

DIPLOPIA AFTER SUB-TENON'S ANESTHESIA FOR CATARACT SURGERY

DIPLOPIA POSTCIRUGÍA DE CATARATA CON ANESTESIA SUBTENONIANA

MERINO P¹, MUÑOZ-SANZ N², GÓMEZ-DE-LIAÑO P², GUTIÉRREZ-PARTIDA B², SEIJAS-LEAL O²

ABSTRACT

Purpose: To study the clinical signs, treatment and prognosis of strabismus after sub-Tenon's anesthesia for cataract surgery.

Methods: Eight patients without previous strabismus developed incomitant diplopia immediately after cataract surgery; the left eye was affected in five patients and the right eye in three. Restrictive strabismus was diagnosed with the cover test, prisms, and active and passive ductions in all cases. In seven cases the deviation was vertical and in one patient it was horizontal. The average deviation was 17.5 S.D. 9.84 (range 5-35) prismatic dioptres in primary position. The deviation increased looking upward in seven cases, and looking sideways to the left in the other. It was considered to be a good result if the diplopia disappeared after treatment.

Results: Botulinum toxin was the first treatment applied in four patients, but only one showed a good response and required no further therapy. Strabismus surgery was required in four cases, and prisms were adapted in three. Three patients required two strabismus operations. A good result was achieved in all cases, with the average time interval being 10.12 (SD 5.5) months.

RESUMEN

Objetivo: Estudiar las características del estrabismo secundario a la cirugía de catarata con anestesia subtenoniana; su tratamiento y pronóstico.

Método: Ocho enfermos sin estrabismo previo presentaron diplopía inmediatamente después de la cirugía de catarata; cinco de ojo izquierdo, tres de ojo derecho. La exploración con cover test, prismas y ducción activa y pasiva mostró estrabismo restrictivo: siete de componente vertical y uno horizontal. La desviación media fue de 17,5 DE: 9,84 dioptrías prismáticas (rango 5-35) en la mirada al frente. La posición máxima de desviación fue en superversión en siete, y en levoversión en otro. Todos tenían diplopía invalidante. Se considera buen resultado si desaparecía la diplopía con el tratamiento.

Resultados: Cuatro casos recibieron tratamiento quirúrgico, en uno sólo se inyectó toxina botulínica y en tres se pusieron prismas. La toxina botulínica se empleó como primera opción en cuatro casos y sólo fue eficaz en un enfermo. De los cuatro casos operados, tres necesitaron dos cirugías y un paciente sólo un tiempo quirúrgico. Se consiguió buen resultado en los ocho pacientes tratados. El tiempo medio de evolución fue de 10,12 DE: 5,46 meses.

Received: 7/7/05. Accepted: 17/3/06.

Eye Motility Section. Ophthalmology Dept. HGU Gregorio Marañón. Madrid. Spain.

¹ Ph.D. in Medicine.

² Graduate in Medicine.

Correspondence:

Pilar Merino Sanz

C/. Marqués de Lozoya, 14, Esc. 1, 14-B

28007 Madrid

Spain

E-mail: jacoboy@telefonica.net

Conclusions: Sub-Tenon's anesthesia may result in restrictive strabismus and incomitant diplopia which does not resolve spontaneously. The inferior rectus is the most commonly affected muscle. Strabismus surgery is required to resolve the diplopia in half of the cases. Good results have been achieved in all patients (*Arch Soc Esp Oftalmol* 2006; 81: 141-146).

Key words: Sub-Tenon's anesthesia, diplopia, restrictive strabismus, cataract surgery.

Conclusiones: La anestesia subtenoniana puede provocar un estrabismo restrictivo y una diplopía muy invalidantes que no se resuelven espontáneamente. El recto inferior es el músculo más frecuentemente afectado. La cirugía muscular es necesaria para resolver el problema en la mitad de los casos. Se consiguen buenos resultados quirúrgicos.

Palabras clave: Anestesia subtenoniana, diplopía, estrabismo restrictivo, cirugía de catarata.

