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## Original Articles



## Case Reports



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## Original Articles



## Case Reports

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Original Article

# Pain Perception in Phacoemulsification with Topical Anesthesia and Evaluation of Factors Related with Pain

Zeynep Dadacı, Mehmet Borazan, Nurşen Öncel Acır
Mevlana University Faculty of Medicine, Department of Ophthalmology, Konya, Turkey

**Summary**

**Objectives:** Evaluation of pain during and after phacoemulsification with topical anesthesia in patients with senile cataract and investigation of factors related with pain.

**Materials and Methods:** Ninety-two adult patients scheduled for routine clear corneal phacoemulsification with topical anesthesia who had no previous cataract surgery in their fellow eyes were included in the study. Verbal pain scale and visual analog scale were used to measure pain intensity. Demographic characteristics, concomitant systemic diseases, drug consumption, need of additional anesthesia during surgery, surgical complications, duration of surgery and surgeon comfort were also evaluated for each patient.

**Results:** Seventy-two patients (78.3%) reported pain during surgery and 68 patients (73.9%) reported pain in the period after the surgery. When the intensity of pain during the surgery was evaluated, the percentage of patients reporting mild, moderate and intense pain was 35.9%, 25.0% and 17.4%, respectively. The average verbal pain score during the surgery was 1.4±1.0 (0-3). Reported pain level was not associated with age or gender ($p>0.05$). Diabetic patients and patients who consumed nonsteroidal anti-inflammatory drugs in the morning before operation reported less pain during and after the surgery ($p<0.05$). There were no complications except posterior capsule rupture in one patient. Duration of surgery was longer in patients who reported pain during surgery ($p<0.05$). There was no significant difference between pain reported during surgery and surgeon comfort ($p>0.05$).

**Conclusion:** Patients frequently experience pain during phacoemulsification with topical anesthesia. Although pain perception does not affect surgical success, preoperative administration of analgesics in suitable patients or giving additional anesthesia to patients reporting severe pain during surgery may increase patient comfort.

**Keywords:** Pain, phacoemulsification, topical anesthesia, verbal pain scale, visual analog scale

## Introduction

Phacoemulsification under local anesthesia is the surgical method currently used to treat most cases of senile cataract.[1] Retrobulbar or peribulbar anesthesia plus topical anesthesia (alone or with intracameral anesthesia) are commonly used for local anesthesia. Various potentially sight-threatening complications have been reported related to agents used in retrobulbar or peribulbar anesthesia or arising from the technique itself.[2] Among these complications are chemosis, ecchymosis, retrobulbar hemorrhage, globe penetration or perforation, extraocular muscle damage, ptosis, amaurosis, penetration of the optic nerve sheath and optic atrophy.[3] The use of topical anesthesia may help avoid possible complications of retrobulbar or peribulbar anesthesia, but the possibility of eye closing and movement due to pain sensation may present a significant handicap.

Topical anesthesia is growing in popularity with the clear corneal incision phacoemulsification procedure.[4] Although the use of topical anesthesia during phacoemulsification surgery is a faster method and eliminates the risk of complications associated with local anesthesia, it has been reported that patients experience intraoperative and/or postoperative pain at a rate of 34 to 90%.[5,6,7] In most studies the intraoperative and/or postoperative pain is reported as mild, but in some patients the pain is severe enough to require intervention and lasts for days.[5,6]

There are many reports in the literature about the effect of different anesthetic agents,[8] additional sedation[9] and preoperative analgesic medication[10] on intraoperative and postoperative pain during cataract surgery under topical anesthesia. However, there are very few studies evaluating pain levels and the factors generally associated with pain. Awareness of the various factors that may affect pain could help identify patients with a greater

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chance of experiencing pain prior to the procedure, thus enabling necessary precautions to be taken and allowing a more comfortable and less complicated surgery. In this study, we aimed to evaluate patients' intraoperative and postoperative pain using two commonly applied pain assessment methods, the verbal pain scale (VPS) and visual analog scale (VAS),[10,11] and investigate the factors that may influence pain perception.

## Materials and Methods

This prospective, single-centered, observational study included 92 patients who were evaluated in the Mevlana University Faculty of Medicine Ophthalmology Clinic and scheduled for routine clear corneal phacoemulsification surgery under topical anesthesia for senile cataract. It has been reported in the literature that pain occurs more often in a patient's second cataract surgery; therefore, in this study we included patients undergoing cataract surgery for the first time.[12] Patients with allergy or contraindication to the drugs likely to be used during the surgery, dementia, major psychiatric disorder or other neurological disease impacting memory and cognitive function; patients with only one eye or with visual acuity in the fellow eye too low to use the VAS; and patients who did not sign the informed consent form or were noncompliant were excluded from the study. Patients with any previous ocular surgery other than cataract surgery or any ocular disease such as glaucoma, uveitis or keratoconus were also excluded. Prior to the start of the study, approval was obtained from the local ethics committee, the study participants were informed about the study and informed consent forms were obtained. The study was conducted in accordance with the principles set forth in the Declaration of Helsinki.

Patients underwent a full ophthalmologic examination including visual acuity assessment, slit-lamp examination, applanation tonometry and fundus examination. A detailed medical history was obtained from each patient and concomitant systemic diseases and medications used regularly were recorded. Patients using warfarin were referred to the cardiology clinic before surgery to have their medication adjusted. Patients were instructed to take all regularly scheduled medications except aspirin on the morning of the operation and the VPS and VAS to be applied preoperatively were explained.

All patients underwent clear corneal phacoemulsification under topical anesthesia. Topical anesthesia consisted of 0.5% proparacaine hydrochloride (Alcaine 0.5%, Alcon Pharmaceuticals, Puurs, Belgium) drops applied to the ocular surface twice with a 2-3 minute interval. Intracameral anesthesia was not used. Prior to the surgery, the ocular surface was washed with 5% povidone iodine. All procedures were performed through clear corneal incisions with a Whitestar Signature (Abbott Medical Optics, Santa Ana, CA, USA) phacoemulsification system using the 'stop and chop' technique. The procedure was concluded by applying of 1 mg/0.1 ml cefuroxime to the anterior chamber and checking the incisions for leakage.

Patients' pain levels were assessed intraoperatively and postoperatively using the VPS and VAS. On the VPS, pain is graded as 0 (no pain), 1 (mild pain), 2 (moderate pain), 3 (severe pain), or 4 (unbearable pain). Patients were asked to rate their level of pain with the VPS during the procedure, immediately following the procedure, and at 30 minutes, 1 hour, 2 hours, 4 hours and 24 hours after the procedure. For the VAS, patients were asked to use a pen to mark their level of pain on a 10 cm horizontal line on which one end was labeled 'no pain' (I feel no pain) and the other end was labeled 'unbearable pain' (The worst pain I have ever experienced) (Figure 1). The distance from the 'no pain' end of the line to the patient's mark was measured in cm. Patients were asked to rate their level of pain with the VAS immediately following the procedure and at 30 minutes, 1 hour, 2 hours, 4 hours and 24 hours after the procedure. Patients were monitored in the hospital for 4 hours following the procedure. Patients' demographic characteristics, concomitant systemic diseases, medications used (including nonsteroid anti-inflammatory [NSAI] drugs), additional anesthesia applied during surgery, surgical complications, duration of surgery (min) and surgeon comfort/discomfort were also evaluated. Cases in which the surgeon had to warn the patient or experienced difficulty due to the patient moving and/or tensing the eye were considered 'surgeon discomfort'; the patient avoiding eye movement was considered 'surgeon comfort'.

**Statistical Analysis**

Data were statistically analyzed using SPSS v15.0 for Windows (SPSS, Inc.). The chi-square test was used for intergroup comparisons of nominal data and the Student's t-test was used to compare numerical parameters. The level of significance was accepted as $\alpha$=0.05.

## Results

The study included 92 patients, 47 (51.1%) men and 45 (48.9%) women. The mean age of the patients was 66.9±10.6 (range, 43-85) years. There was no statistically significant difference between the mean ages of the male and female patients (men: 67.1±9.9 years, women: 66.8±11.4 years, p=0.89).

Seventy-two (78.3%) of the patients reported intraoperative pain and 68 (73.9%) reported postoperative pain. On intraoperative pain assessment using the VPS, 21.7% of the patients reported having no pain, while 35.9%, 25.0% and 17.4% of patients reported mild, moderate and severe pain, respectively. Immediately after the surgery, 26.1% of patients reported having no pain, whereas mild pain was reported by 32.6%, moderate pain by 22.8% and severe pain by 18.5% of the patients. None of the patients described their intra- or

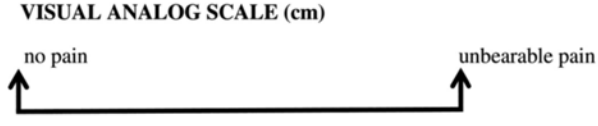


**Figure 1.** The visual analog scale

postoperative pain as unbearable. Seventy-two patients (78.3%) reported feeling no pain after the second postoperative hour. The patients' intraoperative and postoperative pain levels evaluated by VPS and VAS are shown in Table 1.

No statistically significant association was found between reported intraoperative and postoperative pain levels and age or gender (p>0.05) (Table 2). Concomitant systemic diseases were present in 62% of the patients in the study. Diabetic patients (n=28) reported significantly less pain both intra- and postoperatively (p=0.03 and p=0.01, respectively). No significant associations emerged between other systemic diseases and pain scores (p>0.05). Patients who took an NSAI drug on the morning of the surgery (42 patients, 45.6%) reported significantly less intraoperative pain (p<0.001). However, after the second postoperative hour, there was no difference in pain level between patients who took an NSAI drug and those who did not (Table 3).

Additional anesthesia (intravenous fentanyl) was administered to 3 patients who tensed or moved their eyes because of intraoperative pain. Posterior capsule rupture occured in one of the patients included in the study. This patient reported moderate to severe pain. None of the patients developed serious postoperative complications.

The mean surgery duration was 22.2±4.6 minutes. Surgery duration was significantly longer in patients who reported having intraoperative and postoperative pain (p=0.003 and 0.01, respectively). Among patients with no intraoperative pain, the surgeon's comfort was rated as good in 80%, while the rate of good surgeon comfort was 62.5% among patients with intraoperative pain. However, the difference was not statistically significant (p=0.14).

## Discussion

Many studies have demonstrated the efficacy and safety of cataract surgery through clear corneal incision under topical anesthesia, and it is one of the most common surgical procedures performed today.[13,14,15] Topical anesthesia is preferred over local anesthesia by patients because it does not require an injection like in the retrobulbar or peribulbar application of local anesthesia, and also by physicians because it avoids injection-related complications.

In the current study evaluating pain levels experienced by patients undergoing phacoemulsification under topical anesthesia, 72 of 92 patients (78.3%) reported feeling pain intraoperatively. In a recent study investigating the analgesic efficacy of topical anesthesia for phacoemulsification surgery, pain was reported by 89.5% of the patients.[6] In another study including 124 eyes of 96 patients, pain was reported at a rate of 71.8% among patients undergoing cataract surgery under topical anesthesia. However, in this study, deep topical anesthesia was achieved using topical anesthetic drops as well as sponges soaked in an anesthetic substance applied to the inferior and superior fornices.[13]

In the current study, a total of 68 patients (73.9%) reported postoperative pain, mostly within the first hour after surgery. Porela-Tiihonen et al.[5] evaluated patients' postoperative pain levels after phacoemulsification with topical anesthesia and reported that 34% of their patients felt pain postoperatively, with 10% of patients describing their pain as severe the day after surgery. The authors stated that patients were asked to rate their pain within the first 4 hours after the procedure. The lack of a specific time when patients' pain levels were assessed may prevent the proper evaluation of these data. In our study, 60.9% of patients reported having pain at 30 minutes after the surgery, whereas 21.7% reported pain at postoperative 2 hours.

Many studies have utilized the VPS and/or VAS to evaluate pain levels during phacoemulsification surgery under topical anesthesia. Apil et al.[6] used the VPS with patients who received topical anesthesia and found a mean pain level of 1.01±0.41.

