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Phacoemulsification in previously vitrectomized patients: An analysis of the surgical results in 100 eyes as well as the factors contributing to the cataract formation

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PURPOSE. *To evaluate the safety and effectiveness of phacoemulsification with clear corneal incision in previously vitrectomized patients as well as factors affecting the development time and type of cataract occurring after pars plana vitrectomy (PPV).*
METHODS. *The authors conducted a prospective study of 100 consecutive eyes of patients who developed a cataract after PPV. Three groups were established based on the underlying vitreoretinal pathology. The main outcome measurements were intraoperative and postoperative complications and changes in best-corrected visual acuity (BCVA).*
RESULTS. *The median interval between PPV and phacoemulsification was 11.5 months. Patients with proliferative diabetic retinopathy required phacoemulsification earlier (p=0.018). Posterior subcapsular cataracts developed more frequently in patients <50 years (73.7%, p=0.000) and affected those who underwent vitrectomy primarily for complicated retinal detachment (48.8%, p=0.046). Intraoperative complications included posterior capsular tears (4%), luxated nucleus into vitreous (2%), and zonular dialysis (5%). Postoperative complications were vitreous hemorrhage (6%), retinal redetachment (4%), pupillary synechiae (6%), ocular hypertension (4%), and Seidel phenomenon (3%). Posterior Nd:YAG laser capsulotomy was required in 44% of eyes. BCVA was improved in 85% of cases at the end of follow-up (median, 15.5 months). Twenty-one patients with one functioning eye (61.9%) demonstrated visual improvement compared with 79 patients with bilateral vision (91.1%; p=0.003).*
CONCLUSIONS. *The technique allows stable improvement in BCVA through long follow-ups. It is more risky than in nonvitrectomized eyes. The visual results after phacoemulsification in vitrectomized eyes seem to be limited by retinal comorbidity and surgical complications. (Eur J Ophthalmol 2006; 16: 52-9)*

KEY WORDS. *Clear corneal incision, Phacoemulsification, Vitrectomized*

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INTRODUCTION

The incidence of cataracts in patients who have undergone pars plana vitrectomy (PPV) has increased because of the more widespread utilization of vitreoretinal surgery. Multiple predisposing factors in this kind of cataract formation have been reported, although none predominates (1-11). In this series, intravitreal gas, scleral buckling, age, and underlying vitreoretinal disease have been analyzed to determine if they play a significant role in the time of

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development and type of cataracts found. Phacoemulsification in vitrectomized eyes is surgically more challenging than in nonvitrectomized eyes, because of various anatomic changes within the eye that imply a higher risk for intraoperative complications (11).

The purpose of this prospective study was to evaluate the visual outcome and the intraoperative and postoperative complications after phacoemulsifi-cation with clear corneal incision in vitrectomized eyes.

A total of 100 eyes of vitrectomized patients have been evaluated (to our knowledge, the largest series published) (7, 11-19).

PATIENTS AND METHODS

One hundred eyes of white patients (58 men, 42 women) who had been previously vitrectomized (PPV) and subsequently developed a cataract were consecutively enrolled to undergo clear corneal phacoemulsification (when the cataract was considered to be the cause of visual loss), in Hospital Ramón y Cajal, Madrid.

The mean patient age was 60.35 years (SD±12.98; range, 20–78); 81% of the patients were older than 50 years.

Considering the underlying vitreoretinal pathology before vitrectomy, three groups were established (Fig. 1).

Thirty patients had proliferative diabetic retinopathy (PDR), including vitreous hemorrhage and tractional retinal detachment, 43 patients had nondiabetic retinal detachment (RD) complicated by vitreoretinal proliferation, and 27 patients had other vitreoretinal pathologies without RD (4 macular holes, 4 nondiabetic vitreous hemorrhages, 5 choroidal neovascular membranes, 4 epiretinal membranes, 8 diabetic or nondiabetic macular edema, and 2 central retinal vein occlusion).

Twenty-one patients were blind in their fellow eye (10 each in the group with PDR and RD and 1 in the group with other vitreoretinal pathologies). In 88 eyes, vitrectomy had been performed only once.

