseshoe-shaped laser in 7 cases. There were no differences between groups A and B in what concerns the type of cataract, hardness, time or power of the phaco utilised. The duration of the surgery was greater in group B (mean 14' 29"), than in group A (mean 12' 06") ($p = 0.026$).

The only complications encountered, intraop iris damage, was more frequent in group B (14.29% of

Table I. Demographic data, type of diabetes and of cataract, expressed as percentages in each group

Groups	Number	Age	R. eye	L. eye	ID-DM	NID-DM	Cortical	Nuclear	Subcap.
A	208	77.5	48.5	51.5	0	0	18	78.5	3.5
B	42	74.8	50	50	57.7	42.3	19.2	80.8	0
C	10	76.9	80	20	80	20	20	80	0

ID-DM: Insulin-dependent diabetes mellitus; NID-DM: Non-insulin dependent diabetes mellitus.

Table II. Mean and standard deviation (SD) of total surgery time (in minutes), total phacoemulsification time (in seconds), percentage of phacoemulsification utilised and iris damage (in percentages)

Groups	Surgery time	Phacoemulsification time	Percentage	Iris damage
A	12.06 SD 3	56.3 SD 33.2	22.8 SD 8.6	0.96
B	14.29 SD 5	58.7 SD 38.2	23.5 SD 8.2	14.29
C	12.4 SD 8.9	42.8 SD 18.7	20.6 SD 6.1	0

eyes) than in group A (0.96%) with a statistically significant difference (p<0.001).

The mean and standard deviation (SD) of the baseline macular thickness in OCT in Group A was of 204.6 µm (SD 21.8) whereas in group B it was of 241.6 µm (SD 56.3).

In eyes with diabetic retinopathy, we considered as a macular edema or as an increase of pre-existing edema a macular thickness increase of at least 43.74 µm (2 SD of the group A baseline), with respect to the baseline of each eye in any of the checkups carried out at 5 at or 12 weeks.

The baseline macular thickness in OCT was significantly higher in group B than in group A (p<0.001).

Of the 42 eyes of group B, ten eyes (23.8%) had a baseline thickness over 248.41 µm (mean ± 2 SD of group A), which is interpreted as a sign of presence of macular edema.

All the patients of group C, which received TAIV had a baseline thickness exceeding 248.41 µm (mean ± SD: 322.80 SD 36.28).

Table II shows thickness values measured with OCT in microns in each group and checkups.

In group A we did not detect any patient with clinically significant CME, but in 4 eyes (1.92%) we detected an increase of macular thickness ≥ 43,74 µm (2 SD of group A baseline value). In none of the control eyes we objectively identified an increase of macular thickness ≥ 43.74 µm in the tomography readings at 5 and 12 weeks vis-à-vis the baseline.

In group B, 6 eyes exhibited clinically significant CME with reduction of visual acuity (14.2%). In 12 eyes we detected an increase of the macular thickness ≥ 43.74 µm (28.5%), in six eyes it appeared at the five-week checkup and in the remainder at the 12-week checkup. Out of the 12 eyes, only two exhibited a baseline macular thickness exceeding 248.4 µm. In all eyes with clinically significant edema, OCT had evidenced an increase of the macular thickness in the five week as well as the 12 week checkup (figs. 1 and 2).

The differences between groups were significant (p<0.001).

In the ten eyes that received TAIV we observed a mean reduction of the central thickness of 68 µm, SD 25,06 µm (range –27 to –90 µm) at five weeks and of 77 µm, SD 14,39 µm (range –61 to –87 µm) at 12 weeks (figs. 3 and 4). We did not observe any complication attributable to the use of TAIV and ocular pressure stayed below 20 mmHg in all cases.

In all eyes, preop visual acuity improved after the operation. Table 4 shows mean corrected visual acuity in the three postop checkups carried out on all patients.

Table III. Mean and standard deviation (SD) of macular thickness (in microns) measured with OCT in the three chekups

Group	Day 6	Five weeks	12 weeks
A	204.6 SD 21.8	217.1 SD 42	214.9 SD 44
B	241.6 SD 56.3	252.3 SD 44.8	267.9 SD 58.2
C	322 SD 36	254 SD 23	245 SD 31

OCT : «Optical coherence tomography».

