SUBLUXATION OF THE LENS: ETIOLOGY AND RESULTS OF TREATMENT

LUXACIÓN DEL CRISTALINO: ETIOLOGÍA Y RESULTADOS

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ABSTRACT

Objective: To evaluate the indications for surgery, visual results and postoperative complications of pars plana vitrectomy (PPV), in patients with retained lens fragments in the vitreous cavity.

Methods: 86 eyes from 83 patients who underwent PPV for retained lens fragments at the Hospital Central de Asturias between April 1997 and December 2004 were reviewed. The average age was 68 years (12-90 years). Patients with proliferative diabetic retinopathy, maculopathy and inadequate follow-up examination (less than 3 months) were excluded. The results have been analysed according to the etiology of the subluxation.

Results: The average follow-up time was 32.5 months (6-73 months). The most common cause for subluxation of the lenses was cataract surgery and trauma. In 48.15% an intraocular lens was implanted. The average preoperative visual acuity (VA) was 0.06 (logMAR 1.0) and postoperative VA 0.4 (logMAR 0.4). 61.7% of the eyes had increased preoperative intraocular pressure, whereas only 32 eyes (39.5%) had this postoperatively. The most common intra-operative complications were retinal tears (4) and retinal detachment (1). The most common postoperative complications were retinal detachment (3) and bullous keratopathy (2).

RESUMEN

Objetivo: Evaluar las indicaciones, resultados funcionales y complicaciones de la cirugía de vitrectomía pars plana (VPP), en el manejo de la luxación a cámara vítrea del cristalino.

Métodos: Se han revisado 86 ojos de 83 pacientes con una media de edad de 68 años (rango 12-90 años) tratados mediante VPP de luxación posterior del cristalino que se han realizado en nuestro Servicio entre abril de 1997 y diciembre de 2004. Se han excluido los pacientes con retinopatía diabética proliferativa, patología macular previa y aquellos en los que no se ha podido completar un seguimiento mínimo de 3 meses. Se han analizado los resultados según la etiología de la luxación.

Resultados: El tiempo medio de seguimiento fue 32,5 meses (6-73 meses). La etiología más frecuente de la luxación fue la secundaria a cirugía de cataratas, seguido de los traumatismos. Se ha colocado lente intraocular en el 48,15% de los casos. La agudeza visual (AV) media precirugía fue 0,06 (logMAR 1,0) y la postquirúrgica 0,4 (logMAR 0,4). 61,7% presentaban hipertensión ocular preoperatoria. Como complicaciones quirúrgicas cabe destacar cuatro casos de roturas retinianas y un caso de desinserción retiniana, y entre las postquirúrgicas tres casos de desprendimiento de retina (3,7%) y dos casos de descompensación endotelial (2,5%).

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Conclusion: PPV is a relatively simple and low risk technique, which allows good visual restoration and minimizes complications of the subluxated lenses (*Arch Soc Esp Oftalmol* 2006; 81: 471-478).

Key Words: subluxated lens, vitrectomy, pars plana.

La hipertensión ocular postquirúrgica estuvo presente en 32 casos (39,5%).

Conclusión: La VPP es una técnica relativamente sencilla, aunque no exenta de riesgos, que nos permite buena recuperación visual y minimizar las complicaciones que conlleva la luxación posterior del cristalino.

Palabras Clave: luxación, cristalino, vitrectomía, pars plana.

INTRODUCTION

Dislocations of the lens can be classified as congenital (ectopia lentis) and acquired (1). *Ectopia lentis* can emerge in homo cystinuria (bilateral subluxation of the inferonasal lens), in the Marfan syndrome (subluxation of the superior and bilateral lens) and in the Weill-Marchesani syndrome (microspherophakia).

The acquired dislocations of the lens can be traumatic (the most frequent cause) (2), spontaneous (secondary to other ocular pathologies) and post-surgical. Spontaneous luxations occur due to rupture of the zonular fibres as a consequence of degenerative and inflammatory in long-standing glaucoma, high myopia, hypermature cataract, retina detachment (RD) and pseudoexfoliation syndrome (1,3) although the latter is much less frequent (2,3). Cataract post-surgical luxations due to rupture of the posterior capsule are relatively frequent (4) and in many cases entail the collapse of a nuclei fragment which usually does not exceed half (a full collapse is rare).