Based on the clinical appearance during slit-lamp examination, three morphologic patterns of cataracts were established: nuclear or corticonuclear (37 eyes), posterior subcapsular (35 eyes), and combined (28 eyes). Several factors that could have affected the time to development and types of cataract after vitrectomy were analyzed (underlying vitreoretinal disease, use of intravitreal gas, scleral buckling, and patient age [>50 or ≤50 years]).

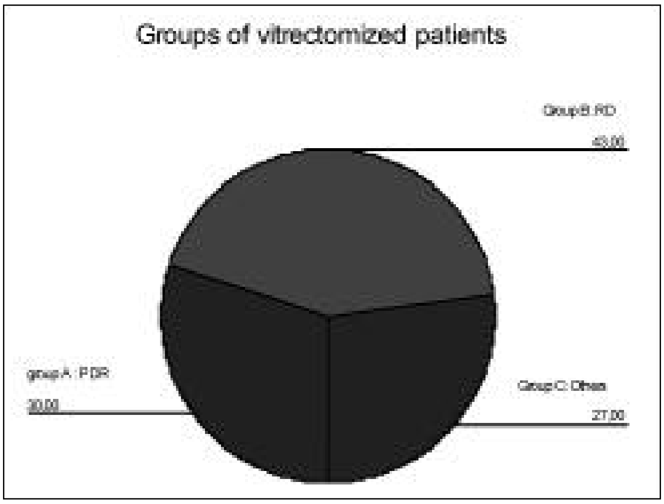

Fig. 1 - *Classification of patients who underwent vitrectomy by underlying vitreoretinal pathology. PDR = proliferative diabetic retinopathy; RD = retinal detachment; others = other vitreoretinal pathologies.*

Surgical technique

Before phacoemulsification, all patients signed an informed consent form approved by the hospital's Institutional Review Board. Surgery was performed under general anesthesia in 14% of the cases, retrobulbar anesthesia in 80%, and topical anesthesia in 6%. A Honan intraocular pressure reducer was not used preoperatively. Eyelashes were routinely isolated and topical 5% povidone-iodine solution was applied in the conjunctival sac before surgery. Phacoemulsification was performed in all cases by a single surgeon (A.P.-M.), with a clear corneal limbal 2.8-mm superotemporal incision. The viscoelastic used was Healon 10 mg/mL. No iris flexible hook retractors were needed, and only one capsular tension ring was used. A divide-and-conquer phacoemulsification technique was performed, in which the surgeon used a chopper to manipulate the nucleus and a peristaltic bomb ultrasound machine (Legacy, Alcon Laboratories, Ft. Worth, TX, USA) in burst mode.

The most common intraoperative difficulties found in vitrectomized patients were poor mydriasis, sudden changes in pupil size and anterior chamber depth, unstable posterior lens capsule, and zonular weakness. To minimize risk of intraoperative complications, we took special care in keeping the infusion bottle height at 80 cm, introducing 0.3 mL of 1:1000 epinephrine in 500 mL of balanced salt solution, reducing the ultrasound power about 30% less than usual, and keeping the maximum vacuum at 350 mmHg and the flow rate in 20–25 cc/min.

An intraocular lens (IOL) was implanted in 94 eyes: in the first 20 cases foldable lenses were not available, so rigid polymethylmethacrylate (PMMA) MZ60BD Alcon Laboratories IOLs were implanted in the capsular bag (16 cases) or ciliary sulcus (4 cases). After the introduction of foldable IOLs, hydrophobic acrylic foldable AcrySof MA60BM Alcon Laboratories IOL was implanted in the capsular bag in 62 cases, and silicone foldable SI-30NB Allergan Medical Optica IOL was placed in the capsular bag in 9 cases. PMMA MTA4UO Alcon Laboratories IOL was implanted in anterior chamber in 3 cases. The corneal incision was sealed with a 10/0 nylon suture in 83 eyes and non sutured in 17 cases. Following surgery, a corticosteroid and antibiotic solution was injected subconjunctivally.

