MORPHOLOGICAL MACULAR CHANGES AFTER CATARACT SURGERY: RISK FACTORS

CAMBIOS MORFOLÓGICOS MACULARES TRAS CIRUGÍA DE CATARATAS: FACTORES DE RIESGO

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ABSTRACT

Objective: To analyze morphological macular changes after uncomplicated cataract surgery and their correlation with age and arterial hypertension.

Methods: Total macular volume (TMV), foveal volume (FOVOL) and foveal thickness (FOV) in patients who had undergone cataract surgery were measured using OCT3 Stratus® before surgery, the day after the intervention and one month later. The data were analyzed using SPSS 15.0 software.

Results: The study group was composed of 114 eyes from 114 patients. The mean TMV, FOVOL and FOV in the subgroup of patients with signal strength over 6 before cataract surgery were 6.59 (SD0.67) µm³; 0.16 (SD0.02) µm³ and 204.97 (SD29.79) µm. One month after surgery the measurements were TMV: 6.93 (SD0.56) µm³; FOVOL: 0.17 (SD0.06) µm³ and FOV: 218.07 (SD87.60) µm. We found statistically significant differences (P<0.05) in TMV, but not in FOVOL or FOV. The group of patients under 74 years showed a greater increase in TMV. Patients with arterial hypertension did not show an increase in TMV or FOV compared to patients without arterial hypertension.

RESUMEN

Objetivos: Analizar cambios en la morfología macular tras cirugía no complicada de cataratas y su correlación con la edad y la hipertensión arterial.

Métodos: Se realizaron medidas del volumen macular total (TMV), volumen foveal (FOVOL) y espesor foveal (FOV) con OCT3 Stratus® en pacientes sometidos a cirugía de catarata antes de la cirugía, el día después y un mes después de la misma. Los datos fueron analizados utilizando SPSS 15.0 software.

Resultados: Se incluyeron 114 ojos de 114 pacientes. Los valores medios de TMV, FOVOL y FOV en el subgrupo con Signal Strength por encima de 6, antes de la cirugía de catarata fueron 6.59 DE 0.67 µm³; 0.16 DE 0.02 µm³ y 204.97 DE 29.79 µm. Un mes después de la cirugía de cataratas las mediciones fueron TMV: 6.93 DE 0.56 µm³; FOVOL: 0.17 DE 0.06 µm³ y FOV: 218.07 DE 87.60 µm. Encontramos diferencias estadísticamente significativas (P<0.05) en el volumen macular total, no así en el espesor o volumen foveal. El grupo de pacientes menores de 74 años mostraron un mayor incremento en TMV. Los pacientes con hipertensión arterial no mostraron un...
Conclusions: We found a sub-morphological macular oedema one month after uncomplicated cataract surgery, with age being a risk factor for developing a greater increase in TMV. Arterial hypertension does not seem to be a risk factor for these changes (Arch Soc Esp Oftalmol 2009; 84: 605-610).

Key words: OCT III, cataract surgery, total macular volume, foveal volume, foveal thickness, macular oedema, arterial hypertension.

INTRODUCTION

It is well known that uncomplicated cataracts surgery with the phacoemulsification technique produces a number of macular morphological changes (1-5).

The determination of said morphological alterations has been made possible with the appearance of imaging diagnostic techniques such as Optical Coherence Tomography.

However, we found very few studies that assess the behavior of the macular and foveal volume with the OCT3 model (6,7) as well as the correlations of said macular alterations with particular characteristics of the patient. For this reason, we considered carrying out a study of the behavior of Total Macular Volume (TMV), foveal volume (FOVOL) and foveal thickness (FOV) in patients submitted to uncomplicated cataract surgery utilizing the OCT3 Stratus® model. Likewise, we studied the influence that age and high blood pressure could have on the above parameters.

SUBJECTS, MATERIAL AND METHODS

We studied 114 eyes of 114 patients who were scheduled for cataracts surgery in the Príncipe de Asturias University Hospital (HUPA) in the period from February 2006 to April 2007, after obtaining their informed consent both for the surgery and for obtaining OCT3 images.

A prospective study was designed with the following characteristics: masked observer, non-randomized, observational, comparative and self-controlled. The study was carried out after securing the approval of the Ethics Committee of the HUPA hospital.

The patients had to fulfill the following inclusion and exclusion criteria:

1) unhindered access to the study and not having an interest in its outcome; 2) signature of informed consent under the approval of the HUPA Ethics Committee; 3) Not exhibiting any pathology and a history of previous surgery of pharmacological treatments in the eye to be studied; 4) we included patients with refraction spherical refraction defects of up to ± 5 spherical dioptres and/or ± 3 cylindrical dioptres; 5) we excluded patients with intra- or post-surgery complications.

A sub-group was set up for patients with an image quality exceeding 6 as measured with the Signal Strength parameter.

