

Prevalence of diplopia related to cataract surgery among cases of diplopia

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PURPOSE. *To evaluate the prevalence of diplopia in Greece after cataract surgery among diplopia cases.*

METHODS. *The authors retrospectively reviewed the medical records of 571 patients with diplopia over an 8-year period in order to evaluate the prevalence of diplopia related to cataract surgery. The surgical and anesthetic records were also reviewed. All patients had full orthoptic assessment including prisms with cover test in all gaze positions. The chi-square and cross-tabulation statistical tests were used for statistical analysis.*

RESULTS. *Thirty-nine cases (6.8%) were having persistent diplopia related to cataract surgery. Type of anesthesia was peribulbar. Hyaluronidase was not used. Thirteen patients were men and 26 were women. Left eyes were involved in 22 cases (56.4%), right in 17 cases (43.6%). Mean age was 72.5 years. Patients were divided into four groups. Group 1 consisted of 29 patients related to surgical trauma due to anesthesia. Group 2 consisted of 7 patients related to pre-existing disorders. Group 3 consisted of 2 patients related to aniseikonia or anisometropia. Group 4 with 1 patient related to macular pathology. Vertical diplopia was mostly noted (28 cases). Twenty-nine patients were corrected with prisms, 9 needed strabismus surgery, and 1 needed both surgery and prisms.*

CONCLUSIONS. *Cataract surgery is not a common cause of persistent diplopia. However, this report highlights that prevalence of diplopia related to cataract is high among cases of diplopia in general, with diplopia being mostly vertical ($p=0.001$), affecting females ($p=0.006$), and being more common in left eyes, although results did not reach statistical significance ($p=0.133$). (Eur J Ophthalmol 2007; 17: 914-8)*

KEY WORDS. *Anesthesia, Cataract, Diplopia, Prisms, Strabismus*

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INTRODUCTION

Cataract surgery is the most frequently performed surgical procedure in the western world (1). The standard approach consists of phacoemulsification and intraocular lens implantation under regional or topical anesthesia as a day-case surgery.

That persistent diplopia may occur following cataract surgery is well known. There are many mechanisms which have been described including operative damage to or-

bita soft tissues and extraocular muscles, central disruption of fusion, loss of previously adequate fusion (decompensated heterophoria), disclosure of previous strabismus, or previously unrecognized systemic disorder (such as thyroid related orbitopathy) (2-6).

The purpose of this retrospective study is to establish the prevalence, clinical causes, and treatment for patients with persistent diplopia following cataract surgery in a large series of Greek patients with diplopia.

METHODS

We retrospectively reviewed the medical records of a series of 571 consecutive patients with ocular misalignment and diplopia in our Orthoptic Department over an 8-year period. Follow-up time was at least 2 years. The surgical and anesthetic records were also reviewed to determine the ocular history and the type of anesthetic injections.

Data collected included patient age, sex, onset of diplopia in relationship to surgery, eye involved, method of anesthesia, preoperative and postoperative best-corrected visual acuity, motility pattern, and ultimate therapeutic intervention. All patients had full orthoptic assessment in all nine gaze positions for distance and in the primary one at near using prism alternate cover testing. There was no strict exclusion criterion based on visual acuity. However, visual acuity was analyzed to determine if best-corrected visual acuity was adequate to allow accurate recognition of diplopia.

Treatment modalities for the ocular deviations, extraocular muscle surgery and prisms, were also recorded.

Chi-square and cross-tabulation statistical tests were used for statistical analysis. A p value less than 0.05 was considered to be statistically significant.

RESULTS

In these 571 cases there were various causes of diplopia, such as previous head injury or trauma, thyroid eye dis-

ease, paresis of external muscles, and previous retinal detachment surgery.

Thirty-nine cases (6.8%) had persistent diplopia related to previous cataract surgery. Of 39 patients, 13 were men (33.3%) and 26 were women (66.6 %). The incidence of left eye extraocular involvement was greater than right eye involvement (22 cases, 56.4%, vs 17 cases, 43.6%). Mean age was 72.5 years. The youngest patient was 22 years old and the oldest one 84 years old.

In all 39 cases the type of anesthesia was peribulbar. Hyaluronidase was not used.

Comparing diplopia related to cataract with all cases of diplopia we found the following. Vertical diplopia was more common after cataract surgery (28/39; 71.8%) in comparison to the main group (238/571; 34.9%). Comparing vertical diplopia with other types of diplopia (horizontal or mixed deviations) chi-square analysis showed that p was significant (p=0.001) (Tab. I).