**Table 1. Patients' mean pain levels assessed using the verbal pain scale and visual analog scale**

| | Intraoperative | Postoperative | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 minutes | 30 minutes | 1 hour | 2 hours | 4 hours | 1 day |
| Verbal pain scale | | | | | | | |
| % | 78.3 | 73.9 | 60.9 | 39.1 | 21.7 | 9.8 | 4.3 |
| Mean score | 1.4±1.0 | 1.3±1.1 | 0.9±0.9 | 0.6±0.8 | 0.3±0.6 | 0.1±0.4 | 0.1±0.3 |
| Visual analog scale | | | | | | | |
| cm | - | 2.5±2.2 | 1.6±1.8 | 1.1±1.5 | 0.5±1.1 | 0.2±0.6 | 0.1±0.1 |

**Table 2.** Comparison of the demographic characteristics of patients with and without intraoperative and postoperative pain

| | Intraoperative pain (+) | Intraoperative pain (-) | p value | Postoperative pain (+) | Postoperative pain (-) | p value |
|---|---|---|---|---|---|---|
| Age (years) | 67.2±10.6 | 66.0±10.9 | 0.67 | 66.6±10.5 | 67.8±11.1 | 0.64 |
| Gender<br>Male (n=47)<br>Female (n=45) | <br>34<br>38 | <br>13<br>7 | 0.16 | <br>35<br>33 | <br>12<br>12 | 0.90 |

**Table 3. Comparison of mean pain levels assessed by verbal pain scale and visual analog scale (cm) according to nonsteroid anti-inflammatory use**

| | Verbal pain scale | | | Visual analog scale | | |
|---|---|---|---|---|---|---|
| | NSAI (+) | NSAI (-) | p value | NSAI (+) | NSAI (-) | p value |
| Intraoperative | 0.8±0.8 | 1.9±0.9 | <0.001 | - | - | - |
| Postoperative 0 minutes | 0.7±0.8 | 1.9±1.0 | <0.001 | 1.4±1.7 | 3.3±2.2 | <0.001 |
| Postoperative 30 minutes | 0.5±0.7 | 1.3±0.9 | <0.001 | 0.9±1.6 | 2.2±1.8 | <0.001 |
| Postoperative 1 hour | 0.3±0.6 | 0.8±0.9 | 0.01 | 0.6±1.3 | 1.3±1.6 | 0.03 |
| Postoperative 2 hours | 0.2±0.5 | 0.4±0.7 | 0.20 | 0.4±1.1 | 0.5±1.1 | 0.49 |
| Postoperative 4 hours | 0.1±0.4 | 0.2±0.5 | 0.47 | 0.1±0.5 | 0.2±0.7 | 0.54 |
| Postoperative 1 day | 0.1±0.4 | 0.02±0.1 | 0.22 | 0.1±0.5 | 0.04±0.2 | 0.34 |

NSAI: Nonsteroid anti-inflammatory

In the current study, the intraoperative pain level was evaluated as 1.4±1.0 using the VPS. In their studies comparing topical anesthesia to sub-Tenon's anesthesia, Srinivasan et al.[16] reported VPS pain levels of 3.44±2.3 and 2.25±2.2 and Zafirakis et al.[17] of 1.13±1.57 and 0.80±0.93 in the topical anesthesia group during or immediately after the surgery and at postoperative 30 minutes, respectively. The mean pain level as assessed by VPS in the current study was 2.5±2.2 immediately after surgery and 1.6±1.8 at postoperative 30 minutes.

We detected no association between intra- or postoperative pain levels and patient age or gender. Similarly, Apil et al.[6] reported that intraoperative pain was not associated with age or gender in their study. However, in a study including 506 patients, Tan et al.[18] found that female patients experienced more pain during cataract surgery, while Gombos et al.[19] reported that young patients were more sensitive to pain during cataract surgery.

Most patients scheduled for senile cataract have one or more concomitant systemic diseases. To the best of our knowledge, there are no studies in the literature investigating the relationship between concomitant diseases and pain sensation during cataract surgery. We found that diabetic patients reported feeling less pain during and after cataract surgery. This may be attributable to diabetic neuropathy. Mocan et al.[20] observed by confocal scanning laser microscopy that the corneal nerve plexus was less dense and showed more morphologic abnormalities in diabetic patients.

We found that surgery duration was significantly longer in patients who reported having intraoperative and postoperative pain. Rothschild et al.[7] also reported that surgery duration was significantly longer in the patient group with high pain scores. No relation emerged in our study between intraoperative pain and surgeon comfort. It has been reported in the literature that the use of sedation in addition to topical anesthesia resulted in less pain and better surgeon comfort.[9]

Although topical anesthesia does not provide analgesia as effectively as retrobulbar or peribulbar anesthesia, there is evidence that these methods do not differ in terms of surgical outcome and reliability.[4] However, as topical anesthesia does not affect the intraocular tissues, patients may feel pain in certain situations, such as when the surgical instrument touches the iris, and blood pressure, heart rate and serum adrenaline levels may rise as a result.[19] Various techniques such as intracameral anesthesia,[15] supplemental sedation[9] and taking an analgesic preoperatively[10] have been shown to be effective in addition to topical anesthesia for improving surgical safety and comfort. We also found that patients who used an NSAI drug on the morning of the surgery had significantly lower pain levels.

In the current study, most of the patients undergoing phacoemulsification surgery under topical anesthesia experienced pain. However, most patients' pain was mild to moderate, and pain perception was not associated with surgical outcome or surgeon comfort.

## Conclusion

Most patients experience pain during phacoemulsification surgery under topical anesthesia. Although pain perception does not affect surgical success, giving selected patients an analgesic prior to surgery or administering additional anesthesia to patients with severe pain can improve patient comfort.

**Ethics**

Ethics Committee Approval: Mevlana University Ethic Committee Approval Number 2013/004, Informed Consent: Obtained.

Peer-review: Externally peer-reviewed.

**Authorship Contributions**

Surgical and Medical Practices: Zeynep Dadacı, Mehmet Borazan, Nurşen Öncel Acır, Concept: Zeynep Dadacı, Mehmet Borazan, Nurşen Öncel Acır, Design: Zeynep Dadacı, Mehmet Borazan, Nurşen Öncel Acır, Data Collection or Processing: Zeynep Dadacı, Mehmet Borazan, Nurşen Öncel Acır, Analysis or Interpretation: Zeynep Dadacı, Mehmet Borazan, Nurşen Öncel Acır, Literature Search: Zeynep Dadacı, Mehmet Borazan, Writing: Zeynep Dadacı.

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Original Article

# Surgical Indications and Clinical Results of Patients with Exchanged Intraocular Lenses in a Tertiary Eye Hospital

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**Summary**

**Objectives:** To evaluate the demographics, surgical indications and clinical results of patients with repositioned or explanted intraocular lens (IOL) in a tertiary referral eye hospital.

**Materials and Methods:** Forty-eight eyes of 48 patients that underwent surgery to exchange or reposition the IOL at Ulucanlar Eye Training and Research Hospital between 2009 and 2013 were included in the study. Medical records of patients were evaluated for surgical indications, time elapsed since initial operation, preoperative and postoperative best corrected distance visual acuity and the presence of ocular disease.

**Results:** The mean age of the 31 male and 17 female patients was 64.91±14.26 years. Median time between the initial and final operations was 36.0 months. Pseudoexfoliation syndrome (PEX) was present in 25% of the patients. There was history of previous vitreoretinal surgery in 18.8% of patients, ocular trauma in 6.3%, high myopia and refractive surgery in 4% of patients. In the first operation the IOL was implanted in the sulcus in 50%, in the bag in 27.1%, and in the anterior chamber in 20.8%; following the final surgery the IOL was in the sulcus in 27.1%, in the anterior chamber in 22.9%, and fixated to the sclera in 10.4% of the patients, while the remaining 29.1% remained aphakic. Indication for the secondary surgery was IOL dislocation in 58%, corneal decompensation in 20.8% and IOL degeneration in 6.3%. In the final surgery, IOL was exchanged in 54.2% of the cases, removed in 31.3% of cases, and repositioned in 14.6%. Visual acuity improved by 1-3 lines in 52.3% and remained stable in 13.6% of the patients postoperatively.

**Conclusion:** IOL exchange may be necessary at any time following cataract surgery due to surgical complications, IOL dislocation, biometric measurement errors and corneal decompensation. Factors such as vitreoretinal surgery and the existence of PEX increase the risk of IOL exchange surgery.

**Keywords:** Bullous keratopathy, intraocular lens exchange, intraocular lens subluxation, pseudoexfoliation

## Introduction

Phacoemulsification is the most commonly performed cataract surgery technique both in Turkey and abroad, and posterior capsule perforation is one the most feared complications. Inadequate posterior capsule support may lead to decentration of the implanted lens and result in complaints like vision loss, blurred vision and double vision. In cases with severe visual disturbances, removing the intraocular lens (IOL) may be necessary. Other than inadequate posterior capsule support, other potential reasons an IOL may need to be removed or exchanged postoperatively include incorrect refractive power of the IOL, visual disturbances (e.g. glare) caused by the IOL, and elevated intraocular pressure related to the IOL. Whether or not to replace a removed lens and the anatomic location of the new lens are decided based on surgeon experience, patient age, the condition of the posterior capsule, and the patient's other ocular pathologies (glaucoma, diabetic retinopathy, asteroid hyalosis, low endothelial cell count, increased corneal thickness).[1,2]

In this study, we aimed to evaluate the demographic characteristics, indications for IOL removal and visual outcomes in patients undergoing IOL exchange or repositioning in a tertiary referral hospital.

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## Materials and Methods

The records of 86 patients who underwent IOL exchange surgery in Ulucanlar Eye Hospital between 2011 and 2014 were analyzed retrospectively. Forty-eight eyes of 48 patients who were followed for at least 6 months after the second surgery were included in the study. The patients' age, gender, history of systemic disease, any additional ocular pathology, indication for IOL exchange, time elapsed since implantation of the first IOL, and the anatomic positions of the first and second IOLs were recorded. Patients with intravitreal dislocation of the IOL were excluded. Calculations using biometric measurements for both the sulcus and the bag were done to determine the power of the IOL to be implanted. Biometric evaluation of the fellow eye was used for patients with corneal opacity or for whom keratometric measurement could not be performed. Intracameral, subTenon's or subconjunctival anesthesia was used during surgery. Approval for the study was granted by the Ankara Numune Training and Research Hospital Ethics Committee. Data were statistically analyzed as numerical values and percentages.

## Results

The 48 patients in the study included 31 men and 17 women with a mean age of 64.91±14.26 (range, 26-87) years. The median time between the first and second surgeries was 36.0 months (range, 1-260 months).

Surgical indications were dislocated IOL in 58% (n=28), corneal decompensation in 20.8% (n=10), and IOL degeneration in 6.3% (n=3) of the patients (Table 1).

Twenty-five percent (n=12) of the patients were positive for pseudoexfoliation syndrome (PEX), 18.8% (n=9) had previous vitreoretinal surgery, 6.3% (n=3) had a history of iridophacodonesis or ocular trauma, and 4% (n=2) had high myopia or previous refractive surgery (Table 2). Clinical indications for previous vitreoretinal surgery was macular hole in 2 cases, diabetic retinopathy in 3, intravitreal hemorrhage in 2, endophthalmitis in 1 and choroidal neovascular membrane in 1 case. After the second surgery, 4 of the 13 PEX patients remained aphakic, while the IOL was implanted in the anterior chamber in 5 patients, in the sulcus in 2 patients and was fixated to the sclera in 2 patients. Eight of the patients in this study underwent their first surgery in our hospital; the remaining were operated at different times in other centers.

The IOL was exchanged in 54.2% (n=26) of the patients, removed in 31.3% (n=15) and repositioned in 14.6% (n=7) (Table 3). Initial IOL implantation was in the sulcus for 50%, in-the-bag for 27.1%, and anterior chamber for 20.8% of the patients; in the second surgery, IOL position was in the sulcus for 27.1%, anterior chamber for 22.9%, scleral fixation for 10.4%, and 14 patients (29.1%) remained aphakic (Table 4). Seven of the 14 patients who remained aphakic after the second surgery had bullous keratopathy; these patients' initial IOLs had been implanted in the anterior chamber. These patients were 36, 26, 44 and 49 years of age. The IOL was removed due to corneal decompensation in 10 (60%) of the aphakic patients. For the remaining aphakic patients, there was insufficient posterior capsule support and the IOL could not be implanted in the anterior chamber due to uveitis (1 patient), glaucoma (2 patients), and iris defect (1 patient). Three of the 10 patients with corneal decompensation were under 55 years old and were scheduled for keratoplasty. The other 7 patients had fellow eyes within normal limits and did not accept the possible risks of keratoplasty; they underwent medical treatment and were followed in the cornea unit.