An additional sub-group was set up for patients diagnosed with high blood pressure according to clinical criteria. We excluded patients with ophthalmoscopic signs of hypertensive retinopathy as well as those under anti-hypertensive diuretic treatment.

A sub-group was set up for patients under and over age 74, the mean sample value.

Phacoemulsification technique was carried out with implant of acrylic foldable lens implant (Acrosilf MA60BM, Alcon® Laboratories) with the same surgical instrument (Legacy 2000. Alcon® Laboratories) under topical anesthesia (Lidocaine 5%) and corneal incision. In all cases the surgeon was the same (M.A.T.G).

Measurements were taken in four stages under pupil dilatation conditions. The stages were: before surgery, the day after surgery and one .... after by the same observer (J.P.E). In each stage 3 measurements

Conclusions: Encontramos un edema macular sub-morfológico un mes después de la cirugía no complicada de cataratas, siendo la edad un factor de riesgo para desarrollar un mayor incremento en TMV. Por otro lado la hipertensión arterial no parece ser un factor de riesgo para que se produzcan dichos cambios

Palabras clave: OCT III, cirugía de cataratas, volumen macular total, volumen foveal, espesor foveal, edema macular, hipertensión arterial.
were taken, choosing the one which exhibited the best image quality. We utilized OCT III Stratus® with the Fast Macular Thickness image acquisition strategy. The images were analyzed utilizing the Macular Thickness/Volume Tabular application.

The results were statistically analyzed with the SPSS 15.0 statistical application. The T for student test was applied for paired samples in the study of changes in the TMV, FOV and FOVOL parameters after cataract surgery. The T for student test was applied for independent samples in the TMV and FOV studies in patients with arterial hypertension vis-à-vis patients without arterial hypertension, and in the TMV study based on each patient age.

RESULTS

The general group of the study comprised 114 eyes (65 right; 49 left) of 114 patients (52.7% male, 47% female), with a mean age of 71.6 SD 9.4 years.

The subgroup of patients with SS above 6 was of 27 (24%). In said subgroup, the mean values of TMV, FOVOL and FOV before cataracts surgery were 6.59 SD 0.67 µm³; 0.16 SD 0.02 µm³ and 204.97 SD 29.79 µm. The day after surgery, the values for said parameters were: TMV: 6.65 SD 0.62 µm³; FOVOL: 0.16 SD 0.02 µm³ and FOV: 199.24 SD 32.01 µm. One month after cataracts surgery, the measurements were: TMV: 6.93 SD 0.56 µm³; FOVOL: 0.17 SD 0.06 µm³ and FOV: 218.07 SD 87.60 µm. We did not find statistically significant differences in any parameter the day after cataracts surgery. We did find statistically significant differences (P<0.001) in TMV one month after cataract surgery, but not in the foveal thickness or volume (P>0.05).

In what concerns the patients of the general group (n=114) of ages between 62 and 81, two groups were formed taking as reference age 74 (under 74: n=54, mean age 68 SD 6 years; over 74: n=54, mean age 72.5 SD 3.5 years). The TMV measurements prior to surgery in patients under 74 after before and after surgery were of 6.52 SD 0.87 µm³ and 7.06 SD 0.83 µm³ respectively. As regards the group of patients over 74, the baseline TMV was of 6.47 SD 0.53 µm³, while one month after surgery TMV was 6.65 SD 0.54 µm³. We found no statistically significant differences between the values prior to the cataracts surgery between both groups (p=0.7). However, these differences were found one month later (P=0.01), with a TMV increase in both groups in an isolated manner.

The group of patients with high blood pressure comprised 46 subjects, selecting 46 control patients from the general group. The TMV values of hypertensive patients before surgery and one month thereafter were of 6.33 SD 0.72 µm³ and 6.47 SD 0.62 µm³ respectively. In the control group the values were, for baseline TMV baseline, 6.62 SD 0.74 µm³, while one month after surgery TMV values were: 6.98 SD 0.81 µm³. No statistically significant differences were found between both groups. As regards foveal thickness values, we did not find differences between both groups before or after surgery (table I).

DISCUSSION

The total macular volume of the patients subjected to cataracts surgery exhibited an increase one month after said surgery, with the foveal volume and thickness remaining constant during said period.

Van Jagow et al (6) studied 33 patients without previous macular pathology in which phacoemulsification and IOL implant in posterior chamber in one eye, taking the contralateral eye measurements as control. The inclusion criteria included a minimum SS of 5. The minimum and also the mean foveal thickness were monitored utilizing the Fast Macular Thickness OCT3 strategy. They found an increase in both thicknesses after cataract extraction (day 1 and week 6 in the case of mean minimum foveal thickness, day 1 and weeks 1 and 6 in the case of mean foveal thickness). The contralateral eye was taken as control group. They considered

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<th>Table I. Comparison foveal thickness at baseline and one month after cataracts surgery, in subgroup of control patients without high arterial pressure and subgroup of patients with high arterial pressure</th>
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<td>FOV</td>
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<td>(t for student, paired) level (P&lt;0.05)</td>
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<td>FOV0HTA Vs FOV0HC</td>
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<td>FOV2HTA Vs FOV2HC</td>
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FOX0HTA: Baseline foveal thickness in high arterial pressure patients; FOV0HC: Baseline foveal thickness in control group; FOX2HTA: foveal thickness one month after cataracts surgery in high pressure patients; FOV2HC: foveal thickness one month after cataracts surgery in control group.
that the mean foveal thickness measurement is more reproducible than the analysis of the mean minimum foveal thickness.