All patients received topical broad-spectrum antibiotic for 1 week with tapering of the topical corticosteroids for 3 weeks after surgery. Best-corrected visual acuity (BCVA) was measured after vitrectomy, before phacoemulsification, 2 months after phacoemulsification, after posterior Nd:YAG laser capsulotomy, and at the end of the follow-up period.

VAs of 0.05 or higher were measured using the Snellen VA chart. For VA levels lower than 0.05 the following scale was used: 0.04 for counting fingers from 1 to 5 meters, 0.03 for counting fingers at 50 cm, and 0.02 for hand movement or light perception. Changes in BCVA after phacoemulsification are presented in the Results instead of absolute VA levels, because due to underlying vitreoretinal pathology, we found very low VA levels (under 0.05) after PPV in 24% of the cases. All the intraoperative and postoperative complications were recorded.

Statistical analysis was performed with the SPSS 10.0 program (SPSS Inc., Chicago, IL). The following tests were used: Pearson's chi square (χ^2) test to compare categorical variables, Mann-Whitney test to correlate a continuous variable with a categorical dichotomous variable, and Kruskal-Wallis test to correlate a continuous variable with a categorical variable of three or more categories.

Categorical variables were patient age ≤50 or ≥ 50 years, scleral buckling, use of intraocular gas, groups of vitrectomized patients, kind of cataracts, kind of IOL, Nd:YAG laser capsulotomy, and changes in BCVA. Continuous variables were time intervals between PPV and phacoemulsification or between phacoemulsification and Nd:YAG laser capsulotomy. Statistical significance was considered for $p<0.05$ values.

RESULTS

The median interval between vitrectomy and phacoemulsification was 11.5 months (range, 3 weeks to 12 years). Patients with PDR required cataract surgery earlier (median, 6.5 months) compared with patients with RD (median, 12 months) or those with other vitreoretinal pathologies (18 months) (p=0.018). Patient age (p=0.954), use of intraocular gas (p=0.503), scleral buckling (p=0.143), and the types of cataract (p=0.130) did not have a statistically significant effect on the interval between PPV and phacoemulsification.

Posterior subcapsular cataracts were the most frequently observed in patients with RD (48.8%; p=0.046). No predominant morphologic type of cataract was found in patients with PDR (36.7% nuclear or corticonuclear, 33.3% posterior subcapsular, and 30% combined). In the patients with other vitreoretinal pathologies, 55.6% were nuclear or corticonuclear (p=0.046). Scleral buckling (p=0.143) or the use of intraocular gas (p=0.140) had no statistically significant effect on the type of cataract. Patients ≤50 years developed posterior subcapsular cataracts in 73.7% versus only 25.9% of patients >50 years (p=0.000).

Intraoperatively, posterior capsular tears occurred in four cases (4%), nucleus luxation into the vitreous cavity in two cases (2%), and zonular dialysis in five cases (5%) (Tab. I).

At the end of the follow-up period (median, 15.5 months; range, 6 months to 7 years), 85 eyes (85%) had an improved BCVA compared with that prior to phacoemulsification. Sixty eyes (60%) improved three or more lines, 15 eyes (15%) improved two lines, and 10 eyes (10%) improved one line. Six eyes (6%) maintained the same VA they had before phacoemulsification, and nine eyes (9%) had worse BVCA (eight eyes lost one line, and one eye lost two lines) (Figs. 2 and 3). Table II shows absolute VA levels after PPV, before and after phacoemulsification. Thirty percent of patients achieved a BCVA of 0.5 or more on the Snellen chart at the end of the follow-up period.

Thirteen of the 21 patients who were blind in their fellow eye (61.9%) and 72 of 79 patients (91.1%) with bilateral vision had a BCVA improvement after phacoemulsification (p=0.003). In patients with no surgical complications during phacoemulsification surgery 94.1% achieved visual improvement, while in patients with a surgical complication only 65.65% achieved visual improvement (p=0.000).