Change in visual acuity after the second surgery was a loss of 4 or more rows in 6.8%, loss of 1-3 rows in 22.7%, gain

**Table 1. Patients' indications for intraocular lens exchange in a second surgey**

| Indication | n | % |
|---|---|---|
| IOL subluxation | 58 | 28 |
| Corneal decompensation | 20.8 | 10 |
| IOL degeneration | 6.8 | 3 |
| Iris capture | 10 | 5 |
| Patient dissatisfaction | 2 | 1 |
| Inaccurate biometry | 2 | 1 |

IOL: Intraocular lens

**Table 2. Patients' concomitant ocular pathologies**

| Concomitant ocular pathology | % | n |
|---|---|---|
| Pseudoexfoliation syndrome | 25 | 12 |
| Vitreoretinal surgery | 18.8 | 9 |
| Iridophacodonesis or ocular trauma | 6.3 | 3 |
| High myopia, refractive surgery | 4 | 2 |

**Table 3. Final surgical procedure type**

| Procedure type | % | n |
|---|---|---|
| IOL exchange | 54.2 | 26 |
| IOL removal | 31.3 | 15 |
| IOL repositioning | 14.6 | 7 |

IOL: Intraocular lens

**Table 4. Initial and final intraocular lens positions**

| Intraocular lens location | Initial (%) | Final (%) |
|---|---|---|
| Anterior chamber | 20.8 | 22.9 |
| Sulcus | 50 | 27.1 |
| Intracapsular | 27.1 | 8.3 |
| Scleral fixation | 2.1 | 10.4 |
| None (aphakic) | ------ | 29.1 |

of 1-3 rows in 52.3% and gain of 4 or more rows in 4.5% of the patients; visual acuity remained the same in 13.6% of the patients (Table 5).

## Discussion

With the major technological advancements made in cataract surgery, indications for postoperative IOL exchange have changed over time. Analysis of studies from the last 25 years investigating indications for IOL exchange and explantation reveal the changes that have occured over the last few decades (Table 6). In a study evaluating patients from the 1990s, a period of rapid development in lens technology and surgical techniques, the most common indication for IOL exchange or removal was bullous keratopathy.[3] In light of advancements in microsurgery, 2 studies evaluating IOL exchange surgeries performed in the 2000s reported the most frequent indications as refractive errors and IOL opacification.[4,5] Jason et al.[1] found IOL decentration as the most frequent indication in their study. Mamalis et al.[6] reported that IOL dislocation was the most common cause of IOL exchange or removal after cataract surgery, regardless of IOL type. In a study by Jin et al.[4] evaluating cases between 1998 and 2004, the most common indication for IOL exchange was incorrect IOL power calculation (41%), whereas in a similar study Lyle and Jin.[3] the most common indication for IOL removal was corneal decompensation (38%). In the present study, we found IOL subluxation to be the most common reason for IOL removal or exchange.

Jason et al.[1] evaluated patients who underwent IOL exchange between 2007-2011 and reported that IOL dislocation was the indication in 45% of the surgeries. Similarly, we found IOL subluxation as the most common indication for lens removal in our study (58%).

Unlike dislocation of the IOL, dislocation of the lens-capsule complex can occur years after an uncomplicated surgery due to progressive separation of the zonules associated with various causes such as PEX, retinitis pigmentosa, and long axial length.[7] In their multi-center study, Pueringer et al.[8] analyzed nearly 15,000 cases who underwent cataract surgery within a period of about 30 years to evaluate the risk of late IOL dislocation. They reported the risk of IOL dislocation as 0.1% at 10 years and 1.7% at 25 years. Davis et al.[9] evaluated cases with spontaneous IOL dislocation who underwent IOL repositioning and reported that independent of lens type, the presence of PEX was the most important risk factor for lens dislocation, followed by previous vitreoretinal surgery and trauma. In our study, PEX was the most common ocular pathology in patients undergoing IOL exchange.

Jason et al.[1] reported that in PEX patients with dislocated IOL, 40% had an open posterior capsule, posterior capsule was opened in 10% with YAG laser capsulotomy, and the others had intact posterior capsules. In another study, PEX patients with IOL subluxation underwent IOL exchange or repositioning with good visual prognosis and a very low rate of intra- and postoperative complications.[2]

Jin et al.[4] reported that a visual acuity better than 20/40 was achieved in 90% of patients who received an anterior chamber IOL. With technological advancements, open-loop, flexible anterior chamber IOLs have become a lens replacement option that provides good visual outcomes. In a study by Kwang et al.[10] comparing anterior chamber and scleral-fixated IOLs in patients with inadequate posterior capsule support, scleral-fixated IOLs were associated with lower rates of intra- and postoperative complications, while anterior chamber IOLs resulted in better final visual acuity outcomes. Erçalık et al.[11] compared the clinical outcomes of anterior chamber and scleral-fixated secondary IOLs after complicated

**Table 5. Change between visual acuity after first surgery and final visual acuity**

| Postoperative change in visual acuity | % |
|---|---|
| Loss of ≥4 rows | 6.8 |
| Loss of 1-3 rows | 22.7 |
| Gain of 1-3 rows | 52.3 |
| Gain of ≥4 rows | 4.5 |
| No change | 13.6 |

**Table 6. Summary of the indications for intraocular lens exchange in the last 25 years of literature**

| Author, Year | Indication for IOL exchange | % |
|---|---|---|
| Lyle and Jin[3] (1992) | Bullous keratopathy | 38.4 |
| | IOL decentration/dislocation | 22/13 |
| | Cystoid macular edema | 14 |
| | Inaccurate biometry | 14 |
| Jin et al.[4] (2005) | Refractive error | 41 |
| | IOL decentration/dislocation | 37 |
| Marques et al.[12] (2007) | For anterior chamber IOLs: anterior chamber inflammation | 53 |
| | For posterior chamber IOLs: decentration/ dislocation | 85 |
| Leysen et al.[5] (2009) | IOL opacification | 31 |
| | IOL decentration | 19 |
| | IOL dislocation | 18 |
| | Capsular fibrosis | 14 |
| Jason et al.[1] (2014) | IOL decentration/dislocation | 45 |
| | Inaccurate biometry | 22 |
| | Patient dissatisfaction | 21 |
| | IOL opacification | 7 |

IOL: Intraocular lens

phacoemulsification surgery with 15 cases in each group and reported comparable results. However, in the present study, the youngest patient in the anterior chamber group was 67 years old. Marques et al.[12] reported secondary inflammation as the most common indication for the explantation of anterior chamber IOLs. Of the 14 patients in this study who remained aphakic, 7 had anterior chamber IOLs and 7 developed bullous keratopathy. However, despite 4 of these patients being under 50 years old (two were under 40 and 1 was under 30), they received anterior chamber IOLs after cataract removal in their initial surgery. Regardless of the advances in IOL technology in the last few decades, anterior chamber IOLs inevitably increase endothelial cell loss. We believe that the development of bullous keratopathy in these patients provides further evidence that anterior chamber IOLs are not a good choice for young patients. In our clinic, anterior chamber IOLs are not implanted in patients less than 60 years old as a principle.

In this study, 29.1% of patients with PEX were left aphakic after IOL removal, anterior chamber IOLs were implanted in 33%, in the sulcus in 15% and 15% received scleral fixated secondary IOLs. In-the-bag IOL implantation was not performed in any of the PEX patients in the second surgery. In the presence of exfoliation, spontaneous partial or complete zonular dialysis may occur after cataract surgery. In particular, dislocations occurring within the first 3 months have been associated with inappropriate capsulorhexis, while dislocations occurring after the first 3 months have been associated with zonular weakness.[9] This explains why IOLs could not be implanted in the capsular bags of PEX patients during their secondary surgery for IOL exchange. Shingleton et al.[2] looked at the cases of PEX patients with early and late period IOL dislocation after cataract surgery and found that the IOL was exchanged in 85% and repositioned in 15% of the cases. However, their study included patients whose only indication for repeated surgery was IOL dislocation; patients undergoing IOL removal due to bullous keratopathy were not included as they were in our study. In the current study, secondary corneal decompensation was the primary reason for not replacing the explanted IOL, and was also the second most common indication for IOL removal.

Of the 7 patients in our study who were left aphakic after IOL explantation due to corneal decompensation and edema, 3 were scheduled for keratoplasty, while the other 4 patients were unwilling to face the risks associated with keratoplasty because of their advanced age and good vision in the fellow eye. Duran et al.[13] evaluated the indications for and outcomes of 29 cases undergoing anterior chamber IOL explantation and reported that corneal decompensation was the indication for IOL explantation in 22 cases. Three of those underwent keratoplasty and scleral-fixated IOL implantation; no surgical intervention was performed in the remaining cases.

## Conclusion

IOLs may require surgical correction due to complications of previous cataract surgery, late IOL subluxation, or inaccurate biometry. This risk is higher in patients with factors like PEX, previous vitreoretinal surgery and trauma. The decision of whether to replace the IOL and in which anatomic position to implant the replacement IOL depends on the patient's anterior and posterior segment examinations, age, general health, and the surgeon's experience and preference.

**Ethics**

Ethics Committee Approval: Approval for the study was granted by the Ankara Numune Training and Research Hospital Ethics Committee, Informed Consent: It was taken.

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**Authorship Contributions**

Surgical and Medical Practices: Sevim Kavuncu, Aslıhan Esra Omay, Mehmet Hakan Tırhış, Pelin Yılmazbaş, Concept: Sevim Kavuncu, Aslıhan Esra Omay, Mehmet Hakan Tırhış, Pelin Yılmazbaş, Design: Sevim Kavuncu, Aslıhan Esra Omay, Mehmet Hakan Tırhış, Pelin Yılmazbaş, Data Collection or Processing: Sevim Kavuncu, Aslıhan Esra Omay, Mehmet Hakan Tırhış, Pelin Yılmazbaş, Analysis or Interpretation: Sevim Kavuncu, Aslıhan Esra Omay, Mehmet Hakan Tırhış, Pelin Yılmazbaş, Literature Search: Sevim Kavuncu, Aslıhan Esra Omay, Mehmet Hakan Tırhış, Pelin Yılmazbaş, Writing: Sevim Kavuncu, Aslıhan Esra Omay, Mehmet Hakan Tırhış, Pelin Yılmazbaş.

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Original Article

# Changes in Anterior Chamber Depth after Combined Phacovitrectomy

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## Summary

**Objectives:** To evaluate changes in anterior chamber depth (ACD) and postoperative refractive outcomes after combined phacovitrectomy.

**Materials and Methods:** This study included 10 eyes of 10 patients that underwent combined phacovitrectomy (study group) and 14 eyes of 14 patients that underwent phacoemulsification surgery (control group) at İstanbul Medipol University Ophthalmology Department. Preoperative and 3-month postoperative best corrected visual acuity (BCVA), ACD, change in ACD and refractive outcomes were compared between the two groups.

**Results:** Preoperative ACD, postoperative ACD at 3 months and change in ACD were similar between two groups (p=0.403, p=0.886, p=0.841). Postoperative mean refractive outcomes were 0.22±0.51 diopter in the phacovitrectomy group and -0.39±0.53 diopter in the phacoemulsification group (p=0.019). BCVA was increased in both groups (p=0.001).

**Conclusion:** Postoperative refractive outcomes in eyes that underwent combined phacovitrectomy are different from those in eyes that underwent only phacoemulsification surgery. This is important in determining preoperative intraocular lens power before combined phacovitrectomy.

**Keywords:** Phacovitrectomy, anterior chamber depth, intraocular lens, postoperative refractive outcomes

## Introduction

The incidences of both cataract and vitreoretinal pathologies increase with advancing age. Cataract can interfere with visualization and complicate vitreoretinal surgery. Furthermore, vitreoretinal surgery precipitates or accelerates cataract formation. According to one study, the rate of cataract surgery in phakic patients after vitreoretinal surgery was 75% at 1 year and 90% at 2 years.[1]

Recent improvements in vitrectomy devices and surgical techniques have allowed the successful execution of phacoemulsification combined with pars plana vitrectomy (PPV), which has been termed 'phacovitrectomy'. Phacovitrectomy has various advantages and disadvantages.[2] One of the drawbacks of phacovitrectomy is deviations in the refractive outcomes.[3] The literature contains varied results, but myopic shift has been most commonly reported after phacovitrectomy.[4,5,6] Errors in axial length measurement, changes in anterior chamber depth (ACD), and aqueous humour replacing the vitreous all affect the refractive index and lead to myopic shift.[3] ACD determines the effective lens position (ELP), which is an important factor in modern intraocular lens (IOL) power calculation formulas. Every 1 mm change in ELP results in 1.5 diopters (D) of deviation.[3]

The purpose of this study was to evaluate changes in ACD and refractive outcomes after phacovitrectomy.