Typically, the extraction of dislocated lenses in vitreous required complex surgical techniques (2) not free of complications. This conditioned the prescription of surgery in cases where complications arose and/or vision was reduced due to permanent obstruction of the optical axis. Even though surgical techniques have evolved considerably, intervention continues to have a reserved visual prognosis dependent on the development of complications. The purpose of this paper is to assess the etiology, functional results and complications of vitrectomy pars plana (VPP) associated to phaco-fragmentation in some cases in the management of lens luxation in the vitreous chamber.

SUBJECTS, MATERIAL AND METHODS

A retrospective study was made of posterior lens dislocation treated with VPP in our service between April 1997 and December 2004. The Hospital Central of Asturias is a reference hospital for retina-vitreous pathologies in the Principality of Asturias. We excluded patients with proliferative diabetic retinopathy, previous macular pathology and those unable to complete a minimum follow-up of 3 months. The results were analyzed according to the etiology of the dislocation.

Surgery was performed on 86 eyes of 83 patients with a mean age of 67,63 (range, 12-90), standard deviation (SD) 16,54. Of these, 39 patients (46,99%) were male and 44 women (53,01%). In 41 cases (47,67%) right eyes (RE), and in 45 cases (52,33%) left eyes (LE).

In 48 eyes (55,81%) surgery was prescribed due to luxation of lens fragments after phacoemulsification, 27 eyes (31,40%) had suffered previous traumatism, 6 cases had a spontaneous luxation (6,98%) and in five cases (5,81%) the patients had lens ectopiae.

The evolution period since the emergence of the condition to the surgery varied between 1 and 120 days, with a mean of 31,80 days and SD of 26,87 days, with the exception of 4 cases who exhibited congenital luxation and one eye which exhibited traumatism 10 years later.

Prior to surgery, 49 cases (56,98%) exhibited high IOP (33 post-phacoemulsification, 12 post-traumatism and 4 with spontaneous luxation), three eyes had glaucoma (all with spontaneous lens luxation), 47 (54,65%) had corneal edema in varying degrees (35 post-phacoemulsification, 11 post-trau-

Table I. Preop findings of lens luxations based on etiology

Preop findings	Etiology			
	Post-phacoemulsification (48 eyes)	Post-traumatism (27 eyes)	Spontaneous luxation (6 eyes)	Lens Ectopia (5 eyes)
Ocular hypertension*	33 (68,75%)	12 (44,44%)	4 (66,67%)	0
Glaucoma	0	0	3 (50%)	0
Uveitis	18 (37,50%)	4 (14,81%)	1 (16,67%)	0
Corneal Edema	35 (75,92%)	11 (40,74%)	1 (16,67%)	0
RD	2 (4,17%)	5 (18,52%)	0	0
Pseudoexfoliation	0	0	1 (16,67%)	0
Myopia Magna	0	0	1 (16,67%)	0

* Increase of IOP secondary to the inflammatory process.

matism and one with spontaneous luxation), 23 cases (26,74%) exhibited uveitis (18 post-phacoemulsification, 4 post-traumatism and one with spontaneous luxation), and in seven cases (8,14%) RD was associated (2 postphacoemulsification and 5 post-traumatism). The preop findings of lens luxations, based on their etiology, are shown in table I.

The data were analyzed with a database application (SPSS, version 11.00, SPSS Inc., Chicago, Illinois, USA) utilizing Mann Whitney's U statistical method and Chi Square for independent samples (statistically significant $p < 0,05$).

Surgical technique

In cases with IOP increase treatment was established to lower the pressure together with anti-inflammatory treatment (topical and systemic).

