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Visual function and late complications after cataract surgery by phacoemulsification with primary posterior capsulotomy and intracapsular foldable intraocular lens implantation

Ocena funkcji wzroku oraz późnych powikłań po operacji zaćmy metodą fakoemulsyfikacji z jednoczesną kapsulotomią tylną oraz wszczepem dotorebkowym zwijalnych soczewek wewnątrzgałkowych

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Summary: Purpose: Evaluation of visual function and late complications after cataract phacoemulsification with primary posterior capsulotomy and intracapsular foldable intraocular lens implantation in 22-months follow-up.
Material and methods: Twenty five eyes of 25 patients (mean age: 53 years) were included in the study. All the eyes underwent primary posterior thermal capsulotomy and in-the-bag foldable IOL (Acrysof) implantation. Postoperative visual acuity and complications were analyzed.
Results: The best corrected visual acuity 1.0 (Snellen chart) was achieved in 92% (23/25) of the eyes. The most frequent complication was a slight vitreous dislocation to the anterior chamber (4/25 of eyes – 16%), resulting in the pupil deformation in two eyes (2/25 of eyes – 8%) In one eye (1/25 of eyes – 4%) retinal detachment was observed. None of the patients presented CME.
Conclusions: A very good visual function and low rate of serious late complications suggest, that cataract phacoemulsification with primary posterior capsulotomy and in-the-bag foldable IOL implantation should be taken into consideration, as an option for preventing PCO. The results of the present study suggest the risk of retinal detachment and CME does not appear, to increase after the primary posterior capsulotomy. However, this conclusion has to be confirmed by randomized studies with longer follow-up period and larger series of patients.

Słowa kluczowe: operacja zaćmy, fakoemulsyfikacja, wszczep soczewki, pierwotna kapsulotomia tylna, funkcja wzroku, powikłania późne.
Key words: cataract surgery, phacoemulsification, IOL implantation, primary posterior capsulotomy, visual function, late complications.

Introduction

Posterior capsule opacification (PCO) is the most common complication after cataract surgery and intraocular lens (IOL) implantation and occurs in 4 to 50% of surgical cases several years after surgery. It arises from the proliferation of lens epithelial cells (LEC) on the equatorial region of the capsule and migration of these cells into visual axis (1). The PCO rate depends on the time that passed since the surgery, the type of implanted IOL, the surgeon's experience, the technique used, and associated systemic and ocular diseases (2). Factors predisposing to PCO are young age, complicated or traumatic surgery (3), uveitis and diabetes (4, 5). PCO can be prevented by opening the posterior capsule during cataract surgery by primary posterior continuous curvilinear capsulorrhexis (PCCC). The PCCC technique is frequently used in children with and without anterior vitrectomy to prevent PCO (6), but is rarely used in adults (7). The major concern about PCCC in adults is a more difficult surgical technique, and possible increased risk of retinal complication such as cystoid macular edema (CME) and retinal detachment.

However, Galand et al. (7) found in a large series of adult patients that the incidence of retinal complications was not higher than in cataract surgery without PCCC. Nevertheless the efficacy of PCCC in preventing PCO remains still controversial. Closure of the PCCC has been reported in young, diabetic and uveitic adult patients (8).

The goal of our study was to determine visual function and late complications after cataract phacoemulsification with primary posterior capsule opening and intracapsular, foldable IOL implantation.

Patients and methods

Twenty five patients (25 eyes), mean age of 53 years (range 25 to 82 years) with cataract (nuclear hardness grades from 1 to 3 – Emery-Little classification) were included for the study. Types of cataract are shown in Table I.

The patients with known, coexisting retinal or nerve diseases were excluded. All patients gave informed consent after they received an explanation of the nature and possible consequences of the procedure. This study was approved by the Committee of the Medical Ethics of Medical University in Szczecin The same surgeon performed all the operations in topical anesthesia (Alcaine), using one-handed endocapsular phacoemulsification technique (Shepherd's technique) that included a clear, temporal corneal incision 3.5 mm, an anterior diathermic capsulotmy (9) (5 mm diameter), hydrodissection, phacoemulsification of the nucleus. After the cortical clean up, a posterior diathermic capsulotomy was performed. The capsular bag was refilled with viscoelastic material (Provisc). After the central posterior capsule was punctured by 27 gauge needle, Provisc was injected through the hole under the capsule into the Berger space to separate the capsule from the anterior hyaloid in 4.0-5.0 mm central circular zone (Fig. 1).