## Materials and Methods

This prospective study included 24 eyes of 24 patients operated on between January and July 2013 at the İstanbul Medipol University Faculty of Medicine, Ophthalmology Clinic. The study was approved by the İstanbul Medipol University Ethics Committee. The study group consisted of 10 eyes of 10 patients that underwent phacovitrectomy; the control group included 14 eyes of 14 patients that underwent phacoemulsification only. The study group included patients

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with cataract having PPV for various pathologies [epiretinal membrane (ERM) and vitreomacular traction (VMT)] whose axial length could be measured using the IOLMaster (Carl Zeiss Meditec AG, Jena, Germany), while the control group included patients having cataract surgery whose axial length could be measured with the IOLMaster. Patients with previous intraocular surgery, refractive error greater than ±5 D, pseudoexfoliative or traumatic cataract, and patients requiring silicone or gas endotamponade were not included in the study. Patients for whom axial length could not be measured with the IOLMaster were excluded.

All patients underwent a complete ophthalmologic examination and provided informed consent after electing surgery. After measuring axial length with the IOLMaster, the SRK-T formula was used to calculate the IOL power for a target refraction of -0.50 D. Because the IOLMaster does not always provide reliable ACD measurements in pseudophakic eyes, ACD was measured using A-scan ultrasonography (Eye Cubed™, Ellex, Adelaide, Australia).[7] All measurements were performed by the same technician prior to pupil dilation.

All procedures were performed by the same surgeon (G.G.). In the study group, the vitrectomy procedure followed phacoemulsification and IOL implantation. For all patients, phacoemulsification was performed through a 2.8 mm superior corneal incision and a SN60WF hydrophobic acrylic IOL (Alcon, Foxworth, TX, USA) was implanted in the capsular bag. The vitreoretinal procedure was performed as a standard 23-gauge vitrectomy with membrane peeling. Air, gas or silicone oil tamponade was not used in any of the patients.

Postoperative evaluation was done in the third month. A full ophthalmologic examination including best corrected visual acuity (BCVA), A-scan ultrasonography and ACD measurement were performed. Refractive errors were measured by autorefractometer (Topcon KR 8800, Oakland, NJ, USA) and recorded as spherical equivalent.

BCVA, preoperative and postoperative ACD, change in ACD and refractive errors were compared between the two groups.

The Wilcoxon signed ranks test and Mann-Whitney U test were applied during statistical analysis using SPSS version 15.0 software. The level of significance was accepted as $\alpha$=0.05.

## Results

Twenty-four eyes of 24 patients were evaluated in this study. The 10 patients in the phacovitrectomy group underwent vitreoretinal surgery due to ERM (7 patients) or VMT syndrome (3 patients). No intraoperative or postoperative complications occured in any of the patients. All patients were followed for the full 3-month follow-up period. The demographic distributions and preoperative ACD, preoperative BCVA, axial length and calculated IOL power are shown in Table 1. The two groups had comparable age and gender distributions, as well as axial length, preoperative ACD and calculated IOL power (p>0.05). The control group had significantly higher preoperative BCVA than the study group (p=0.0001). In the study group, BCVA increased significantly from 0.89±0.12 logMAR preoperatively to 0.38±0.15 logMAR at postoperative 3 months (p=0.001). BCVA of the control group also increased significantly from 0.56±0.17 logMAR preoperatively to 0.50±0.06 logMAR at postoperative 3 months (p=0.001).

The pre- and postoperative ACD values, changes in ACD and spherical equivalents at postoperative 3 months for both groups are shown in Table 2. Mean ACD of the phacovitrectomy group was 2.87±0.26 mm preoperatively and 4.11±0.54 mm at postoperative 3 months. The mean change in ACD was 1.24±0.43 mm, which was a statistically significant increase (p=0.001). In the control group, the mean ACD was 2.91±0.41 mm preoperatively and increased by a mean of 1.27±0.33 mm to reach 4.18±0.39 mm at postoperative 3 months. This was also a significant increase in depth (p=0.001). Preoperative ACD, 3-month postoperative ACD and change in ACD were similar between the two groups (p=0.403, p=0.886, p=0.841, respectively). There was a significant difference in spherical equivalent at postoperative 3 months between the phacovitrectomy group (0.22±0.51 D) and the control group (-0.39±0.53 D) (p=0.019).

## Discussion

Phacovitrectomy is being performed with increasing frequency. Advances in both cataract and vitreoretinal surgery play a role in this trend. Along with higher anatomic success rates, postoperative refractive outcomes have gained importance

**Table 1. Comparison of demographic and preoperative characteristics between groups**

| | Study group (n=10) Mean ± SD | Control group (n=14) Mean ± SD | p value |
|---|---|---|---|
| Age (years) | 60.4±13.6 | 64.29±0.89 | 0.666 |
| Gender (F/M) | 7/3 | 10/4 | 0.666 |
| Preoperative BCVA (LogMAR) | 0.89±0.12 | 0.56±0.17 | 0.0001 |
| Axial length (mm) | 23.36±0.63 | 23.62±0.88 | 0.666 |
| Preoperative ACD (mm) | 2.87±0.26 | 2.91±0.41 | 0.403 |
| IOL power (D) | 21.65±0.12 | 21.89±1.92 | 0.886 |

SD: Standard deviation, F/M: Female/male, BCVA: Best corrected visual acuity, ACD: Anterior chamber depth, IOL: Intraocular lens, D: Diopter

| Table 2. Comparison of postoperative characteristics between groups | | | |
|---|---|---|---|
| | **Study group (n=10) Mean ± SD** | **Control group (n=14) Mean ± SD** | **p value** |
| Preoperative ACD (mm) | 2.87±0.26 | 2.91±0.41 | 0.403 |
| Postoperative ACD (mm) | 4.11±0.54 | 4.18±0.39 | 0.886 |
| ACD change (mm) | 1.24±0.43 | 1.27±0.33 | 0.841 |
| Postoperative refraction (D) | 0.22±0.51 | -0.39±0.53 | 0.019 |
| SD: Standard deviation, ACD: Anterior chamber depth, D: Diopter | | | |

in combined surgery.[8] Differing results are reported in the literature, but the most common refractive outcome of phacovitrectomy is myopic shift.[4,5,6] These studies, most of which use ultrasonic biometry, have demonstrated that errors in the measurement of axial length are usually the source of this myopic shift.[8] Ultrasonic biometry measures axial length as the distance between the cornea and the surface of the internal limiting membrane. Axial length may be measured shorter in patients with increased macular thickness, thus causing a deviation toward myopia. Kovács et al.[6] recommended using optical coherence tomography (OCT) to measure macular thickness in ERM patients and using this value to correct axial length while doing biometric calculations. Patel et al.[9] claimed that adjusting the lens strength to be slightly hypermetropic in patients with macular pathology will reduce myopic shift. In optical biometry, axial length is measured as the distance between the cornea and the retinal pigment epithelium, and increased macular thickness can result in underestimation of axial length.[10] Optical biometry requires patient fixation, which allows for more accurate axial length measurement. However, pathologies such as ERM which cause eccentric fixation may result in the measurement of axial length on a different axis and lead to refractive deviations.[11]

ELP has been demonstrated as one of the factors that influences biometric calculation. ELP is determined by ACD, axial length, corneal thickness and IOL-related factors.[12] As the actual position is difficult to determine, ELP is based on the ACD measurement. It has been reported that after cataract surgery ACD increased by approximately 1.4 mm and ELP shifted posteriorly.[13] According to another study, an even larger increase in ACD occured after phacovitrectomy and the IOL tended to be placed more posteriorly.[14] In contrast, Hamoudi and La Cour[3] observed that after phacovitrectomy, posterior capsule fibrosis was more severe than in cataract surgery alone, and that this caused the ELP to move anteriorly. Suzuki et al.[5] found that using intraocular gas tamponade shifted the ELP forward, resulting in a change toward myopia. Schweitzer and Garcia[15] evaluated the effect of gas tamponade on postoperative refractive values in eyes having phacovitrectomy and reported that the postoperative refraction of eyes that received gas tamponade was -0.30 D, compared to +0.16 in eyes that did not receive gas tamponade.

This study involved the comparison of ACD changes and refractive values 3 months postoperatively in 10 eyes of 10 patients having vitrectomy and 14 eyes of 14 patients having only phacoemulsification. Intraocular tamponade was not used in any of the patients during phacovitrectomy. Both groups showed comparable preoperative and postoperative ACD values and ACD change. There was a significant difference between the groups in refractive values at 3 months postoperatively, with the phacovitrectomy group showing a more hypermetropic shift compared to the control group. These results are consistent with those obtained by Schweitzer et Garcia[15] in eyes with gas tamponade. Our findings of comparable ACD values but different refractive outcomes between the two groups suggests that either ACD alone does not represent ELP, or that in addition to ELP other factors such as postoperative axial length and macular edema also play a role in biometric calculation. In patients with macular pathology, preoperative axial length measurements may differ from postoperative measurements due to eccentric fixation or changes in macular thickness.[8] Because the aim of the current study was to evaluate changes in ACD, we did not evaluate changes in axial length. Therefore, the weakest aspect of this study is that macular thickness and postoperative axial length were not measured by OCT. The myopic shift occurring in patients after phacovitrectomy cannot be explained by changes in ACD alone. Preoperative macular thickness appears to be the most important factor in postoperative myopia.

The algorithms in current biometric formulas are specific for phacoemulsification; algorithms for phacovitrectomy have not been developed yet. It has not been clearly established how this affects refractive outcomes. Developing algorithms for phacovitrectomy and using these for biometric calculations may improve the refractive success of phacovitrectomy.

## Conclusion

The refractive outcomes of eyes having phacovitrectomy may differ from those of eyes having phacoemulsification alone. Determining the factors that contribute to this difference is essential in order to improve the refractive outcomes of phacovitrectomy.

**Ethics**

Ethics Committee Approval: İstanbul Medipol University Ethics Committee 10840098-604.01.01-E.2754, Informed Consent: It was taken.

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**Authorship Contributions**

Surgical and Medical Practices: Gökhan Gülkılık, Sevil Karaman Erdur, Merve Özbek, Mustafa Özsütçü, Mahmut Odabaşı, Göktuğ Demirci, Mehmet Selim Kocabora, Mustafa Eliaçık, Concept: Gökhan Gülkılık, Sevil Karaman Erdur, Merve Özbek, Mustafa Özsütçü, Mahmut Odabaşı, Göktuğ Demirci, Mehmet Selim Kocabora, Mustafa Eliaçık, Design: Gökhan Gülkılık, Sevil Karaman Erdur, Merve Özbek, Mustafa Özsütçü, Mahmut Odabaşı, Göktuğ Demirci, Mehmet Selim Kocabora, Mustafa Eliaçık, Data Collection or Processing: Gökhan Gülkılık, Sevil Karaman Erdur, Merve Özbek, Mustafa Özsütçü, Mahmut Odabaşı, Göktuğ Demirci, Mehmet Selim Kocabora, Mustafa Eliaçık, Analysis or Interpretation: Gökhan Gülkılık, Sevil Karaman Erdur, Merve Özbek, Mustafa Özsütçü, Mahmut Odabaşı, Göktuğ Demirci, Mehmet Selim Kocabora, Mustafa Eliaçık, Literature Search: Gökhan Gülkılık, Sevil Karaman Erdur, Merve Özbek, Mustafa Özsütçü, Mahmut Odabaşı, Göktuğ Demirci, Mehmet Selim Kocabora, Mustafa Eliaçık, Writing: Gökhan Gülkılık, Sevil Karaman Erdur, Merve Özbek, Mustafa Özsütçü, Mahmut Odabaşı, Göktuğ Demirci, Mehmet Selim Kocabora, Mustafa Eliaçık.

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Original Article

# Characteristics of Fundus Autofluorescence in Active Polypoidal Choroidal Vasculopathy

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## Summary

**Objectives:** To define characteristic fundus autofluorescence (FAF) findings in eyes with active polypoidal choroidal vasculopathy (PCV).

**Materials and Methods:** Thirty-five eyes of 29 patients with active PCV who were diagnosed at Ege University Faculty of Medicine, Department of Ophthalmology, Retina Division between January 2012 and November 2014 were included in the study. All the patients underwent a complete ophthalmological examination including fundus photography, spectral-domain optical coherence tomography, fluorescein angiography, FAF photography, and indocyanine green angiography (ICGA). ICGA was used to diagnose active PCV and identify lesion components. FAF findings were described at the retinal site of the corresponding lesions identified and diagnosed using ICGA.