DISCUSSION

In recent years we have seen great progress in cataract surgery, both in the surgical technique as well as with modern phacoemulsifiers, in addition to the design and construction of intraocular lenses

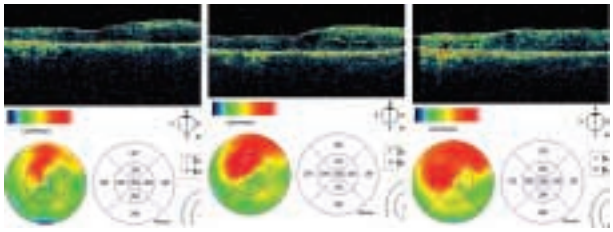

Fig. 1: OCT of patient with diabetic retinopathy and macular edema photocoagulated on several occasions, A) six days after cataract surgery: central thickness 264 µm, B) at five weeks: central thickness 330 µm, foveal cysts and C) at 12 weeks: central thickness 356 µm, cysts persist. Previous visual acuity 0,05, at day 6, 0.6, at one month 0.6 and at 3 months 0.3.
OCT: «Optical coherence tomography».

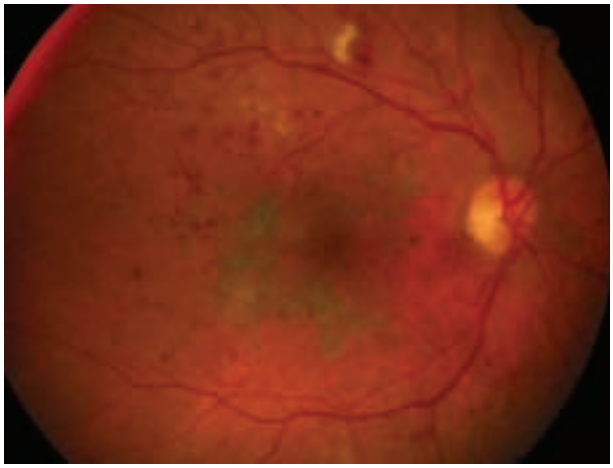

Fig. 2A: Retinography of the same patient of Figure One, 12 weeks after cataract surgery.

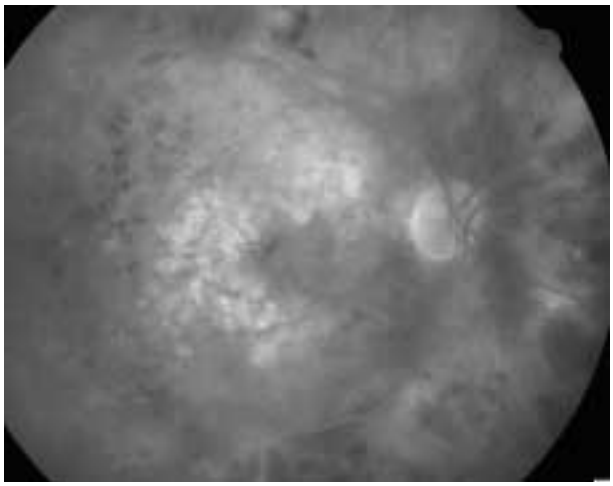

Fig. 2B: A in later stages shows important areas of ischaemia, marked hyperfluorescence in posterior pole with petal-shaped and honeycomb pattern.

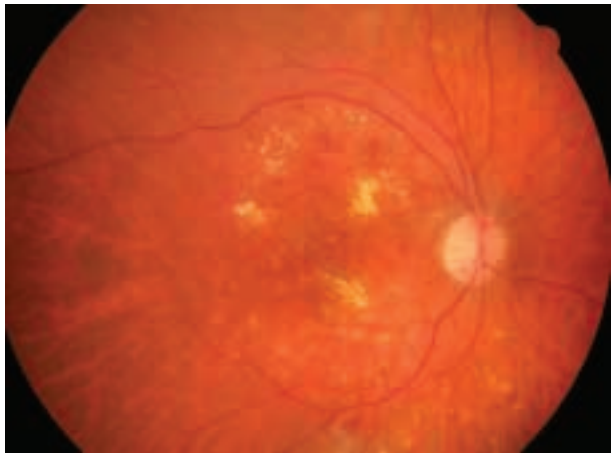

Fig. 3A: Retinography of a patient with diabetic retinopathy and macular edema which persisted even after photocoagulation, six days after cataract surgery with intra-vitreal triamcinolone injection.

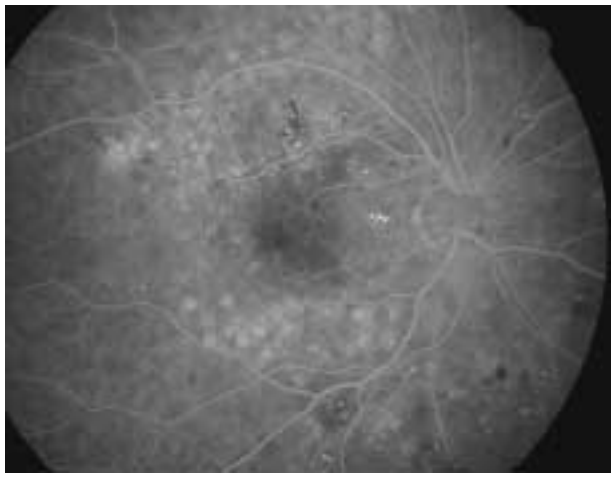

Fig. 3B: The angiography shows a moderate macular hyperfluorescencce in later stages.

which have allowed faster and cleaner surgery with much lower complication rates in comparison to intracapsular and even extracapsular techniques. Accordingly, aphakic or pseudo-phakic CME, formerly a frequent complication, seems more uncommon at present although potentially serious in chronic cases.