Surgery was performed under peribulbar anesthesia except in three cases (3,49%) due to the age of patients (12 and 15 years) and consisted in VPP at 3mm from the scleral-corneal limbus, release of the pupillar area vitreous and vitreo-retinal adherences to the lens nucleus. In seven cases liquid perfluorocarbon (PFCL) was injected in seven

cases (8,14%) through a silicone tip cannule under the lens in order to avoid damages above the retina of hard lenses or to refloat and extract it through the anterior chamber (2 cases). In the rest of patients we performed phacofragmentation or manual fragmentation and suction with vitreotome depending on the hardness of the nucleus. In 23 cases (26,74%) posterior chamber intraocular lens (PC IOL) was implanted in the sulcus (when the rest of capsulorhexis was sufficient); in 19 cases (22,09%) anterior chamber intraocular lens was implanted (AC IOL) with 44 eyes (51,16%) remaining aphakic. We did not place any IOL sutured in the sulcus (table II).

In patients exhibiting RD or retinal rupture expansible gases were utilized as post-surgical tampons: SF6 and C3F8, and IOL was not inserted.

RESULTS

The most frequent indication of surgery was post-phacoemulsification luxation of lens fragments (55,81% of cases) followed by traumatism (31,39%). Prior Visual Acuity (VA) ranged between 0,01 (perception of light; logMAR 1,0) and

Table II. IOL Implant during VPP

IOL	Etiology			
	Post-phacoemulsification (48 eyes)	Post-traumatism (27 eyes)	Spontaneous luxation (6 eyes)	Lens ectopia (5 eyes)
PC	23 (47,92%)	0	0	0
AC	10 (20,83%)	8 (26,93%)	1 (16,67%)	0
Aphakic	15 (31,25%)	19 (70,37%)	5 (83,33%)	5 (100%)

0,7 (logMAR 0,1), mean 0,07 (logMAR 1,0) and SD of 0,13. The preop mean VA in postphacoemulsification lens luxations in vitreous chamber was of 0,05 (logMAR 1,0; SD 0,09), post-traumatism 0,09 (logMAR 1,0; SD 0,13), due to spontaneous luxation 0,04 (logMAR 1,0; SD 0,06) and in lens ectopiae the values were 0,23 (logMAR 0,6; SD 0,28).

The mean post surgical VA was of 0,44 (logMAR 0,3), range 0,01-1,0 (logMAR 1,0-0,0) and SD 0,26 and equal or above 0,5 (logMAR 0,3) in 43 cases (50%). Analyzed on the basis of etiology, the mean postop VA in post-phacoemulsification lens luxations to vitreous chamber was of 0,46 (logMAR 0,3; SD 0,26), of which 56,25% with vision equal to or above 0,5 (logMAR 0,3). In patients with previous traumatism, the VA was of 0,36 (SD 0,26), and only 37,04% achieved vision equal to or above 0,5, slightly below the first case but not statistically significant ($p=0,097$). This is due to the fact that these patients exhibited other retinal pathologies associated to traumatism (macular involvement with macular scars). In the case of spontaneous luxations, the mean post surgery VA was of 0,56 (logMAR 0,3; SD 0,34), and 0,47 (logMAR 0,3; SD 0,19), in lens ectopiae (table III). The follow-up time ranged between 3 and 73 months, mean 31,13 months with SD of 20,00. The mean final VA of patients intervened before 30 days (48 cases) was of 0,43 (logMAR 0,4) and 0,41(logMAR 0,4) for

patients with over 30 days evolution (38 cases), these differences not being statistically significant ($p=0,746$).

The complications which emerged during surgery comprised 4 cases (4,65%) of retina ruptures (one in postphacoemulsification luxation, two in post-traumatic luxation and one with spontaneous luxation), one case (1,16%) of corneal ulcer (in post-traumatic luxation) and one with iatrogenic iridectomy, one superior retinal deinsertion and one case of accidental puncture during anesthesia in postphacoemulsification luxation (table IV). The surgical complications comprised three eyes (3,49%) with RD (all in the group of postphacoemulsification luxation, none in the other groups, $p=0,29$), two eyes (2,32%) with endothelial decompensation (1 in postphacoemulsification luxation and one in spontaneous luxation), and one eye (1,16%) with de-centering of the IOL (in the group of post-traumatic luxation) which caused monocular diplopia, making it necessary to reinsert the IOL. In patients with RD we carried out cerclage surgery to complete the peripheral vitrectomy, achieving in all cases the reapplication of the retina.