**Results:** The mean age of the 29 study patients (15 men, 14 women) was 64.6±7.5 years (range, 54-82 years). ICGA revealed active PCV in 35 eyes, consisting of polypoid lesions in 11 eyes (31.4%), branching vascular networks (BVN) in 10 eyes (28.6%), and a combination of polypoid lesions and BVNs in 14 eyes (40%). On FAF images, 4 different patterns were detected at the corresponding retinal sites of 25 polypoid lesions detected by ICGA: confluent hypoautofluorescence with a hyperautofluorescent ring in 18 eyes (72%), hyperautofluorescence with hypoautofluorescent ring in 2 eyes (8%), confluent hypoautofluorescence in 1 eye (4%), and granular hypoautofluorescence in 1 eye (4%). The remaining 3 eyes (12%) demonstrated blocked hypoautofluorescence because of the excessive hemorrhaging in the macula. The FAF images showed the granular hypoautofluorescent FAF pattern in all 24 BVNs (100%) consistent with the location of the lesions on ICGA.

**Conclusion:** The typical PCV lesions, polypoid lesions and BVNs had characteristic autofluorescent findings on FAF imaging. Non-invasive, quick, and repeatable FAF imaging can be considered a reliable and helpful diagnostic technique for the diagnosis of active PCV.

**Keywords:** Autofluorescence, fundus autofluorescence, polypoid, polypoidal choroidal vasculopathy, branching vascular network

## Introduction

Polypoidal choroidal vasculopathy (PCV) commonly manifests with serous and hemorrhagic retinal pigment epithelium (RPE) detachment and is characterized by polypoidal vascular dilations and/or abnormal branching vascular networks (BVN) in the inner choroidal vessels.[1] First described by Yanuzzi et al.[1] in 1982, the debate continues to this day whether PCV is a separate entity or a subtype of neovascular age-related macular degeneration (nv-AMD). The natural course and treatment of PCV are distinct from nv-AMD, which is clinically significant for differential diagnosis.[2,3,4]

Indocyanine green angiography (ICGA) imaging is accepted as the gold standard diagnostic method for PCV due to its ability to visualize lesion components like polypoidal dilations, BVN and choroidal vascular hyperpermeability (CVH). However, several challenges to the clinical application of ICGA are the long time required for imaging, difficulty in obtaining the dye, and equipment requirements. There is therefore a need for other PCV diagnostic methods that are less invasive, require less time and are easily repeatable.

Fundus autofluorescence (FAF) imaging is a diagnostic method which, instead of using fluorescent dye, is based on the inherent fluorescence of ocular structures. When stimulated with light of specific wavelengths, these structures autofluoresce at longer wavelengths due to the presence of fluorophore molecules. This autofluorescence (AF), which comes from N-retinyliden-

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N-retinylethanolamin (A2-E) found in lipofuscin granules in the retinal pigment epithelium, can be easily visualized using a fundus camera or a confocal scanning laser microscope modified with AF filters. FAF imaging provides valuable information concerning the metabolism and function of the RPE, and is a noninvasive, rapid, reliable and repeatable diagnostic method that has utility in the diagnosis of many diseases affecting the outer retinal layers.[5,6]

In this clinical study we aimed to determine the characteristic FAF appearance of lesion components like polypoidal structures and BVNs in eyes with active PCV using short-wavelength confocal scanning laser ophthalmoscopy (cSLO).

## Materials and Methods

This prospective study included 35 eyes of 29 patients (15 male, 14 female) who were referred to the Ege University Faculty of Medicine, Department of Ophthalmology, Retina Unit with an initial diagnosis of nv-AMD and were diagnosed with active PCV between January 2012 and November 2014. All patients underwent a comprehensive ophthalmologic examination including medical history, best corrected visual acuity (BCVA), slit-lamp examination, fundus photography, spectral domain optical coherence tomography (SD-OCT), fluorescein angiography, FAF imaging and ICGA. SD-OCT images were acquired with the Heidelberg Spectralis HRA-OCT device (Heidelberg Engineering, Heidenberg, Germany) which operates with the cSLO technique. During the same session, ICGA was performed, OCT images were acquired at the retina sites corresponding to lesions found on ICGA, and FAF images were recorded using using 488 nm wavelength argon blue laser excitation with a 500 nm barrier filter.

The mean age of the patients was 64.6±7.5 (range, 54-82) years and mean BCVA was 0.28±0.28 Snellen (range, light perception-1.0).

PCV diagnosis was based on the detection of hyperfluorescent polypoidal focal choroidal vascular dilations and/or BVN lesions on ICGA, especially within the first 6 minutes. PCV was considered active in the presence of subretinal or intraretinal fluid, hemorrhage, pigment epithelium detachment or signs of leakage on FAF.

FAF images of the areas corresponding to polypoid lesions or BVNs on ICGA were described in terms of hyperautofluorescence and hypoautofluorescence patterns. The terms hyper- and hypoautofluorescence refer to areas of increased or decreased AF compared to the normal fundus. Hypoautofluorescent signals were further subgrouped as 'confluent hypoautofluorescence' and 'granular hypoautofluorescence'. Confluent hypoautofluorescence describes areas of homogenously decreased AF which can be easily distinguished from the surrounding fundus; granular hypoautofluorescence describes heterogenous areas containing lesions with various degrees of hypoautofluorescence. In addition to these terms, cases in which hemorrhagic lesions impeded the normal autofluorescent signal of the fundus were described as 'blocked AF'.

## Results

Of the 35 eyes diagnosed with active PCV, ICGA revealed polypoid lesions only in 11 eyes (31.4%), BVNs only in 10 eyes (28.6%), and both polypoid lesions and BVNs in 14 eyes (40%) (Figure 1).

Four different patterns were found in the FAF images of retinal areas corresponding to the 25 polypoid lesions detected by ICGA. These patterns were: confluent hypoautofluorescence with surrounding hyperautofluorescent ring in 72% (n=18), hyperautofluorescence with surrounding hypoautofluorescent ring in 8% (n=2), confluent hypoautofluorescence in 4% (n=1), and granular hypoautofluorescence in 4% (n=1). Blocked hypoautofluorescence was observed in 12% (n=3) of the eyes due to hemorrhage (Figure 2). All of the 24 BVN lesions (100%) showed granular hypoautofluorescence on FOF in the areas corresponding to the lesion on ICGA (Figure 3).

SD-OCT sections obtained at areas exhibiting the most common polypoid lesion pattern of confluent hypoautofluorescence with surrounding hyperfluorescent ring revealed typical OCT appearance of polypoid lesions forming spindly processes on the posterior RPE surface with moderate interior reflectivity (Figure 4). Merging the OCT and FAF images showed that the areas of confluent hypoautofluorescence with surrounding hyperfluorescent ring on FAF corresponded to the sharp protusions of RPE detachment due to polypoid lesions.

## Discussion

The eyes with active PCV in this study exhibited FAF patterns characteristic of polypoid lesions and BVNs. In FAF imaging, the conventional short-wavelength (488 nm) cSLO method was used in order to visualize the natural fluorescence arising due to the distribution of lipofuscin in the RPE.

Four distinct FAF patterns were observed in the polypoid lesions in the current study. The most common pattern was confluent hypoautofluorescence with hyperautofluorescent halo (72%), followed by the opposite pattern, hyperautofluorescence with hypoautofluorescent ring (8%). All of the BVN lesions (100%) showed granular hypoautofluorescence on FAF.

There are a few clinical studies in the literature which investigated the FAF characteristics of PCV.[7,8,9]

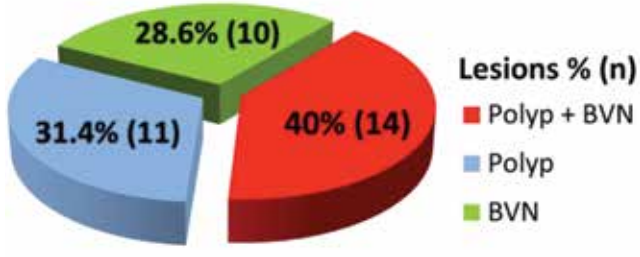


**Figure 1.** Distribution of polypoidal choroidal vasculopathy lesion components visualized by indocyanine green angiography
BVN: branching vascular networks

Yamagishi et al.[7] analyzed the FAF features of polypoid lesions and BVNs in eyes with PCV. They observed two typical FAF patterns, reporting that all polypoid lesions exhibited central confluent hypoautofluorescence and the majority (80.4%) had a circumferential hyperautofluorescent ring. The second FAF pattern they observed was granular hypoautofluorescence in 98.9% of the areas correspondent to BVNs. In another study, Yamagishi et al.[9] detected the polypoid lesion FAF pattern of confluent hypoautofluorescence with hyperautofluorescent ring in only 74% of patients.

Suzuki et al.[8] described the FAF features of polypoid lesions in eyes with PCV and their changes after 3 years' follow-up. They found that initially only 94.4% of polypoid lesions showed abnormal appearance on FAF, with the most common pattern (86.1%) being central hypoautofluorescence with a hyperautofluorescent ring. They also reported an abnormal FAF appearance (granular hypoautofluorescence) in only 67.7% of BVN lesions. The initial FAF appearance of the remaining 5.6% of polypoid lesions and 22.9% of BVN lesions was normal; however, by the end of the 3-year follow-up period there was a significant decrease in the BVNs with normal FAF appearance (6.2%).

The FAF patterns of polypoid lesions and BVNs most commonly observed in the current study were totally consistent with those reported in other studies. In addition, two other distinct FAF patterns were observed for polypoid lesions and the term 'blocked hypoautofluorescence' due to hemorrhage was used for the first time. Furthermore, none of the patients in our study exhibited normal FAF appearance. We believe this discrepancy between studies may be due to the fact that all of the patients included in our study had active and symptomatic manifestations of PCV. It seems that in other studies, PCV patients were not separated based on clinical characteristics like disease activity or the presence of symptoms.

The central hypoautofluorescence shown by polypoid lesions on FAF has been attributed to the formation of anterior processes in the RPE layers overlying the lesions; it has been claimed that these anatomic changes, which can also be detected on OCT, may lead to cellular damage by creating mechanical stress and pressure in the RPE layers.[9] In fact, in many studies the polypoid structures and BVN typical of PCV have been described as lesions found just beneath the RPE which alter its morphology and in time even cause structural changes in the RPE. Analyses using OCT have revealed the close relationship between PCV lesions and the RPE. Histopathologic studies have demonstrated disruptions in the continuity of the RPE in PCV patients and proposed that this may arise due to abnormal hemodynamics in the choroidal vessels.[10] The structural changes in the RPE caused by PCV lesions affects the distribution of lipofuscin. This

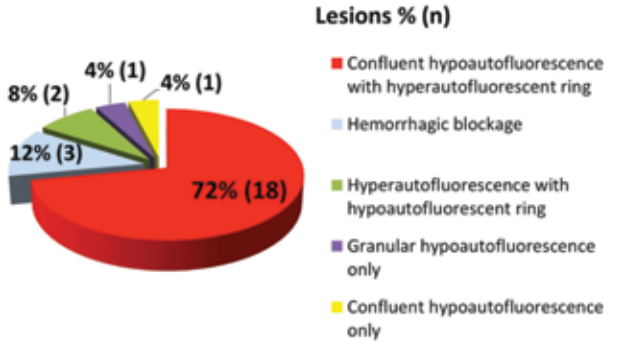


**Figure 2.** Fundus autofluorescence patterns and distribution of retinal areas corresponding to polypoid lesions on indocyanine green angiography

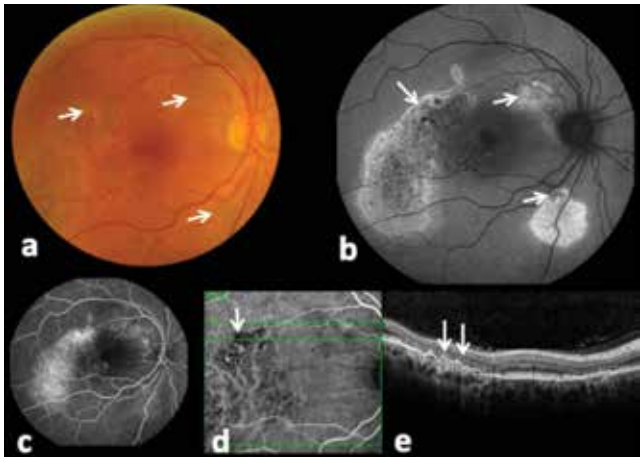


**Figure 3.** Areas of branching vascular networks (white arrows) in the right eye of a 72-year-old male patient visualized by a) color fundus photography, b) fundus autofluorescence, c) fluorescein angiography, d) indocyanine green angiography and e) spectral domain optical coherence tomography. The granular hypoautofluorescent fields on fundus autofluorescence represent the areas of branching vascular networks determined on indocyanine green angiography and spectral domain optical coherence tomography