INTRODUCTION

Diplopia after cataract surgery is due to several factors (1-3): previous strabismus due to systemic diseases such as hyperthyroidism which go unnoticed; alterations of binocular vision caused for example by a prolonged cataract occlusion; optical causes such as anisometry; and finally, surgical traumatism of extra-ocular muscles and orbital tissue due to anesthesia. Among the affected extraocular muscles published in literature, the inferior rectus is involved more frequently due to its position vis-a-vis the needle of the retro-bulbar or peribulbar anesthesia (2,4-6). The majority of research published in literature refers to a higher prevalence of vertical strabismus and (among these) hypotropies instead of hypertropies (2,6-8). Retro-bulbar and peri-bulbar anesthesia are the types of anesthesia that cause the problem (7). According to some authors, sub-Tenon anesthesia would not involve extraocular muscles and it constitutes a safe anaesthetic technique (3,6,9).

In this article we describe restrictive diplopia and strabismus caused by sub-Tenon anesthesia utilised in cataract surgery as well as the results of its treatment.

SUBJECTS, MATERIAL AND METHODS

Since 2001, 8 patients were referred to the Eye Motility Section of the Ophthalmology Department for diplopia immediately after cataract operations. In all cases, sub-Tenon infiltration was used with blunt cannule with a mixture of 5% lidocaine (Lidocaína HCl. B. Braun Medical, S.A.) and phentanyl

as anesthetic technique. The volume was 2-4 ml. The sub-Tenon injection was made by opening the conjunctiva and Tenon in the lower nasal sector at the level of the equator. The surgery report does not indicate anaesthetic events such as blood clots, haemorrhage or conjunctival chemosis.

All patients had been operated for cataracts by means of phacoemulsification and introduction of intraocular lens without surgical complications. All were subjected to detailed anamnesis and none referred antecedents of strabismus, diplopia or amblyopia as well as absence of systemic diseases such as a hyperthyroidism, miastenia gravis, etc, with the exception of one patient who had diabetes.

All the cases referred ocular deviation accompanied by double vision when withdrawing the eye bandage in the first cure.

The mean age was 75.5 years (range 71-81). Of the 8 cases, five were women and three men, in five the left eye was affected and in three the right eye. A study was made with cover test and prisms for measuring the deviation in the primary gaze position, in supraversion and infraversion, registering the maximum deviation. Active duction was recorded classifying the limitation of movement between 1 and 3 plus signs (+), while passive duction was studied in the practice, confirming the result in surgery if the patient was operated for strabismus.

All patients were asked about the presence of diplopia and if it allowed them to carry on with their normal activity, defining it as invalidating if it did not.

The existence of torticollis was explored while measuring binocular visual acuity at a distance of 6 m, and the Hess-Lancaster screen was taken.

The time elapsed from the appearance of diplopia to the application of our first treatment (medical or surgical) was recorded. Surgical treatment was con-

sidered if the vertical deviation was of >8 diopters and horizontal deviation of >12 diopters, if more than six months had elapsed since the beginning of diplopia and if the patient accepted surgery without the guarantee of eliminating double vision. If the deviation was small, if the time elapsed was lower or if the patient rejected surgery, the treatment comprised prisms or botulin toxin.

Surgery was performed with topical anesthesia for intraop assessment of the muscle condition and because in most cases general anesthesia was not indicated due to the advanced age of the sample.

The result was considered to be good if the diplopia disappeared after the treatment, either medical or surgical.

RESULTS

Out of the eight cases object of this study, seven had vertical deviation (hypotropy) and one case had horizontal endotropy (table I).

The mean deviation was 17.5, SD: 9.84 diopters in primary gaze position (range, 4-35). One patient got worse after one month and went from 4 to 12 diopters, and another one got worse after one month of the first strabismus surgery.

Table I includes preop data referring to the deviation type, deviation magnitude, maximum deviation position, active and passive duction, existence of torticollis and degree of the diplopia.

In the seven cases of vertical strabismus, the position of maximum deviation and diplopia was supraversion and also infraversion in two, and in the case of horizontal strabismus the maximum was found in levoversion. The limitation of supraduc-

tion was ++/+++ in six cases and +/+++ in one case, and limitation of levoversion + /+++ in an additional case.