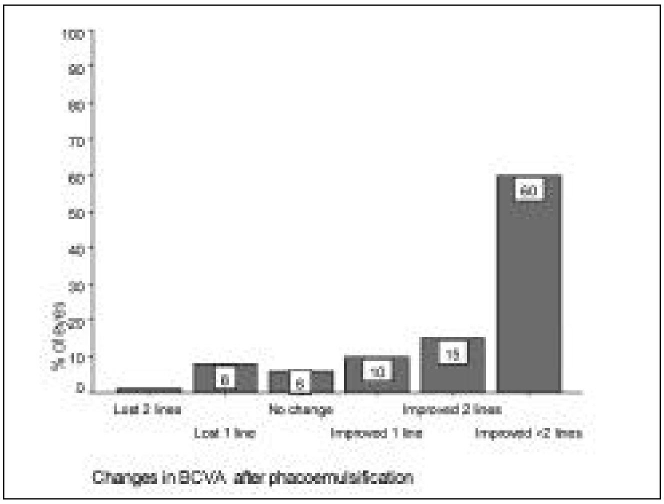

Fig. 2 - *Bar chart shows visual results after phacoemulsification.*

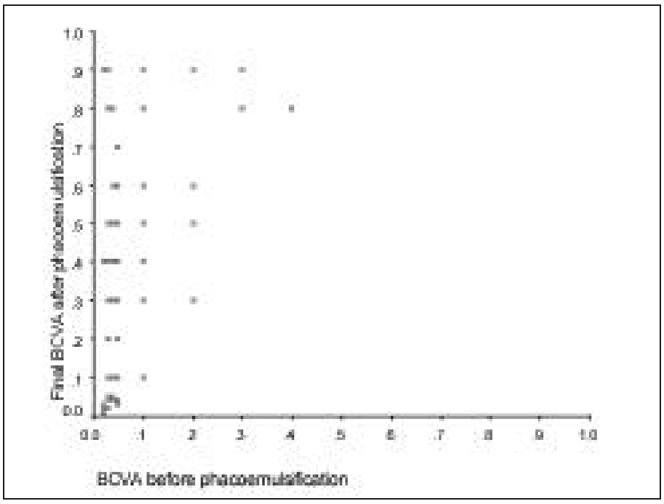

Fig. 3 - *Scattergram shows best-corrected visual acuity (BCVA) (Snellen chart) before phacoemulsification and intraocular lens implantation versus BCVA (Snellen chart) after phacoemulsification at the final follow-up visit.*

Posterior capsule opacification (PCO) was the most frequent postoperative complication and required posterior Nd:YAG laser capsulotomy in 44% of the eyes at a median interval of 4 months (range, 1 month to 6 years). The VA improved after the capsulotomy in 65.9% of the cases. No patient lost vision after the procedure, and no complications attributable to posterior capsulotomy were observed through the follow-up period.

Posterior capsulotomy was more frequently performed in the following subgroups: posterior subcapsular

TABLE I - INTRAOPERATIVE AND POSTOPERATIVE SURGICAL COMPLICATIONS

Complications		No. eyes (%)
Intraoperative		
	Capsular tear	4 (4)
	Luxated nucleus into vitreous cavity	2 (2)
	Zonular dyalisis	5 (5)
Postoperative		
	Vitreous hemorrhage	6 (6)
	Ocular hypertension	4 (4)
	Retinal redetachment	4 (4)
	Pupillary synechiae	6 (6)
	Seidel phenomenon	3 (3)

TABLE II - DEVELOPMENT OF ABSOLUTE BCVA

Visual acuity (Snellen chart)	Postvitrectomy, no. eyes (%)	Before phacoemulsification, no. eyes (%)	After phacoemulsification, final VA, no. eyes (%)
<0.05	24 (24)	60 (60)	18 (18)
≥0.05 to <0.5	69 (69)	40 (40)	52 (52)
≥0.5	7 (7)	0 (0)	30 (30)

BCVA = Best-corrected visual acuity

cataracts (71.4%) versus combined cataracts (35.7%) and nuclear or corticonuclear (24.3%) (p=0.000); RD group (62.8%) versus the PDR group (30%) or the group with other vitreoretinal pathologies (29.6%) (p=0.004); patients with scleral buckling (61.4%) versus patients without scleral buckling (30.4%) (p=0.002); and patients who had intraocular gas following PPV (53.5%) versus those without intraocular gas (20.71%) (p=0.003). There was no significant relationship between the need for posterior capsulotomy and age (p=0.175). Although the rate of PCO was greater with PMMA IOLs (75%) than with acrylic (38.7%) or silicone IOLs (44.4%), there were insufficient data to establish a statistically significant difference.