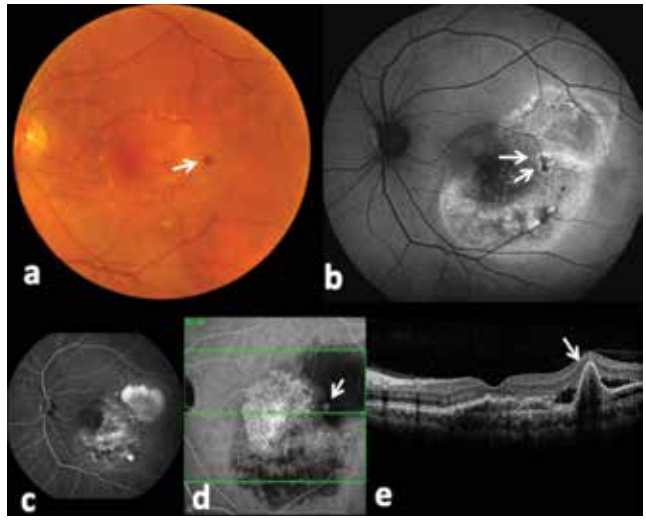


**Figure 4.** Images of a large polyp (white arrows) in the left eye of a 62-year-old male patient acquired by a) color fundus photography, b) fundus autofluorescence, c) fluorescein angiography, d) indocyanine green angiography and e) spectral domain optical coherence tomography imaging. A lesion presenting as subretinal hemorrhage on color fundus photography was determined to be an active polyp on indocyanine green angiography and spectral domain optical coherence tomography. The lesion exhibited confluent hypoautofluorescence with surrounding hyperautofluorescent ring on fundus autofluorescence imaging

increases the probability of being reflected on FAF imaging, which provides important information about the metabolism and function of the RPE, and creating the characteristic FAF appearance of lesions.

Central hypoautofluorescence is a common FAF pattern for polypoid lesions in all studies, which is considered indicative of permanent RPE atrophy and damage.[11]

## Conclusion

The results of our study support that FAF imaging is a noninvasive, rapid, repeatable diagnostic method that is useful in supporting the diagnosis of active PCV by ICG and OCT.

**Ethics**

Ethics Committee Approval: It was taken, Informed Consent: It was taken.

Peer-review: Externally peer-reviewed.

**Authorship Contributions**

Surgical and Medical Practices: Zafer Öztaş, Jale Menteş, Serhad Nalçacı, Mine Barış, Concept: Zafer Öztaş, Jale Menteş, Serhad Nalçacı, Mine Barış, Design: Zafer Öztaş, Jale Menteş, Serhad Nalçacı, Mine Barış, Data Collection or Processing: Zafer Öztaş, Jale Menteş, Serhad Nalçacı, Mine Barış, Analysis or Interpretation: Zafer Öztaş, Jale Menteş, Serhad Nalçacı, Mine Barış, Literature Search: Zafer Öztaş, Jale Menteş, Serhad Nalçacı, Mine Barış, Writing: Zafer Öztaş, Jale Menteş, Serhad Nalçacı, Mine Barış.

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Original Article

# The Effect of Adjuvant Intracameral Triamcinolone Acetonide on the Surgical Results of Trabeculectomy with Mitomycin C

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**Summary**

**Objectives:** To evaluate the effect of adjuvant intracameral triamcinolone acetonide (TA) on the surgical results of trabeculectomy with mitomycin C.

**Materials and Methods:** All consecutive trabeculectomy cases performed in the glaucoma clinic between July 2012 and December 2013 were retrospectively reviewed from the patient charts. Only those with follow-up of 12 months or longer were included. Patients with intraoperative intracameral TA (study group, n=19) were compared to those without TA (control group, n=21) in terms of surgical success, intraocular pressure (IOP) change, medication use and complications.

**Results:** Forty eyes of 31 patients (21 male/10 female, mean age 64.2±13.8 years) were included in the study. The mean follow-up period was 20.9±5.1 months and 20.7±6.7 months in the study and control groups, respectively (p=0.830). Baseline IOP was 26.4±9.9 and 25.2±7.6 mmHg (p=0.979), and final IOP was 12.7±2.6 and 13.6±3 mmHg in both groups respectively (p=0.226). At the final follow-up, complete success was observed in 68.4% and 52.4% of the study and control groups (p=0.349) and anti-glaucoma medication was used by 31.6% (mean number of medications: 0.79±1.2) and 47.6% (mean number of medications: 1.33±1.7), respectively (p>0.05). Bleb encapsulation, leakage, suture-lysis and hypotony rates were similar in both groups (for all, p>0.05). Cataract progression was noted in six (35.3%) and in five (26.3%) of the phakic eyes in the study and control groups, respectively (p=0.720).

**Conclusion:** When used intracamerally, TA did not increase the complication rate in trabeculectomy surgery. Although the group that received TA showed lower IOP levels, use of fewer medications and fewer eyes requiring medication, the differences did not reach significance.

**Keywords:** Intracameral triamcinolone acetonide, surgical success, trabeculectomy

## Introduction

Trabeculectomy lowers intraocular pressure (IOP) via the creation of a fistula through which the aqueous humour can drain from the anterior chamber to the sub-Tenon's space.[1] Unlike other surgical procedures, the goal in trabeculectomy is for the wound to only partially heal postoperatively. In fact, complete healing of the incision is considered a failed surgery. Bleb failure can occur after trabeculectomy for various reasons, but the most common cause is fibrotic changes in the conjunctiva and episclera.[2,3,4] Therefore, modulating wound healing has particular importance in trabeculectomy.

There are four basic stages of wound healing: 1) coagulative phase, 2) inflammatory phase, 3) proliferative phase, and 4) post-proliferative remodeling phase.[5] Mitomycin C (MMC) and 5-florouracil (5-FU), which are currently the anti-mitotic agents most commonly used in trabeculectomy, affect the proliferative phase by reducing fibroblast proliferation and activity, thereby increasing surgical success.[5,6,7] However, because these drugs have been associated with serious, sight-threatening complications such as corneal endothelial failure, bleb leakage, blebitis and endophthalmitis,[8,9,10] the search continues for safer alternative methods to increase the success of trabeculectomy.

As with all ocular surgeries, medications containing corticosteroids improve the success rates of trabeculectomy.[11] Steroid-containing drugs not only affect the inflammatory phase of wound healing (by reducing leukocyte density, distribution and function), but also affect the coagulative phase by reducing

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vascular permeability, and the fibrotic phase by inhibiting the release of inflammatory mediators and growth factors.[5] Triamcinolone acetonide (TA) is a synthetic steroid in the form of white crystals in an aqueous suspension. TA has been detected in the aqueous humour at minimal concentrations for 13 months after subconjunctival application and 18 months after intravitreal application.[12,13] Intracameral administration of TA during trabeculectomy results in high TA concentrations in both the anterior chamber and the subconjunctival space, so the anti-inflammatory and anti-fibrotic effects of TA would be expected to persist in the long term.

In this study we aimed to evaluate whether the intracameral administration of TA as an adjuvant to trabeculectomy with MMC had an impact on surgical success and to assess the possible complications associated with this method.

## Materials and Methods

Adjuvant intracameral TA was administered routinely to patients undergoing trabeculectomy with MMC in the glaucoma clinic of our hospital between April and December 2013. Therefore, the study group included consecutive patients operated during this period who met the study criteria (TA+ group), while the control group (TA- group) comprised consecutive patients from the previous period (July 2012 to March 2013). In accordance with the Declaration of Helsinki, all patients were informed about the surgical procedures and postoperative period, and written informed consent forms were obtained from all participants.

Patients followed for at least 12 months were included in the study. Patients with neovascular glaucoma and glaucoma secondary to uveitis were excluded.

The following data were recorded from patients' charts: age, gender, ocular and systemic diseases, history of cataract surgery or other operations; preoperative corrected visual acuity (CVA), IOP values, drugs used, lens status, findings on slit-lamp, fundus and gonioscopy examinations; and postoperative IOP values, drugs used, and complications.

Patients were evaluated before the surgery; at 1 day, 1 week, and 1, 3, 6 and 12 months after surgery; and once a year thereafter. Visual acuity was measured using Snellen chart and converted to logMAR for statistical analysis. Goldmann applanation tonometer was used for all IOP measurements. Fundus examination was done using a +90 diopter (D) lens.

At the final examination, an unmedicated IOP less than 18 mmHg was considered 'complete success'; IOP less than 18 mmHg with any anti-glaucomatous drug was 'partial success'; and IOP of 18 mmHg or higher was 'failure'. IOP under 5 mmHg was considered hypotony.

**Surgical Technique**

Following stabilization of the globe with a 8/0 vicryl traction suture placed in the superior limbus, a conjunctival flap was created based at the fornix. MMC was applied to the scleral surface at a concentration of 0.2 mg/mL for 2 min, then washed with at least 50 mL of saline solution. Hemostasis was achieved by cauterization when necessary. A half-thickness, 3x4 mm rectangular scleral flap was created. Paracentesis was performed through a side port opened with a 15° blade and 0.10% carbachol (Miostat, Alcon Laboratories, USA) was administered in the anterior chamber. Peripheral iridectomy was performed after removing a 1x2 mm corneoscleral block. The scleral flap was closed at 2 corners with 10/0 nylon sutures. After checking the aqueous drainage, additional sutures were placed when necessary. The conjunctiva was closed with 10/0 nylon sutures in the limbus and checked for leakage. In patients receiving intracameral TA, the procedure was concluded with the administration of 0.1-0.3 mL of 4 mg/mL TA (Kenakort-A, Deva Holding A.Ş., Çerkezköy/Tekirdağ, Turkey) into the anterior chamber through the side port (Figure 1).

All patients were treated postoperatively with topical antibiotic (0.5% moxifloxacin) 5 times a day for 2 weeks and topical 1% prednisolone acetate starting at 6 times a day for the first 2 weeks and decreasing each week for a total of 6 weeks.

**Statistical Analysis**

SPSS version 20.0 software was used in all statistical analyses. Numerical variables are expressed as mean ± standard deviation (SD). Categorical variables are expressed as frequency and percentage (%). The Wilcoxon test was used for dependent intergroup comparisons of numerical variables; the Mann Whitney U test was used for independent comparisons of the two groups. Fisher's Exact test was used for categorical variables. Results with P values less than 0.05 were accepted as statistically significant. Patients with intracameral TA (study group) and without TA (control group) were compared in terms of surgical success and complications.

## Results

**Preoperative Findings**

Forty eyes of 31 patients (21 male, 10 female; mean age 64.2±13.8 years) who met the study criteria were included in the study. The demographic data of the study group (n=19) and control group (n=21) are summarized in Table 1.

There was no significant difference in preoperative characteristics between the two groups (Table 1).

**Surgical Success and Change in Intraocular Pressure**

The mean postoperative follow-up time was 20.9±5.1 months in the study group and 20.7±6.7 months in the control group (p=0.830). At the final follow-up, complete success was observed in 13 eyes (68.4%) of the study group and partial success in 6 eyes (31.6%). In the control group, complete success was achieved in 11 eyes (52.4%) and partial success in 10 eyes (47.6%) (p=0.349). The IOP values and number of medications used preoperatively and at each postoperative follow-up in both groups are shown in Table 2. Figure 2 presents the pre- to postoperative IOP changes in the patient groups in graphic form. After postoperative month 3, the study group showed lower mean IOP and number of medications, and the number of medicated eyes was lower at the final follow-up (31.6% in the study group vs 47.6% in the control group), but these differences did not reach statistical significance.