Cataract	Number of eyes
Senilis	10
Presenilis	9
Traumatic	1
Postinflammatory	5
Total	25

Tab. I. Type of catarct.

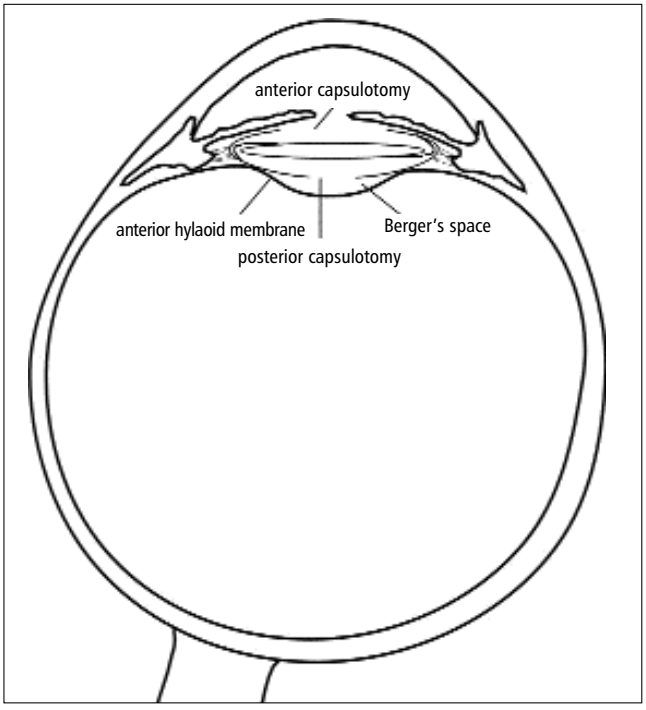

Fig. 1. A schematic eye with posterior capsulotomy after cataract extraction and IOL implantation.

Posterior diathermic capsulotomy of approximately 3.0-4.0 mm was created. A foldable acrylic Acrysof IOL with an optic diameter 6 mm (MA60BM) was implanted in the bag. This was followed by meticulous removal of the Provisc. At the end of surgery, gentamycin 20 mg and dexamethasone 2 mg were injected subconjuctivally in all patients. After surgery, topical dexamethasone 0.1% and antibiotic were administered during the next 3 weeks.

After the surgery (mean follow-up – 22 months) ophthalmological evaluation was performed including the uncorrected and best corrected visual acuity (UCVA, BCVA- Snellen Table), anterior segment evaluation by slit lamp biomicroscopy, keratometry with autorefractometry, funduscopy and fluorescein angiography (cystoid macular edema search).

Results

Visual outcomes

Figure 2 shows preoperative and postoperative visual acuity at a mean follow-up of 22 months (range 15 to 30) after surgery.

In all eyes visual acuity was improved. Before the surgery mean UCVA equaled 0.43 (Snellen chart) while mean BCVA was 0.51. After the surgery mean UCVA and BCVA equaled 0.76 and 0.97 respectively. Thirteen eyes (13/25 eyes – 52 %) achieved UCVA 1.0. In twenty three eyes (23/25 eyes- 92 %) BCVA 1.0 was obtained.

The main causes of the reduced postoperative VA (2/25 eyes- 8%- BCVA-0.7) were: retinal detachment successfully treated by pars plana vitrectomy and amblyopia.

Before and after the surgery, the mean corneal astigmatism equaled 0.55 D and 0.78 D, respectively. This difference was not statistically significant (Wilcoxon test- $p>0.9$).

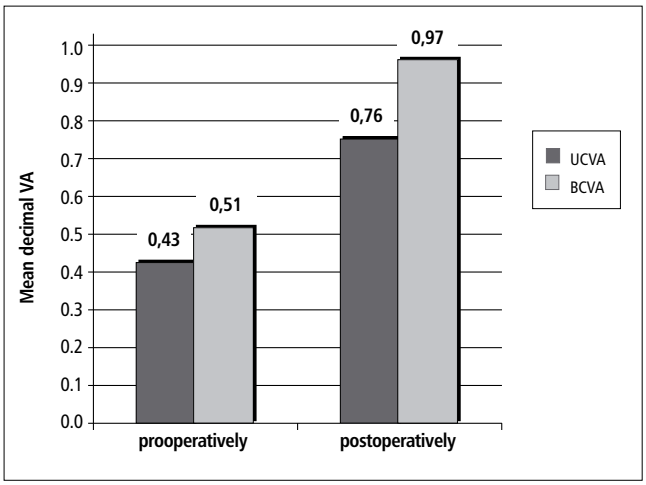

Fig. 2. Visual acuity (Snellen Table) before and after cataract surgery at a mean follow-up of 22 months. (dark gray bars – uncorrected visual acuity UCVA; light gray bars – best corrected visual acuity BCVA).