Post surgical high IOP appeared in 32 eyes (37,21%) (18 in postphacoemulsification luxation, one in post-traumatic luxation and three in spontaneous luxation), wherein eleven eyes (34,37%) were controlled with medical treatment and at the time of writing they did not require said treatment.

Table III. Preop and postop VA according to etiology

AV	Etiology			
	Post-phacoemulsification (48 eyes)	Post-traumatism (27 eyes)	Spontaneous Luxation (6 eyes)	Lens Ectopia (5 eyes)
Preop	0,05 (SD 0,09)	0,09 (SD 0,13)	0,04 (SD 0,06)	0,23 (SD 0,28)
Postop	0,46 (SD 0,26)	0,36 (SD 0,26)	0,56 (SD 0,34)	0,47 (SD 0,19)

Table IV. Intraop complications in lens luxation surgery based on etiology

Complications In surgery	Etiology			
	Post-phacoemulsification (48 eyes)	Post-traumatism (27 eyes)	Luxation us Luxation (6 eyes)	Lens Ectopia (5 eyes)
Retina rupture	1 (2,08%)	2 (7,41%)	1 (16,67%)	0
Iatrogenic iridectomy	1	0	0	0
Retina deinsertion	1	0	0	0
Anesthesia puncture	1	0	0	0
Corneal ulcer	0	1 (3,70%)	0	0

Table V. Postsurgical complications in VPP due to lens luxation based on etiology.

Post surgery Complications	Etiology			
	Post-phacoemulsification (48 eyes)	Post-traumatism (27 eyes)	Spontaneous Luxation (6 eyes)	Lens ectopia (5 eyes)
RD	3 (6,25%)	0	0	0
Endothelial Decompensation	1 (2,08%)	0	1 (16,67%)	0
High IOPO	18 (37,50%)	11 (40,74%)	3 (50%)	0
IOL de-centering	0	1 (3,70%)	0	0

The rest of cases (21 eyes, 65,63%) at present require medical treatment for controlling IOP. One case (1,23%) evolved towards optical atrophy. If we consider the patients who had been submitted to phacoemulsification, 18 (37,50%) exhibited high IOP but at this time only ten eyes (18,75%) need medical treatment and of these, two cases were previously diagnosed with chronic simple glaucoma. When analyzing this in patients with previous traumatism, it was seen that 11 patients (40,74%) exhibited high IOP and, at present, the percentage of patients with medical treatment is higher, 8 eyes (29,63%) which does not represent a statistically significant difference ($p=0,62$).

Postsurgical complications of lens luxation according to their etiology are shown in table V.

DISCUSSION

Lens posterior luxation accounts for 20-40% of all lens luxations (2). Within non-surgical luxation causes, the most frequently found is traumatism (2,4), followed by spontaneous luxation and lens ectopias. In these cases, the entire lens is luxated. We have verified this in our series, where traumatism represents 71,05% of cases.

Considering post-surgery luxations, the most frequent ones emerge after cataract surgery, mostly due to lens fragments (5). The frequency of posterior capsule rupture during cataract surgery (phacoemulsification) ranges between 0 and 6.25% according to the research we have consulted (6,7). Some papers reach 10% in previously vitrectomized eyes (8). In many of these cases, fragments of the nucleus fall into the vitreous cavity. In our series, this was the most frequent indication of vitrectomy.

Even though it has always been accepted that tolerance of luxated lenses in the vitreous was very good, we believe the complications which

may arise such as uveitis, corneal edema, glaucoma, hemorrhage of the vitreous, RD and cystoid macular edema, which cause a sharp reduction of VA, thus making it adequate to prescribe extraction of nuclei via vitrectomy (4,9,10). The best time for performing said vitrectomy has not been clearly established because several studies have proved an association between the vitrectomy timing and visual results (5). However, further studies suggest that early vitrectomy can led to better visual results and lower rates of post-surgery glaucoma (4,9,10). In our series we did not find a significant association between mean final VA and the evolution time.

In what concerns the surgical techniques, as other authors (2,4,9) we consider that in soft or medium hard lenses it is not necessary to associate the use of liquid perfluorocarbons (LPFC) during the vitrectomy because the manual or phacofragmentation in the vitreous cavity is quite safe, simple and effective for extracting the dislocated lens. However, in the case of hypermature or very hard lenses, it may be necessary to utilize LPFC for refloating them in order to reduce the impact of the surgery, although neither the LPFC nor phacofragmentation will reduce the risk of RD or result in better visual acuity (4,5,9).