**Complications**

Table 3 summarizes the complications that occurred in each group. In the first month, argon laser suturolysis was performed in 7 eyes (36.8%) in the study group and in 6 eyes (26.6%) in the control group. In the early postoperative period, resuturation was performed in 1 eye (5.2%) of the study group due to conjunctival leakage; in the control group, conjunctival leakage was detected in 3 eyes (14.3%), 2 of which were resutured and 1 was treated with occlusion therapy. One patient in the study group was treated with systemic steroids due to hypotony and choroidal detachment in the early period. Furthermore, transient hypotony which spontaneously resolved was observed in 1 patient from both the study and control groups. Hypotony or conjunctival leakage did not occur in any of the patients in the late postoperative period. During the follow-up period, bleb encapsulation requiring needling developed in 3 eyes (15.8%) in the study group, each of which was managed with a single needling with MMC. In the control group, 4 eyes (19.1%) had encapsulated blebs; 2 of these eyes were treated once by needling with MMC, 1 eye was treated twice and 1 eye 3 times. Lens opacification occured in 6 phakic eyes (35.3%) in the study group and 5 phakic eyes (26.3%) in the control group during the follow-up period. Cataract surgery was performed in 4 eyes in both the study and control groups during the follow-up period after trabeculectomy.

**Table 1. Patients' demographic characteristics and preoperative findings**

| TA (+), n=19 | | Group | | p value |
|---|---|---|---|---|
| | | TA (-), n=21 | | |
| Age (years) | | 65±13.3 | 63.7±14.5 | 0.793 |
| Gender | | | | 1.000 |
| | Male | 9 (69.2) | 12 (66.7) | |
| | Female | 4 (30.8) | 6 (33.3) | |
| Systemic diseases | | | | 0.412 |
| | DM | 3 (23.1) | 4 (22.2) | |
| | HT | 8 (61.5) | 8 (44.4) | |
| Glaucoma Type | | | | 0.349 |
| | POAG | 5 (26.3) | 8 (38.1) | |
| | CCAG | 2 (10.5) | 2 (9.5) | |
| | PEXG | 11 (57.9) | 9 (41.9) | |
| | Other* | 1 (5.3) | 2 (9.5) | |
| Lens status | | | | 0.860 |
| | Phakic | 17(89.5) | 19 (90.5) | |
| | Pseudophakic | 2 (10.5) | 2 (9.5) | |
| CVA (logMAR) | | 0.86±0.9 | 0.83±0.7 | 0.768 |
| IOP (mmHg) | | 26.4±9.9 | 25.2±7.6 | 0.979 |
| Number of medications | | 3.89±0.6 | 3.76±0.5 | 0.555 |
| Cup/disc ratio | | 0.92±0.06 | 0.83±0.15 | 0.073 |
| MD (dB) | | -18.5±8.5 | -17.5±9.1 | 0.896 |
| CCT (µm) | | 536±41 | 539±36 | 0.751 |

Categorical data are given in number (%); numerical values are expressed as mean ± standard deviation (SD). TA: Triamcinolone acetonide, DM: Diabetes mellitus, HT: Systemic hypertension, POAG: Primary open angle glaucoma, CCAG: Chronic closed angle glaucoma, PEXG: Pseudoexfoliative glaucoma, *: Angle dysgenesis, CVA: Corrected visual acuity, IOP: Intraocular pressure, MD: Mean deviation, dB: Decibel, CCT: Central corneal thickness

## Discussion

In this case series, patients with intracameral TA (study group) and without TA (control group) were compared in terms of surgical success and complications. The application of intracameral TA at the end of surgery did not result in any significant differences in the success or complication rates in our study. At the final examination after an average follow-up period of 21 months, the complete surgical success rate was 68.4% in patients treated with intracameral TA and 52.4% in the control group; partial success rates were 31.6% and 47.6% in the study and control groups, respectively. The IOP of all

**Table 2. Mean intraocular pressure and number of medications in the patient groups**

| | | Group | | |
|---|---|---|---|---|
| | | TA (+), n=19 | TA (-), n=21 | p value |
| Initial | | | | |
| | IOP (mmHg) | 26.4±9.9 | 25.2±7.6 | 0.979 |
| | Medications | 3.89±0.6 | 3.76±0.5 | 0.555 |
| Week 1 | | | | |
| | IOP (mmHg) | 15.4±11.5 | 13.2±7.0 | 0.708 |
| | Medications | 0 | 0 | |
| Month 1 | | | | |
| | IOP (mmHg) | 13.2±6.3 | 13.1±5.2 | 0.878 |
| | Medications | 0.06±0.2 | 0.1±0.3 | 0.828 |
| Month 3 | | | | |
| | IOP (mmHg) | 11.7±4.5 | 14.6±5.4 | 0.053 |
| | Medications | 0.33±0.7 | 0.76±1.2 | 0.426 |
| Month 6 | | | | |
| | IOP (mmHg) | 12.7±3.8 | 14.1±4.4 | 0.540 |
| | Medications | 0.42±0.7 | 1.29±1.4 | 0.099 |
| Year 1 | | | | |
| | IOP (mmHg) | 12.7±3.2 | 14.2±5.0 | 0.592 |
| | Medications | 0.58±0.9 | 1.29±1.4 | 0.153 |
| Year 2 | | | | |
| | IOP (mmHg) | 12.0±3.3 | 14.5±3.5 | 0.105 |
| | Medications | 1.00±1.6 | 1.50±1.3 | 0.353 |
| Final follow-up | | | | |
| | IOP (mmHg) | 12.7±2.6 | 13.6±3.0 | 0.226 |
| | Medications | 0.79±1.2 | 1.33±1.7 | 0.333 |

TA: Triamcinolone acetonide, IOP: Intraocular pressure

patients in the study group was 18 mmHg or lower at final follow-up.

Previous studies have demonstrated that minimal concentrations of TA remain in the aqueous humour for 13 months after subconjunctival application and 18 months after intravitreal application.[12,13] Because it suppresses inflammation and reduces vascular permeability, TA is commonly used in ocular disease and surgery, usually in the form of an intravitreal or sub-Tenon injection. TA applied intracamerally during pediatric cataract surgery has been reported to provide superior control of anterior segment inflammation and fewer inflammation-related complications.[14] It has also been shown that the use of intracameral TA does not change the IOP profile or lead to major complications in the postoperative period.[14,15]

The use of TA during glaucoma surgery was first reported in 1986 by Giangiacomo et al.[16] They reported achieving surgical success with 4 mg of TA delivered by subconjunctival injection 0-7 days before surgery in 14 of 15 eyes determined as high-risk for episcleral scarring. In 2006, Tham et al.[17] injected 0.03 mL of 40 mg/mL TA directly into the blebs of 6 eyes undergoing trabeculectomy. They reported promising results from this pilot study and did not observe any signs of endothelial loss or cataract progression. The results of other studies on the use of TA in trabeculectomy are summarized in Table 4. Some of the studies were unable to demonstrate any benefit related to TA,[18,19] while positive results were reported in others.[16,17,20,21]

**Table 3. Postoperative complications observed in the two patient groups**

| Complication, Number (%) | Group | | |
|---|---|---|---|
| | TA (+), n=19 | TA (-), n=21 | p value |
| Suturolysis | 7 (36.8) | 6 (26.6) | 0.738 |
| Early-onset conjunctival leakage | 1 (5.2) | 3 (14.3) | 0.607 |
| Choroidal detachment | 1 (5.2) | 0 | 0.475 |
| Hypotony | 2 (10.4) | 1 (4.7) | 0.596 |
| Encapsulation requiring needling | 3 (15.8) | 4 (19.1) | 1.000 |
| Lens opacification | 6 (35.3) | 5 (26.3) | 0.721 |
| Blebitis/endophthalmitis | 0 | 0 | - |
| Late-onset conjunctival leakage | 0 | 0 | - |

TA: Triamcinolone acetonide

**Figure 1.** Triamcinolone acetonide is visible in the anterior chamber after postoperative intracameral injection and can be seen flowing into the subconjunctival space via the fistula

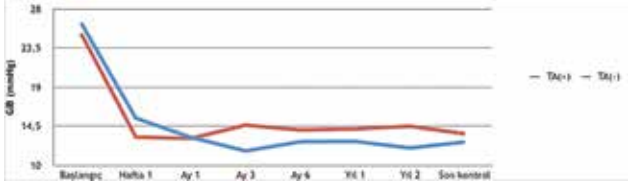

**Figure 2.** Initial intraocular pressure and postoperative changes

Although no significant difference was observed between the two patient groups in our study in terms of surgical outcomes, as of postoperative month 3 the study group showed lower mean IOP and number of medications (Figure 2, Table 2), and the number of medicated eyes was lower at the final follow-up (31.6% in the study group vs 47.6% in the control group). Although not reflected statistically, TA showed a slight beneficial effect when applied in trabeculectomy with MMC.

We observed no effect of TA delivered via intracameral route on trabeculectomy-related complications. The study and control groups showed comparable rates of encapsulation, leakage, suturolysis and hypotony (Table 3). In a case series of trabeculectomy with adjuvant intracameral bevacizumab, it was reported that despite higher rates of surgical success, bevacizumab was associated with increased conjunctival leakage in the early postoperative period.[22] However, there are no reports of increased early or late postoperative complications of trabeculectomy associated with TA.

Steroids are known to increase cataract formation and cause substantial increases in IOP.[23] On the other hand, trabeculectomy itself is also known to accelerate cataract development. In our case series, TA was not associated with higher risk of cataract progression in phakic eyes over the average follow-up period of 21 months. Cataract progression was observed in 35.3% of phakic eyes treated with intracameral TA and 26.3% of the control eyes, and in each group 4 eyes required cataract surgery.

The anti-neoplastic agent MMC reduces scar formation and increases surgical success after trabeculectomy by both suppressing fibroblast proliferation and decreasing collagen production in fibroblasts.[5,24] Furthermore, MMC is toxic to both proliferative and nonproliferative cells, thus leading to apoptosis.[25] Although MMC falls below the minimum effective concentration a few days after ocular application,[26] it is believed that its biological effect continues for a much longer time.[27] Due to these features, trabeculectomy with adjuvant MMC has been associated with higher rates of thin avascular blebs, bleb leakage, and resulting complications like blebitis or endophthalmitis.[8,9,10] No increase in complication rates has been observed in studies using TA in trabeculectomy,[16,17,18,19,20,21] suggesting that TA is safer than MMC. Similarly, we observed no serious complications related to intracameral TA administration in our case series.

**Table 4. Studies using triamcinolone acetonide as an adjuvant in trabeculectomy surgery**

| Source | Study group | Control group | Follow-up (months) | Results | Complications |
|---|---|---|---|---|---|
| Giangiacomo et al.[16] | TA 4 mg (SC, 0-7 days prior) (n=15, high-risk patients) | None | 6-16 | 14/15 success (complete+partial) | TA did not pose any additional risk |
| Tham et al.[17] | TA 1.2 mg/0.03 mL (İB, perop) MMC 0.4 mg/mL, 3 min (n=6, TRAB/Phaco-TRAB) | None | 3 | 100% success | None of the patients developed infection, conjunctival ulceration or cataract |
| Koval et al.[18] | TA 2 mg/0.05 mL (İC, perop) (n=37, TRAB/Phaco-TRAB/ Tube) | No adjuvant treatment (n=40, TRAB/Phaco-TRAB/Tube) | 6 | TA did not increase success rate | TA did not affect the rate of complications related to glaucoma surgery |
| Yuki et al.[19] | TA 20 mg/1 mL (ST, perop) MMC 0.4 mg/mL, 5 min (n=26, secondary glaucoma patients) | MMC 0.4 mg/mL, 5 min (n=27, secondary glaucoma patients) | 12 | TA did not increase success rate | TA did not affect complication rate |
| Kahook et al.[20] | TA 20 mg/0.5 mL (RB, perop) MMC 0.2 mg/mL, 2 min (n=14, Re-TRAB patients) | None | 6 | 13/14 complete success | None of the patients developed leakage, infection, hypotony or conjunctival ulceration |
| Hogewind et al.[21] | TA (purified) 5 mg/0.05 mL (ST, perop) (n=25) | MMC 0.02 mg/mL, 3 min (n=39) | 5 | TA was found at least as effective as MMC (comparable success rates in the two groups) | Complication rate was comparable in the two groups |

Perop: Peroperative, TRAB: Trabeculectomy, Phaco: Phacoemulsification, Tube: Tube shunt surgery, Re-TRAB: Patients undergoing trabeculectomy after a previous failed glaucoma surgery, TA: Triamcinolone acetonide, SC: Subconjunctival, IB: Intrableb, RB: Retrobulbar, ST: Sub-Tenon, IC: Intracameral, MMC: Mitomycin C

A portion of the TA delivered to the anterior chamber at the end of trabeculectomy remains in the anterior chamber, while another portion flows into the sub-Tenon's space around the scleral flap via the fistula (Figure 1). Therefore, high concentration of TA is achieved both in the anterior chamber and around the scleral flap in the early postoperative period. The portion of TA that enters the sub-Tenon's space is released gradually, thus exerting the extended effect demonstrated in previous studies.[12] Delivering TA via a cannula through the limbal side port created during the surgery is quite practical. With sub-Tenon or intrableb delivery, complications such as injection-related sterile necrosis or persistent TA deposits in the subconjunctival space have been reported.[17,28,29]

The basic limitations of this study are that it was retrospective and the patient number was small. Because the study was conducted retrospectively, the TA dose administered could not be completely standardized and ranged from 0.1 to 0.3 mL.