Passive duction was positive in all cases, and these tests, together with the findings recorded in the Lancaster screen, confirmed the restrictive strabismus diagnosis. The eight cases complained of uncomfortable and totally invalidating diplopia. Torticollis was not objectively found in any case. All patients asked for treatment.

The mean time since the appearance of diplopia up to our first treatment was of 5 months, SD: 5.45 (range 1-20).

Table II shows data referring to the treatments and their results.

In four cases botox was injected, in three cases 3 units were injected in the inferior rectum and 5 units in the medial rectum of the remaining case: One case received two injections. The three cases with hypotropy experienced a slight objective and subjective improvement of the deviation in the first month after botox, but afterwards two patients worsened and one more remained without diplopia. The endotropy case improved horizontal deviation in the first month, but subsequently worsened and had a vertical deviation which did not improve spontaneously and required muscle surgery.

Surgery was performed in four cases (three with hypotropy and one with endotropy), the other two were comfortable with the prisms and rejected surgery, and the last patient improved with two botox injections in the inferior rectum and to date did not need additional treatment.

In the other three cases operated due to significant hypotropy (>15 diopters), in one a retro-insertion was made of the inferior rectum and in the

Table I. Preop data

Sex	Age	Eye	Previous surgery	Dev.	Strab.	Max. Dev.	PPM PD Dev.	AD	PD	Diplopia	Torticollis
F	81	RE	Phaco	V/hp	R	Supra	35	++/+++	+	Invalidating	No
F	71	LE	Phaco	H/et	R	Levo	20	+/+++	+	Invalidating	No
M	77	LE	Phaco	V/hp	R	Supra	12	+/+++	+	Invalidating	No
F	71	RE	Phaco	V/hp	R	Supra	16	++/+++	+	Invalidating	No
F	80	LE	Phaco	V/hp	R	Supra	12	++/+++	+	Invalidating	No
F	75	LE	Phaco	V/hp	R	Sup.Infra	25	++/+++	+	Invalidating	No
M	73	LE	Phaco	V/hp	R	Sup.Infra	4, 12 x month	++/+++	+	Invalidating	No
M	76	RE	Phaco	V/hp	R	Supra	5	++/+++	+	Invalidating	No

M: male; F: female; RE: right eye; LE: Left eye; Phaco: phacoemulsification + intraocular lens; Dev: Deviation; V: Vertical; H: Horizontal; hp: hypotropy; et: endotropy; STrab: type of strabismus; R: restrictive; Supra: supraduction; Infra: infraduction; Levo: levoversion; DP: prismatic diopters; AD: Active duction; DP: passive duction.

Table II. Postop data

Treat	Evol. of diplopia (months)	Prism.	Botox	Botox N.º	Qx	Technique	N.º Qx	Treat. postQ	Result	Follow-up (months)
Yes	7	No	No	—	Yes	1.º Retro RLR 2.º Retro LUR+Res LLR	2	No	Good	6
Yes	1	No	Yes	1	Yes	1.º Retro LUR+Res LLtR 2.º Retro RLR	2	No	Good	22
Yes	2	12 DP	No	—	No				Good	12
Yes	2	No	Yes	1	Yes	1.º Retro LUR 2.º Retro RLR	2	No	Good	9
Yes	1	No	Yes	2	No				Good	10
Yes	4	No	Yes	1	Yes	Retro LLR	1	No	Good	13
Yes	3	7 DP	No	—	No				Good	6
Yes	20	5DP	No	—	No				Good	3

Treat: treatment; DP; Prismatic diopters; Botox: Botulin toxin; QX: Surgery; Retro: retroinsertion; RLR: right lower rectum; LUR: left upper rectum; Res: resection; LLR: lower left rectum; MLR: middle left rectum; LLtR: left lateral rectum.

other two it was necessary to add a retroinsertion of the contralateral superior rectum, and in yet another one we also resected the contralateral inferior rectum. In the three cases the result was excellent, the diplopia disappeared without requiring additional treatment with prisms (table II).

In the only patient who had a restrictive endotropia, the horizontal component was operated and in a second surgical period we made a retroinsertion of the inferior rectum to resolve the vertical deviation caused by botox, achieving at the same time excellent results without diplopia in the immediate postop.