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Complication type	Number of eyes
1. opacification of anterior and posterior capsulotomy margins	25 (100%)
1a. with mild pearl-type PCO	24 (96%)
1b. with fibrotic PCO	1 (4%)
2. vitreous prolapse into anterior chamber	4 (16%)
2 a. pupil deformation by the vitreous	2 (8%)
3. a slight IOL decentration	2 (8%)
4. diameter of the posterior capsulotomy larger than the diameter of the IOL optics	2 (8%)
5. secondary closure of the posterior capsulotomy	0 (0%)
6. anterior vitreous opacification	0 (0%)
7. retinal detachment	1 (4%)
8. CME	0 (0%)

Tab. II. Late, postoperative complications after cataract extraction with IOL implantation and posterior capsulotomy (22 months mean).

The mean spherical equivalent at 22 months was + 0.8 D.

Complications

Late, postoperative complications are shown in Table II.

The main postoperative complication (25/25 eyes – 100%) was the opacification of the anterior and posterior capsule margins after capsulotomy with pearl-type or fibrotic PCO (Fig. 3).

Anterior vitreous prolapse into the anterior chamber of the eye was observed in 4/25 eyes (16%); in 2/25 of these eyes (8%) resulted in the pupil deformation as well as in a slight IOL decentration (Fig. 4).

Retinal detachment was found in only one eye (1/25 eyes- 4%) six month after surgery; it received a successful treatment successfully by pars plana vitrectomy with silicone oil injection. No one patient had vitreous opacification behind the IOL and CME (confirmed by fluorescein angiography) and secondary closure of the posterior capsulotomy.

Discussion

At a mean follow-up of 22 months after surgery all the patients in our study gained better visual acuity. The insertion of the foldable IOL through a small incision ensured that surgically induced astigmatism was minimal. The astigmatism did not affect the postoperative visual acuity in any case. The causes of reduced postoperative visual acuity were amblyopia and retinal detachment.

Posterior capsule opacification occurs due to proliferation and migration of lens epithelial cells and is a cause of reduced visual acuity after cataract surgery with capsular bag IOL implantation. It is not possible to remove precisely all these cells from the lens equator. Drugs inhibiting migration of lens epithelial cells are not currently available. That is why the central, planned posterior capsule opening is an effective method, which inhibits cells migration, resulting in a permanently transparent optical zone. In our series of patients we did not perform a commonly used primary posterior continuous curvilinear capsulorrhexis (PCCC), but a posterior diathermic capsulotomy invented by Kloti (9,10) and manufactured by Oertli (Switzerland). In our opinion it is an easier, safer and more predictable method of posterior capsule opening.

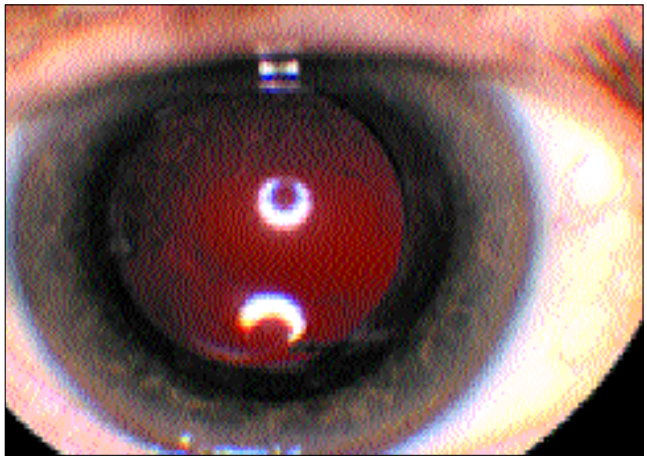

Fig. 3. An example of the eye with of anterior and posterior capsulotomy margins opacification with pearl-type PCO. The visual axis stayed clear at 22 months postoperatively.