Sixteen patients showed hypotropia ipsilateral to the cataract surgery, which increased on upgaze. Forced duction test was positive to elevation. Six patients had vertical diplopia involving the superior rectus muscle ipsilateral to the cataract surgery. Six patients showed restrictive, vertical, or mixed strabismus, which could not be attributed to injury to one extraocular muscle.

From a different perspective, of all patients with vertical diplopia (n=239), 28 were due to previous cataract operation (23.5%) and 76.5% due to other reasons. Numbers were much lower in other groups (2% for horizontal diplopia and 11.6% for mixed - vertical and horizontal - diplopia).

TABLE I - CAUSES OF DIPLOPIA: TYPES OF DIPLOPIA (Causes diplopia cross-tabulation)

Causes	Diplopia			
	Vertical	"Mixed" A	Horizontal	Total
Other causes				
Count	211	82	239	532
% within	30.1	20.2	49.7	100.0
% within Diplopia	76.5	88.4	98.0	88.6
Cataract				
Count	28	8	3	39
% within	71.8	20.5	7.7	100.0
% within Diplopia	23.5	11.6	2.0	11.4
Total				
Count	239	90	242	571
% within	34.9	20.2	44.9	100.0
% within Diplopia	100.0	100.0	100.0	100.0

The crosstabulation shows the frequency of each response at each group. If each group provides a similar level of sex (men- women), the pattern of responses should be similar across groups

Women were more affected in the cataract group (26/39; 66%) in comparison to total 321/571 (56.3%) with the p value being statistically significant ($p=0.006$) (Tab. II).

Left eyes were more affected than right ones. In comparison between the two groups, although left eyes were slightly more affected in the cataract group, results did not reach statistical significance ($p=0.133$) (Tab. III).

According to the causes of diplopia following cataract surgery patients were divided into four etiologic groups.

Group 1 consisted of more than two-thirds of the patients (74.35%; 29/39) related to the surgical trauma of orbital soft tissues and extraocular muscles due to anesthesia. Group 2 consisted of 7 patients related to pre-existing disorders such as thyroid eye disease (4 cases), nerve palsies (2 cases), and childhood strabismus (1 case). Group 3 consisted of 2 patients related to aniseikonia or anisometropia. Group 4 consisted of only 1 patient due to macular pathology.

TABLE II - DIPLOPIA: SEX (Sex * group cross-tabulation)

Sex	Group 1	Group 2	Total
M, count % within	13 (4.1)	321	321 (100)
F, count % within	26 (10.4)	250	250 (100)
Total, count	39	571	571 (100)

Values are n (%). The cross-tabulation shows the frequency of each response at each group. If each group provides a similar level of men/women, the pattern of responses should be similar across groups. The two-sided asymptotic significance of the chi-square statistic is not greater than 0.05 ($p=0.006$), so the differences are likely not due to chance variation, which implies that each group has a statistically significant relationship between the sexes (women/men).

Group 1 = Diplopia related to cataract surgery; Group 2 = Diplopia in total

TABLE III - DIPLOPIA: EYE (Eye* group cross-tabulation)

Eye	Group 1	Group 2	Total
L, count % within	22 (8.3)	265	265 (100)
R, count % within	17 (6.6)	256	256 (100)
Both, count % within	0	50	50 (100)
Total, count % within	39 (6.8)	571	571 (100)

The significance value of Pearson chi-square is 0.133 (>0.05), indicating a statistically insignificant relationship between the different eyes in the two groups.

Group 1 = Diplopia related to cataract surgery; Group 2 = Diplopia in total

Vertical diplopia was mostly noted (28 cases). In the remaining 11 cases diplopia was either horizontal (2/39) or mixed horizontal and vertical.

Twenty-nine patients were corrected with prisms while 9 needed strabismus surgery. The remaining patient needed both surgery and prisms.

DISCUSSION

The occurrence of binocular diplopia after cataract surgery is low (0.18% for all cataract cases and 0.23% for that involving retrobulbar anesthesia) (2). However, binocular diplopia is in many cases related to the cataract surgery. In addition, many patients present a diagnostic challenge and they cannot be categorized into one of the aforementioned etiologies (7).