The mean time of evolution was of 10.12 SD: 5.46 months.

DISCUSSION

The appearance of strabismus with diplopia after cataract surgery has been frequently reported in literature. Its prevalence rates ranges between 0.58% and 2% (1,10). There are several causes for its appearance, but surgical trauma accounted for almost half of ethiological factors (1). The literature points out that the most frequent causes of surgical trauma include miotoxicity and the direct injection of the retro- and peri-bulbar anesthesia in the muscle (2-4,6). For this reason, some authors have recommended the use of topical or sub-Tenon anesthesia to avoid this problem (3,6,9). According to some publications, sub-Tenon anesthesia would be a safe technique to avoid irreversible muscle problems which appear in cataract surgery (3,6,9). In

the literature we have only found one case with paresia of the superior oblique caused by sub-Tenon anesthesia which resolved spontaneously (11).

In our Ophthalmology Department we began to use sub-Tenon anesthesia in 2001 in cases where topical anesthesia was not recommended from the surgical viewpoint.

This study comprises the cases that had ocular deviation and diplopia immediately after cataract surgery with sub-Tenon anesthesia in our hospital in order to study the type of strabismus they exhibited as well as their prognosis and treatment.

The type of strabismus associated most frequently to anaesthetic miotoxicity and surgical trauma is a vertical deviation which consists in hypotropia due to fibrosis of the inferior rectum of the eye (2,5,7,9,12). However, some studies also prove hypertropia, exotropia and torsional strabismus (3,6,10,11).

The muscles which are involved more frequently are the inferior rectum, the superior rectum, the inferior oblique, the superior oblique and the lateral rectum (6). Muscular alterations consist in paresia, hyperaction or fibrosis, which sometimes are reversible unless the patients are of advanced age, when muscle fibrosis does not recover spontaneously (2-4,7). In our small sample, the eight patients had restrictive strabismus, confirmed in the movement and sensory exam in which they exhibited greater deviation and diplopia in the field contrary to the muscle involved, with active and passive limitation of movement towards that field of gaze, seven in supraversion and one in levoversion. The ocular deviation associated to diplopia was present from

the first day after the cataract operation. Seven patients had hypotropia of the affected eye and one had endotropia. The deviation did not improve with time, and in two patients it worsened.

There are contradictory positions about whether the appearance of diplopia immediately after cataract operation should be defined as paresia, and the diplopia which appears later on should be attributed to fibrosis (4,13). In our series, two patients returned to the practice after one month, a further two returned after two months and in the latter we already appreciated restriction. What cannot be known is if initially it was paresia which later evolved towards contraction. The high mean age of the sample (75.5 years) would favour that irreversible muscular damage, and this opinion is shared by other authors (12). The left eye was affected more frequently than the right one (five of the eight cases), which also matches the findings of other publications which attribute greater difficulty for left-handed ophthalmology surgeons or anesthetists for administering anesthesia in the left eyes (2,7-9).

The time elapsed since diplopia up to the first check-up was of 5 SD: 5,45 months (range 1-20), and in six it was below six months. We agree with other authors who recommend waiting over six months before prescribing surgery in order to allow time for the deviation to stabilise or resolve (14,15). The six patients who had an evolution of diplopia under six months were offered treatment with botox; only four accepted. In three of these, it was injected in the inferior rectum of the hypotropic eye, and in the other patient with endotropia the botox was injected in the medial rectum. Hypotropia improved in the three patients, but two reverted one month later to the initial deviation. The patient with endotropia had a bad result with Botox, which additionally caused a vertical deviation.

In three patients good results were achieved adapting prisms: they feel comfortable and don't have double vision. However, two patients had a small a vertical deviation (< 8 diopters) and in another one (who rejected muscle surgery) the deviation is of 12 diopters. Some authors published good results only with prismatic treatment, but don't have any case of restrictive strabismus and the deviations are small (10). In general, a large percentage of cases (which is variable indifference publications) will require surgery (1,2,5,6,8,13-15). In this small sample we have operated four of the eight patients with a retrocession of the inferior rectum in three and a retro-

cession of the medial rectum in one. In addition, in one of the cases we also operated the superior rectum of the contralateral eye and in another case we operated the superior and inferior direct some of the contralateral eye. All the patients had topical anesthesia, with intraop adjustment of the sutures.