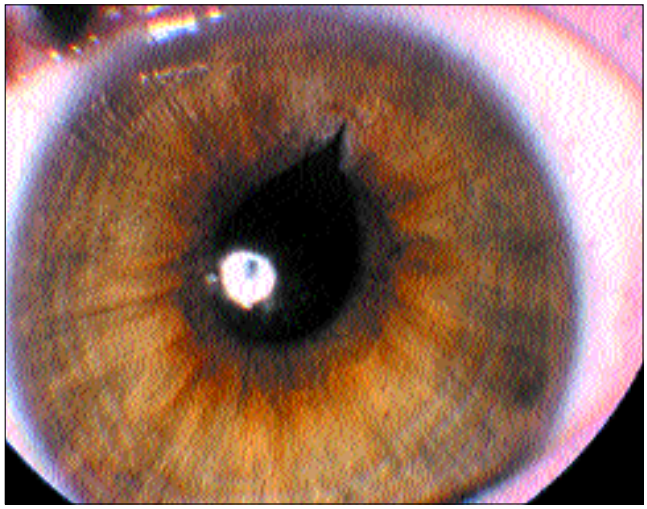

Fig. 4. An example of the eye with postoperative vitreous prolapse into anterior chamber and pupil deformation.

Worth noting is that we did not observe any total secondary closure of posterior capsulotomy and anterior vitreous opacification even in the eyes of patients with chronic uveitis what was described previously (8). One of the reasonable explanations is that the usage of acrylic foldable IOLs in adults is associated with only minimal inflammatory response (11), which is one of the important factors stimulating cellular proliferation, migration and metaplasia of lens epithelial cells. Additionally, Majima (12) reports that soft acrylic IOLs have more lens epithelial cells (LEC) adherence than PMMA and silicone IOLs, and speculates that the enhanced adherence decrease LEC migration.

The PCO was pearl-type and mild in most cases, what was suggested by earlier reports that the PCO associated with AcrySof IOL is mild and progresses slowly (11). A fibrotic PCO was seen in only one eye of a patient with chronic uveitis. The remaining four cases did not show fibrotic PCO. The more severe, postoperative intraocular inflammatory reactions and the chronicity of the uveitis are responsible for fibrotic PCO, what was described previously (4, 8).

The overall incidence of retinal detachment after phacoemulsification ranges from 0 to 3.6% (13) and does not differ significantly from our group of patients with posterior capsulotomy. Over 50% of

pseudophakic retinal detachments occur during the first year after cataract surgery. In our series of patients with posterior capsulotomy, retinal detachment was observed only in 1 patient (1/25 eyes-4%) six months after successful cataract surgery, in which posterior vitreous detachment was found. However, it seems sensible to examine periodically especially those patients with postoperative vitreous prolapse into anterior chamber (4/25 eyes-16%). These eyes are at risk of developing retinal detachment or cystoid macular edema (CME) in the future. Fortunately, the vitreous prolapse was seen only at the beginning of posterior capsulotomy procedure. The main cause of this complication was too small amount of viscoelastic substance injected into the Berger space.

In two eyes (2/25 eyes- 8%) diameter of the posterior capsulotomy was larger than the diameter of the IOL optics. Also in two eyes slight decentration of IOL was observed. Until now, we did not find clinical consequences of these abnormalities.

The incidence of CME varies widely, but is likely in the range of 1-2% using modern cataract extraction techniques (14). In our series of patients we did not observe CME, what was confirmed by fluorescein angiography. One of the explanations is that uveal irritation is necessary for CME and there was no significant uveal irritation with posterior capsulotomy. Additionally, the margin of posterior capsulotomy adheres to the IOL optic, so a barrier between anterior and posterior segment of the eye is quickly reconstituted.

Posterior capsulotomy has some advantages over Nd: YAG laser capsulotomy. There is no shock wave, no lesion of the anterior vitreous. An intact anterior vitreous membrane is crucial for maintaining the barrier function between the anterior and the posterior segment of the eye (15). Disruption of this barrier plays an important role in the pathogenesis of retinal detachment and risk of (CME). After Nd: YAG capsulotomy the risk of retinal detachment is estimated at from 0 to 4.1% after a follow-up of between 3 months and 4 years (11), but CME from 0 to 1.0% (16).

Our study proved the primary posterior capsulotomy is a good, although not an easy surgical method to maintain a clear visual axis. Its crucial advantage is the avoidance of Nd: YAG laser capsulotomy associated with a risk of severe retinal complications and reduction of global costs of cataract surgery. The results of the present study suggest the risk of retinal detachment and CME does not appear to increase after the primary posterior capsulotomy. However, this conclusion has to be confirmed by randomized studies with longer follow-up period and larger series of patients.

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