A PC IOL was implanted in 23 cases, all in patients who had prior phacoemulsification surgery and who had adequate capsular support. In 19 cases an AC IOL was fitted and the rest of cases remained aphakic. We did not fit in IOLs in patients who had a RD associated or retinal ruptures and with whom expandable gases were utilized. No PC IOL was sutured to the sulcus because, even though it is not an excessively complicated technique and can produce good visual results (2,11) it is also frequently associated to cystoid macular edema, vitreous hemorrhage, RD and epiretinal membrane (11) in eyes with important previous pathology.

Satisfactory mean postsurgical VA numbers were achieved (0,44; logMAR 0,4), of which 50% have a VA equal to or better than 0,5 (logMAR 0,3). This result is similar to other series (4,10).

When analyzing the mean postop VA in lens post-phacoemulsification luxations in the vitreous chamber according to etiology, the result is 0,46 (logMAR 0,3), post-traumatic 0,36 (logMAR 0,5), spontaneous luxations 0,56 (logMAR 0,3), and 0,47 (logMAR 0,3), in lens ectopiae. In these two etiological groups we find very few cases, although it is accepted that they have a better prognosis than traumatic ones (2).

Some complications emerged during surgery (retina rupture, corneal ulceration, superior retina detachment, iatrogenous iridectomy and anesthetic puncture) which are not referred by other authors (2,4).

An evaluation of the post-surgery complications shows that the most frequent one is increased IOP, which occurred in 37,21% of cases (32 eyes). IOP returned to normal values in 11 eyes (34,37%) after a period (1 week-2 months) of specific medical treatment which was subsequently withdrawn. At present 21 eyes (65,63%) remain in medical treatment. No vitrectomy post-surgery filtering surgery has been carried out. In one patient (1,16%) the condition evolved to optical atrophy. In other papers we have read that the most frequent post-surgery complication was not increased IOP but cystoid macular edema (9), corneal edema (10) or RD (4).

The most serious post-surgery complication was RD, which occurred in three eyes (3,49%), a lower number than other series (2,4,11). RD is the most frequent cause of poor visual recovery in these patients. The risk of RD has been correlated to the manipulation of the vitreous by the surgeon in the anterior pole attempting to reach the dislocated lens fragments (9). In any case, vitreous-retinal surgeons must also avoid traction of the vitreous in these cases.

Two cases were found (2,33%) of endothelial decompensation, in one case a patient submitted to phacoemulsification surgery without IOL implant, and the other was a patient with spontaneous luxation with very rigid cataract and, as at that time we did not have the phacofragmenter available we performed a manual fragmentation but, as it was impossible to use the vitreotome to aspirate the fragments, these were refloated with LPFC and extrac-

ted through the anterior chamber, thus engaging in a long and complicated intervention. We have found in the literature cases of temporary post-surgery corneal edema (2) but no cases of endothelial decompensation.

Although other series mention cystoid papillary edema as a post-surgery complication (2,4,9), we did not encounter any case.

However, one case (1,16%) was considered as a post-surgery complication due to a de-centering of the IOL which caused monocular diplopia. According to our results, it can be concluded that the most frequent cause of luxation of lens fragments in vitreous chamber was cataract phacoemulsification surgery and eye traumatism the cause of complete lens luxation. The post-surgery visual results are very good (mean VA 0,44 (logMAR 0,4) $\pm$ 0,26 and $\pm$ 0,5 (logMAR 0,3) in 50% of cases) and in our series there are not significant differences in AV if the surgery is carried out early or deferred (30 days). On the other hand, we did not find statistically significant differences in post-surgery results (functional and complications) in patients who had been submitted to phacoemulsification and in patients who had suffered previous traumatism. Therefore, vitrectomy with phacofragmentation in vitreous cavity, without LPFC associated, is a safe, simple and effective technique for extracting luxated lenses with good functional results and low complication rates.

However, high IOP may persist after said interventions.

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