In our retrospective study of 571 patients with double vision in the Orthoptic Department of Ophthalmology Department of Athens University the prevalence of persistent diplopia due to cataract was 39 cases (6.8%). In all cases peribulbar anesthesia was performed. According to the literature, this type of anesthesia is considered safer than retrobulbar anesthesia but the difference is not statistically significant (8-10).

However, a different study showed that the odds of damaging the inferior rectus, as opposed to the superior rectus muscle, with peribulbar anesthesia was 4.8 times higher than with retrobulbar blocks (11).

In all our cases of peribulbar anesthesia, hyaluronidase was not used. In recent studies peribulbar anesthesia-related diplopia was significantly more frequent when hyaluronidase was not added to the anesthetic solution (5, 12, 13).

Our results showed that vertical diplopia was more common (28 cases) ($p=0.001$). Most patients (16 cases) showed hypotropia ipsilateral to the cataract surgery, which increased on upgaze. Forced duction test was positive to elevation, indicating tightness in the area of the inferior rectus muscle, named the inferior rectus restrictive syndrome. Six patients had vertical diplopia involving the superior rectus muscle ipsilateral to the cataract surgery. The remaining six patients showed restrictive, vertical, or mixed strabismus which could not be attributed to injury to one extraocular muscle. There were no cyclovertical muscles affected to produce an acquired Brown syndrome or an inferior oblique muscle injury after the peribulbar injections, like in other reports (14, 15).

The mechanism of injury of extraocular muscles and orbital soft tissues remains speculative. However, according to Schacher et al, the proposed pathogenesis of vertical diplopia in these cases is fibrosis and contracture of the injured muscle, which could be due to anesthetic myotoxicity after direct injection into the muscle or to an intramuscular hemorrhage (16). A similar theory was reported by Hamed for retrobulbar anesthesia affecting the inferior rectus muscle with a cascade of events similar to that leading to Volkmann's ischemic contracture (7).

Several authors have noted more frequent involvement of the left eye (11, 17). In our study, although left eyes were slightly more affected in the cataract group in comparison to the total, results did not reach statistical significance ($p=0.133$). It has been noted that for right handed individuals addressing the left eye (and vice versa), greater adduction of the wrist is required to pass the needle lateral to the inferior rectus muscle. Any relaxation of this adduction results in an angle of approach much more in line with the course of the inferior rectus. In a recent comparative, retrospective study between local and regional anesthesia for cataract surgery, local anesthesia was associated with a lower incidence of diplopia (18). However, greater attention to subtleties of technique may be equally efficacious in lessening the problem.

According to our study, women were more affected in the cataract group (26/39; 66%) in comparison to total 321/571 (56.3%) with the p value being statistically significant ($p=0.006$). To our knowledge, this finding has not been reported previously. We postulate that women were more affected because all four patients with thyroid eye disease, in Group 2, who developed postoperative diplopia, were women.

The other patients of Group 2 with pre-existing disorders had nerve palsies (2) and childhood strabismus. Although these disorders were pre-existing, the presence of a dense cataract may preclude diplopia, rendering pre-existing strabismus asymptomatic.

There were two patients in Group 3 who developed aniseikonia due to high myopia. Due to plasticity of the visual system in early life, central compensation for even considerable anisometropia can occur, precluding aniseikonia and diplopia. However, rendering such patients isometropic by cataract surgery may precipitate aniseikonia and diplopia, as occurred in our patients.

In Group 4 there was one case due to macular pathology. Macular pathology including epiretinal membranes and choroidal neovascular membranes may rarely cause

binocular diplopia because of foveal displacement and rivalry between central and peripheral fusional mechanisms (19-21). In our case the patient had choroidal neovascular membrane.

All our patients were treated either with prisms ($n=29$) or surgery with adjustable sutures ($n=9$). Unlike in previous reports (18), treatment was successful in all our patients, although one patient needed both surgery and prisms.

In the present environment of heightened expectations by both patients and physicians, it is prudent to take measures to anticipate the possibility of postoperative diplopia after cataract surgery. Special attention must be paid to patients with amblyopia, strabismus, or macular disease and longstanding unilateral cataract or aphakia. An orthoptic evaluation should be performed to obtain evidence that the patient can fuse in free space. If there is reasonable doubt that fusion is lost, a two-step operation should be taken into consideration (22).

In conclusion, our report highlights that prevalence of diplopia related to cataract operation is high among cases of diplopia in general, although simplification of surgical technique and a delicate approach by the ophthalmologist make it increasingly possible to perform cataract surgery under topical anesthesia even in complicated cases.

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