Other postoperative complications are shown in Table I. Vitreous hemorrhages developed in 6 cases (6%), pupillary synechiae in 6 cases (6%), retinal redetachment in 4 cases (4%), ocular hypertension in 4 cases (4%), and Seidel phenomenon in 3 cases (3%). No choroidal detachment, expulsive hemorrhage, endophthalmitis, corneal decompensation, or ocular hypotony were observed.

DISCUSSION

Cataract formation and progression are well-known consequences of PPV. Patients in this study underwent phacoemulsification a median of 11.5 months after PPV, which is included in the interval reported by other authors (3, 7, 13-15).

Similar to the data reported by Blodi and Paluska (3), subcapsular posterior cataracts developed more frequently in the RD group (p=0.046) and in patients 50 years of age or younger (p=0.000). It has also been reported that nuclear cataracts after PPV are more frequent in diabetic patients, and patients older than 50 years (10, 20). Interestingly, all patients in Group C (other vitreoretinal pathologies) were older than 50 years, and in this group corticonuclear was the predominant kind of cataract. On the contrary, in patients with PDR there was no predominant morphologic type of cataract.

For patients who have undergone PPV, performing phacoemulsification under local anesthesia might be safer (15, 17, 19, 21). Topical anesthesia could be used with caution in selected patients who are certain to be cooperative during surgery. Honan intraocular pressure reducer (17) or ocular manual massage before surgery are considered unnecessary and risky maneuvers in vitrectomized patients (22).

Although there are many authors who make the incision through a scleral tunnel (8, 13-15, 23, 24), in the current study a superotemporal clear corneal limbal approach was used in all the cases (11-13, 17, 19, 21). Technical difficulties encountered are caused by relative ocular hypotony, weaker zonules (9), unstable posterior lens capsules (13, 14, 25), poor mydriasis (26), and deeper anterior chambers. Thus, using low flow, low ultrasound power, and low bottle height is recommended to avoid ocular hypertension during surgery and minimize risk of intraoperative complications.

The ideal IOL is that with a large optical zone (6 mm) placed in the capsular bag, because it allows better exploration of the peripheral retina. Silicone IOLs are contraindicated in patients with intraocular silicone oil (11, 27, 28).

Many authors have reported the use of corneal or scleral suture (8, 13, 14, 23, 24). A 10/0 nylon suture was used to seal the corneal incision in all the 23 cases where a rigid PMMA IOL was placed, and in 60 other foldable IOLs to avoid a possible Seidel phenomenon or a route for the development of endophtalmitis, although theoretically a small corneal incision is self-sealing and the anterior chamber remains watertight. It has also been reported that vitrectomized eyes are less likely to develop endophthalmitis than non vitrectomized eyes (29). In fact, there was no case of endophthalmitis in the present study.

Intraoperative complications such as choroidal detachment, expulsive hemorrhage, or marked hypotony, which have been described with extracapsular cataract surgery in vitrectomized and nonvitrectomized eyes (22), did not occur in this series. Of the four posterior capsular tears (4%), two patients had developed a cataract immediately after the vitrectomy, suggesting that the posterior capsule could have been damaged during vitrectomy (19). Nevertheless, this rate of posterior capsular tears was lower than that reported for combined phacoemulsification-vitrectomy (18.1%) (30). Many vitrectomized patients present with a dense white plaque in the posterior capsule after vitrectomy (12, 13, 15, 19), which is hard to remove during phacoemulsification. In these cases performing a Nd: YAG laser capsulotomy after the surgery (15) might be a safer procedure, instead of a surgical posterior capsulorrhexis (31). The two cases of luxated lens into the vitreous cavity (2%) occurred after a capsular tear, and the nucleus was successfully removed during the same surgery by performing a pars plana posterior vitrectomy and nuclear reflotation into the anterior chamber with perfluorocarbon liquid, because the surgeon (A.P.-M.) is experienced in phacoemulsification and vitreoretinal surgery.