In our study we did not find a significant increase in the mean foveal thickness in patients intervened for cataracts when compared with the baseline value. This could be related to the post-surgery inflammation level present in the sample of said author.

Van Velthoven (2) published the existence of a significant increase in retinal thickness one month after cataract surgery in all the eyes of his study. However, when analyzing the obtained thickness changes by subgroups, statistical significance was found only in the posterior subcapsular cataracts group, which could be due to the small size of the sample in said subgroup analysis.

In turn, Ching et al (5) studied the prevalence of cystic macular edema and retinal thickness changes measured with OCT 2000 (Humphrey Instruments, San Leandro, CA, USA) after cataract surgery with phacoemulsification. Said study comprised 131 eyes of 131 patients and analyzed both the central retinal thickness and foveal thickness in the preop and 2, 4 and 8 weeks post-op.

They found statistically significant differences in the foveal thickness as well as in central retinal thickness when comparing pre-op values with all post-op values, excepting the central retinal thickness in the fourth week. Said differences show a trend towards lower thickness after surgery than pre-op. In the study author’s opinion, said results could be due to an error in pre-op measurements due to the presence of cataracts.

In our study we selected a group of patients with SS above 6 in all the measurements to minimize the possible artifact which the lens opacity may produce when obtaining results. On the other hand, it is postulated that changing the lens for an intraocular lens could involve a false interpretation by OCT 2000 which would yield a retina with smaller thickness.

Biro Z et al (4) presented a study which include 71 eyes of 71 patients, whose foveal and perifoveal thickness was measured with OCT (in a 3 mm and 6 mm diameter from the fovea) in the pre-op, day 1, 7, 30 and 60 post-op. In the design of the study they classified cataracts from I to III depending to lens transparency criteria. They did not find statistically significant increased foveal or perifoveal thickness in the first day after surgery. However, they did find a significant perifoveal thickening (3.0 mm and 6.0 mm) separately and including the minimum foveal thickness on day 7, 30 and 60 of the follow-up. Said authors described in this manner the existence of a sub-clinical perifoveal macular edema. There are methodological differences which could partially account for the difference in the results of this group and our own. On the one hand, they do not specify the OCT model utilized or the strategy for capturing images. However, they do specify the type of application utilized for analyzing images (Retinal Map Analysis), which differs from the application utilized in our study. In addition, they do not specify image quality criteria or the inclusion of the results to be analyzed.

The group of Cheng (8) carried OCT measurements one week after non-complicated cataract surgery in 80 eyes. The foveal thickness did not experience clinically significant thickening when compared with baseline measurements. On the other hand, said authors did correlate the amount of energy generated by phacoemulsification with post-surgery macular edema.

Perente et al (7), published a series of 110 eyes of 102 patients intervened for cataracts. They analyzed the behavior of the macular thickness in pre-op, day 1 after surgery followed by week 1, month 1 and month 6. To do this, they recorded the mean retinal thickness values obtained as well as volumetric analyses of the foveal centre and the superior, inferior, temporal and nasal macular quadrants. The same method was utilized to record the minimum foveal thickness. They utilized the LOCS II classification for cataloguing the cataract type and the measurements were taken with OCT 3.

The day after surgery, they found a slight reduction in the retinal thickness, which was attributed to the termination of the effect produced by the cataract as regards the dispersion of light and the ensuing improvement in the quality signal. Accordingly, they considered that the measurements in day 1 post-op provide true information about the retinal thickness. However, they did not specify which changes occur to produce said signal quality improvement in any of the available parameters (SS, Signal-Noise Ratio).

Therefore, taking our own results as starting point, we can conclude defining the existence of a macular edema one month after non-complicated cataract surgery in which foveal morphology remains intact, defining said edema as pre-cystic...
macular edema. However, these results are subject to the inclusion of a larger number of patients in order to obtain more reliable conclusions.

The patients under 74 years of age experienced a larger increase in the total macular volume than those over 74. This has not been verified previously in the literature. Perhaps the different behavior of macular morphology between both groups is due to a different pro-inflammatory capacity, which is greater in younger patients.

The patients with arterial hypertension without associated retinopathy did not exhibit a greater increase in total macular volume than non-hypertense patients. Therefore, arterial hypertension as a systemic condition does not seem to be a risk factor for giving rise to increased macular volumes. This fact has not been published previously in the literature.

REFERENCES