Referring only to CCME, the prevalence is of 2%-10% in intracapsular and of 1.2%-2% in extracapsular operations (2,3). In a series of 252 eyes on which uncomplicated phacoemulsification was performed, the prevalence was of 0% (8). In 1999, a publication showing data collected in 4 hospitals of four countries by the International Cataract Surgery Outcomes Study, showed a prevalence of CME as a complication of cataract surgery with phacoemulsification of 0.3% in the United States, of 1.4% in

Table IV. Mean and standard deviation (SD) of visual acuity with best correction for different groups, from 0 to 1 in the three checkups

Groups	Day 6	Five Weeks	12 Weeks
A	0.7 SD 0.25	0.84 SD 0.17	0.83 SD 0.2
B	0.54 SD 0.2	0.7 SD 0.2	0.69 SD 0.2
C	0.49 SD 0.27	0.62 SD 0.2	0.6 SD 0.2

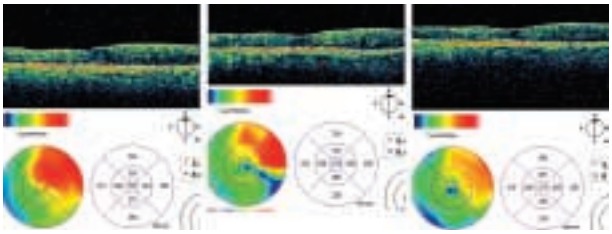

Fig. 4: OCT of the patient of figure 3: A) after six days, central thickness 321 µm, B) at 5 weeks: central thickness 233 µm, and C) at 12 weeks: central thickness 217 µm. Previous visual acuity 0.05, at day 6 0.4, after one month 0.5, after 3 months 0.6.
OCT: «Optical coherence tomography».

Canada, of 0.0% in Denmark and of 0.6% in Spain. The mean prevalence of this research is in the area of 0.4% (4).

In diabetic patients however there seems to be a greater predisposition to developing CME or to a worsening of existing ones, although not all studies have confirmed this tendency (14-18).

In this study, for the nondiabetic group of patients (group A) with 208 eyes, we did not identify any clinical CME case in the three-month follow-up, and only in four eyes (1.9%) we found an increase of the macular thickness via OCT. However, in the group of diabetic patients (group B), six eyes (14.2%) exhibited clinically significant CME and 12 (28.5%) exhibited an increase of macular thickness above 43 µm (2 SD of the mean baseline value of group A). In all the eyes with clinically significant edema, the OCT exhibited an increase of macular sickness both as the 5 and the 12 week checkup.

In the ten eyes that received a TAIV injection we observed a mean reduction of the central thickness of 67 µm at 5 weeks and of 77 µm at 12 weeks, with improvement of visual acuity in all eyes. We did not observe in this small series any complication or detect postop ocular hypertension, as in the small series of Benhamou and Karacorlu (19,20) of three and six eyes respectively with pseudo-phakic CME. In a series by Jonas (21) utilising a dosage of triamcinolone (25 mg), an IOP over 21 mmHg was seen in two of the five treated eyes (40%). This finding is similar to that of other authors in the treatment of diabetic macular edema with different dosages of triamcinolone (21-25). We have not found an explanation to this although it may be simply due to the low number of treated eyes.

The greater length of surgery and the higher number of cases with iris damages in the group of diabetic patients, the only intraop complication found in this series could be related to insufficient pupillar dilatation frequently found in diabetic patients. However, this parameter was not assessed preop in the study protocol.

As other authors (26-28), we believe that the absence of important complications, prophylaxis with AINEs and AIEs are factors that have an influence on the low prevalence of CME as occurred in our series.

We consider that the study of the variations of macular thickness with OCT is a good method to detect clinical and subclinical pseudo-phakic CME. This may be important for establishing treatments to avoid as far as possible the loss of visual acuity in these patients. It is also very useful in the differential diagnosis between diabetic CME, if it appears early in postop, and pseudo-phakic CM with a lower prognosis (15) and which appears typically one month after surgery. Obviously, this also has therapeutic implications (16,18).

One of the shortcomings of this study is perhaps the small number of eyes and a short follow-up, above all in the case of diabetic patients, which could mask the results.

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