Similar to other studies (12-15, 17, 19, 21, 23, 24, 32), BCVA improved after phacoemulsification. Only 30% of the patients had a Snellen VA of 0.5 or higher, which seems low compared to those reported in other series by Chang et al (12) (77.4%) and Grusha et al (13) (63.6–72.2%). This can be attributable to the low VA levels that our patients presented with after PPV (only 5% had a BCVA of 0.5 or better), resulting from the underlying vitreoretinal pathology (Tab. II and Fig. 3). In those cases in which the retinal pathology limits the patient's VA, it is more significant to evaluate the changes (improvement or worsening of VA) after cataract surgery instead of considering absolute values of VA.

Three patients had decreased vision following phacoemulsification. Two of these patients had PDR and neovascular glaucoma and were blind in their fellow eye. The third patient had undergone a previous vitrectomy because of complicated RD, and had a retinal redetachment after phacoemulsification. We did not perform posterior Nd:YAG laser capsulotomy in any of these cases. Patients who were blind in their fellow eye had less potential for improving VA after phacoemulsification than patients with bilateral vision (61.9% versus 91.1%; p=0.003). This fact has been reported, and especially occurs in patients who have lost the fellow eye because of an underlying vitreoretinal pathology and not because of an accidental trauma (33).

In our series, partial pupillary synechiae occurred in six cases (6%) in the postoperative period, a lower percentage than reported after combined surgery (24, 30). More than half of those cases had PDR, and another case was HIV-positive. Vitreous hemorrhages occurred in six cases (6%), all of them during the first 2 months after phacoemulsification. Four patients were blind in their fellow eye and had undergone vitrectomy for PDR with iris neovascularization, and had a very low BCVA after vitrectomy. Only one of them achieved a BCVA of 0.1 after a second vitrectomy postphacoemulsification to clear the vitreous hemorrhage. In the other two cases, the hemorrhage resolved spontaneously with an improvement in the VA levels. All six cases had undergone phacoemulsification without intraoperative complications, and none required a posterior capsulotomy. This would suggest that the vitreous hemorrhage was not related to the surgical procedure but to the pre-existing vitreoretinal pathology. Four patients (4%) presented a retinal redetachment after phaco-emulsification. In these four cases phacoemulsification was performed in the first month after vitrectomy and perhaps they had a vitreoretinal traction that could not be evaluated and treated correctly because of the immediate cataract with which they presented.

PCO is a significant complication after cataract surgery both in vitrectomized and nonvitrectomized patients. Some authors report an incidence of PCO in nonvitrectomized eyes between 11.8 and 43% (26, 34, 35). After phacoemulsification in previously vitrectomized eyes, the incidence of PCO has been reported between 31.8% and 51%, after follow-up periods of 19 to 20 months (13, 15). In our series, a laser Nd:YAG posterior capsulotomy was performed in 44% of the cases at a median interval of 4 months after phacoemulsification. The incidence of PCO requiring capsulotomy was higher in the group of patients who had a PMMA IOL (75%) than in those with an acrylic IOL (38.7%) or a silicone IOL (44.4%). These results agree with those of Hollick et al (36) and Carbonez and Zeyen (37). No complications related to posterior capsulotomy were observed, such as macular edema (38, 39), retinal detachment, uveitis, endothelial damage (34), macular holes (40), or vitreous hemorrhages in vitrectomized patients (7).

We conclude that phacoemulsification with clear corneal approach in previously vitrectomized eyes resulted in VA improvement in 85% of the patients in our study. These results were limited by both the underlying vitreoretinal disease and the surgical complications that are more prevalent in vitrectomized eyes. Phacoemulsification is not exempt from risks, but these risks can be minimized by utilizing careful surgical technique.

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