At the end, the result was good in all surgically treated patients (four). The three who use prisms fitted to their eyeglasses don't have double vision and lead normal lives. Finally, the patient treated with two botox injections is free of double vision.

The positive prognosis of muscle surgery in these cases and of possible anaesthetic muscle toxicity or direct trauma caused by the cannula during the sub-Tenon injection matches those of other publications and favours the previous absence of alterations or binocular vision which would prevent the disappearance of diplopia. Botulin toxin was utilised in four cases due to the intolerance to prismatic treatment and as a temporary solution while awaiting the right time for strabismus surgery due to the high degree of discomfort experienced by the patients. In our experience, this was not effective and so, in contrast with other authors (12) we do not recommend it for this type of restrictive strabismus, not even in small deviations, because it may even worsen the condition.

As a conclusion of this work, it can be said that sub-Tenon injection in the lower nasal quadrant was the cause of the restrictive strabismus which was found. The advanced age of patients may have contributed to perpetuate and worsen the problem. None of the cases was resolved spontaneously. Surgical treatment of strabismus is indicated if the deviation cannot be resolved with prisms and is necessary in half of the cases. The utilisation of botox is not advisable in these restrictive strabismus cases because, on some occasions, it may worsen the condition.

REFERENCES

1. Domingo Gordo B, Merino Sanz P, Arrevola Velasco L, Acero Peña A, Luezas Morcuende J, Gómez de Liaño Sánchez P. Diplopía pos-cirugía de catarata: causas y tratamiento. *Arch Soc Esp Oftalmol* 2000; 75: 581-587.
2. Corboy JM, Jiang X. Postanesthetic hypotropia: a unique syndrome in left eyes. *J Cataract Refract Surg* 1997; 23: 1394-1398.
3. Hunter DG, Lam GC, Guyton DL. Inferior oblique muscle injury from local anesthesia for cataract surgery. *Ophthalmology* 1995; 102: 501-509.

4. Esswein MB, von Noorden GK. Paresis of a vertical rectus muscle after cataract extraction. *Am J Ophthalmol* 1993; 116: 424-430.
5. MacDonald IM, Reed GF, Wakeman BJ. Strabismus after regional anesthesia for cataract surgery. *Can J Ophthalmol* 2004; 39: 267-271.
6. Capo H, Guyton DL. Ipsilateral hypertropia after cataract surgery. *Ophthalmology* 1996; 103: 721-730.
7. Capo H, Roth E, Johnson T, Munoz M, Siatkowski RM. Vertical strabismus after cataract surgery. *Ophthalmology* 1996; 103: 918-921.
8. Schacher S, Luthi M, Schipper I. Vertical diplopia after cataract operation. *Klin Monatsbl Augenheilkd* 2000; 216: 295-297.
9. Johnson DA. Persistent vertical binocular diplopia after cataract surgery. *Am J Ophthalmol* 2001; 132: 831-835.
10. Wylie J, Henderson M, Doyle M, Hickey-Dwyer M. Persistent binocular diplopia following cataract surgery: aetiology and management. *Eye* 1994; 8: 543-546.
11. Spierer A, Schwalb E. Superior oblique muscle paresis after sub-Tenon's anesthesia for cataract surgery. *J Cataract Refract Surg* 1999; 25: 144-145.
12. Tejedor J, Rodriguez Sanchez JM. Vertical strabismus after local anesthesia. *Ophthalmology* 1996; 103: 545-546.
13. Grimmett MR, Lambert SR. Superior rectus muscle overaction after cataract extraction. *Am J Ophthalmol* 1992; 114: 72-80.
14. Burns CL, Seigel LA. Inferior rectus recession for vertical tropia after cataract surgery. *Ophthalmology* 1988; 95: 1120-1124.
15. Koide R, Honda M, Kora Y, Ozawa T. Diplopia after cataract surgery. *J Cataract Refract Surg* 2000; 26: 1198-1204.