## Conclusion

Administration of intracameral TA during trabeculectomy did not increase the complication rate in our study. However, TA did not have a significant effect on long-term surgical success. Nevertheless, despite statistical nonsignificance, the group that received TA exhibited positive trends such as lower IOP levels, fewer antiglaucomatous drugs used postoperatively and fewer cases requiring medication. Further studies on this topic are needed.

**Ethics**

Ethics Committee Approval: A retrospective study, Informed Consent: It was taken.

Peer-review: Externally peer-reviewed.

**Authorship Contributions**

Surgical and Medical Practices: Çiğdem Altan, Ercüment Bozkurt, Banu Şatana, Berna Başarır, Neşe Alagöz, Ceren Yeşilkaya, Concept: Ercüment Bozkurt, Banu Şatana, Çiğdem Altan, Design: Neşe Alagöz, Çiğdem Altan, Ceren Yeşilkaya, Muhittin Taşkapılı, Data Collection or Processing: Neşe Alagöz, Ceren Yeşilkaya, Cengiz Alagöz, Yusuf Yıldırım, Analysis or Interpretation: Neşe Alagöz, Cengiz Alagöz, Çiğdem Altan, Ercüment Bozkurt, Muhittin Taşkapılı, Literature Search: Ceren Yeşilkaya, Cengiz Alagöz, Yusuf Yıldırım, Writing: Neşe Alagöz, Çiğdem Altan.

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Original Article

# Optic Nerve Head Parameters in a Turkish Population Over Forty Years of Age

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**Summary**

**Objectives:** To evaluate the optic disc area and cup area in a normal population over 40 years of age.

**Materials and Methods:** This prospective study was performed in Eskişehir. Fundus photographs were obtained using a nonmydriatic fundus camera. Planimetric measurements of the optic disc and cup area were performed with VK-2 digital imaging software. Optic nerve parameters were then compared between sex and age groups.

**Results:** A total of 3,038 subjects were evaluated. Mean age was 56.6±10.4 years (range 40-91 years). The median disc area of the subjects was 2.87 (2.53-3.23) $mm^2$ in the right eyes and 2.89 (2.55-3.25) $mm^2$ in the left eyes ($p<0.001$). The median cup area of the subjects was 0.46 $mm^2$ (0.33-0.64 $mm^2$) in the right eyes and 0.44 $mm^2$ (0.33-0.61 $mm^2$) in the left eyes ($p<0.001$). The differences in disc and cup area between male and female subjects were not statistically significant ($p>0.05$).

**Conclusion:** We report the normal distribution of disc area and cup area measurements and their association with age and sex.

**Keywords:** Optic disc, optic cup, disc area, cup area

## Introduction

Morphological changes in the optic nerve head have diagnostic value for many systemic and ocular disorders. Disc size and cup-to-disc ratio are important parameters in the assessment of disc damage in glaucoma.[1,2] The normal disc size varies between 0.8 and 6.0 $mm^2$ and can depend on underlying pathologies such as myopia, hyperopia, morning glory anomaly, optic disc drusen and papilledema. There is also a pronounced interindividual variability of disc size due to ethnic variation, equipment used and physicians making the evaluation.[3,4,5,6,7]

Since data on disc parameters in the Turkish population are scarce, the present investigation was conducted to examine optic disc and cup areas in Turkish people over 40 years of age.

## Materials and Methods

This study was a population-based study conducted in Eskişehir. We evaluated both eyes of subjects over age 40 who were reached through registrations in the Health Centers in one township (Kaymaz) and three districts (Esentepe, Şirintepe, Osmangazi) of Eskişehir. After obtaining informed consent, a questionnaire was performed by a professional technician who had more than five years of experience in ophthalmology. Ocular and systemic pathologies as well as demographic factors such as age and sex were noted. Intraocular pressure was measured by Tono-pen (Medtronic Ophthalmics, Jacksonville, Florida, USA) and central corneal thickness by Pacline pachymeter (Opticon 2000 S.p.A., Rome, Italy). Fundus photographs were then taken by a KOWA (Kowa, Nagoya, Japan) nonmydriatic fundus camera. Pupils were not dilated. A total of 3,038 subjects with sufficient media clarity to permit good quality fundus photographs underwent photography.

The fundus images of 3,038 cases were assessed by planimetric measurements using 45º photographs. Borders of the discs and cups were manually marked at 12 points by a researcher and a line was automatically generated by the VK-2 digital imaging software (Figure 1). The cup was outlined as the central depressed area and the site of bending of the vessels was accepted as the

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true margin. The border of the disc was marked at the inner side of peripapillary scleral ring. If present, parapapillary alpha atrophy with irregularities of the retinal pigment epithelium and beta atrophy with absent pigment epithelium and visible choroidal vessels were left outside the drawn borders. In cases with tilted discs, the scleral ring or edge of the retinal pigment epithelial/choriocapillaris layer were accepted as the disc margin. Nonmydriatic fundus camera parameters included disc area, cup area and cup/disc area ratio.

The study population was divided into four groups according to age: 40-49 years; 50-59 years; 60-69 years; and over 70 years. Both eyes of all cases were evaluated. Eyes with glaucoma and eyes without clear fundus images that prevented reliable planimetric assessment were excluded from the study.

Descriptive statistics were used to describe each variable. The descriptive statistisics were demonstrated with n (sample size), mean and standard deviation for continuous variables, and n (sample size), median and 25$^{th}$ (Q1) and 75$^{th}$ (Q3) percentiles for non-normally distributed variables. Kolmogorov-Smirnov and Shapiro-Wilk tests of normality were used to check the normality of variable distributions. Independent variables that did not show normal distribution were compared using Kruskal-Wallis and Mann-Whitney U tests. Wilcoxon Signed Ranks test was used for the dependent non-normally distributed variables. A value of $p<0.05$ was accepted as significant. SPSS 21.0 program was used for statistical analysis.

## Results

A total of 2,862 right and 2,856 left eyes of 3,038 subjects were evaluated. There were 2,241 female and 797 male subjects in the study. Overall mean age was 56.6±10.4 years (range 40-91 years). The mean age of female subjects was 55.6±10.1 years and the mean age of the male subjects was 59.2±10.5 years. Mean intraocular pressure in right and left eyes was 16.2 mmHg and 16.1 mmHg, respectively. The frequency of tilted disc, alpha and beta atrophies was 0.94%, 22% and 7.45%, respectively.

**Optic Disc**

The median disc area of the subjects was 2.87 (2.53-3.23) mm$^2$ in the right eyes and 2.89 (2.55-3.25) mm$^2$ in the left eyes ($p<0.001$). Median disc areas in females were 2.87 (2.57-3.32) mm$^2$ and 2.90 (2.60-3.24) mm$^2$ in right and left eyes respectively. Median disc areas in males were 2.87 (2.53-3.23) mm$^2$ and 2.89 (2.55-3.25) mm$^2$ in right and left eyes respectively. The difference between male and female subjects was not significant ($p=0.25$ and $p=0.19$ for right and left eyes, respectively).

Disc areas according to the age groups are given in Table 1. There was no significant difference between the groups ($p>0.05$). The difference between right and left eyes was significant in the 50-59 and 60-69 age groups.

Disc areas were observed to be larger in the younger and older age groups ($p>0.05$), but the difference was only found to be significant between 60-69 vs 70+ groups in female subjects ($p=0.029$) (Table 2).

**Optic Cup**

Optic cup area ranged from 0.33 to 0.64 mm$^2$ (median 0.46 mm$^2$) in the right eyes and from 0.33 to 0.61 mm$^2$ (median 0.44 mm$^2$) in the left eyes ($p<0.001$). Median cup areas in females were 0.45 (0.34-0.63) mm$^2$ and 0.44 (0.33-0.61) mm$^2$ in right and left eyes respectively. Median cup areas in males were 0.46 (0.32-0.63) mm$^2$ and 0.45 (0.33-0.61) mm$^2$ in right and left eyes respectively. The difference between male and female subjects was not significant ($p=0.49$ and $p=0.73$ for right and left eyes respectively).

There was a significant correlation between disc area and cup area in the right and left eyes ($p<0.001$).

## Discussion

Optic nerve head assessment is important in many ocular and systemic diseases, especially in glaucoma, which is a well known preventable cause of blindness. To detect early pathological changes in the optic nerve head, one must know the normal distribution of its parameters. There are many studies in this area, but almost none in Turkish population.[8,9]

In this study we evaluated optic disc and cup area in a Turkish population. We used a nonmydriatic fundus camera to evaluate the optic nerve head of the subjects. It is a noninvasive, noncontact imaging technique that does not require pupillary mydriasis. Fundus cameras have become increasingly automated and they include computer-assisted digital analysis of the optic nerve head. Computer-assisted techniques have improved intra-observer reproducibility and inter-observer consistency.[10]


**Figure 1.** Drawing of the optic nerve head with peripapillary atrophy

**Table 1. Mean disc areas in the right and left eyes according to the age groups**

| Age | Disc Area (mm$^2$) Right eyes Median (Q1-Q3) | Disc Area (mm$^2$) Left eyes Median (Q1-Q3) | p |
|---|---|---|---|
| 40-49 | 2.91 (2.56-3.27) | 2.90 (2.57-3.26) | 0.752 |
| 50-59 | 2.85 (2.52-3.22) | 2.88 (2.55-3.22) | **0.008** |
| 60-69 | 2.85 (2.51-3.20) | 2.90 (2.55-3.24) | **<0.001** |
| 70+ | 2.91 (2.61-3.29) | 2.94 (2.60-3.31) | 0.158 |

We found the mean optic disc area to be 2.88 mm$^2$ (1.2-5.28 mm$^2$). In the Beijing Eye study performed on the Chinese population, mean disc area was 2.65 mm$^2$ (1.03-7.75 mm$^2$). In the Indian population it was 3.37 mm$^2$ (2.04-4.7 mm$^2$). In all of these studies, planimetric measurements were used.[11,12] Marsh et al.[7] showed that the mean optic disc area was significantly smaller in white and Hispanic subjects than in African-Americans. Durukan et al.[13] found the mean disc area to be 2.12 mm$^2$ in a normal Turkish population, but the measurements were done using a confocal scanning laser ophthalmoscope (HRT II), and this may explain the difference from our study. Thomas et al.[14] compared HRT and planimetric findings and concluded that disc area is measured smaller by HRT than by planimetry (2.24 vs 2.58 mm$^2$). It is well known that the technique and equipment used have an important influence on measurement results.

In our study, the mean disc area was 2.89±0.45 mm$^2$ in male subjects and 2.88±0.46 mm$^2$ in female subjects. Although female subjects had smaller discs, the difference was not significant (p>0.05). Varma et al.[15] studied 3,387 normal American subjects and concluded that males had larger discs than females in both the white and black populations. In contrast, there are other studies which do not support this evidence.[12,16]

We did not find a significant difference between age groups in terms of disc area or cup area. The only significant difference was observed for disc area between the 60-69 and 70+ age groups in female subjects, which might be coincidental. Durukan et al.[13] found a significant difference between subjects over and under 60 years of age, with larger disc areas in subjects over 60 years. In a postmortem study performed by Quigley et al.,[8] no relation was found between age and disc size. The same results were found in the Beijing Eye Study and Baltimore Study.[15,17] This may show that the effect of age on disc size may vary among different nations.

In our study, mean cup area was measured as 0.45 mm$^2$ and we did not find any significant differences in the measurements between sexes. Similar results were observed by Durukan et al.[13] In a study by Xu et al.,[9] the mean cup area of a Chinese population was larger than that of our population, which may be attributable to ethnic differences.

There are some limitations of this study. The evaluation technique requires a high degree of subjective judgment and slight differences in settings used may cause variation between centers. Keratometric readings of patients' corneas or measurements of the axial lengths were not available; therefore, an individual correction for the magnification of the optics of the eye was not possible.

## Conclusion

We report the normal distribution of disc area and cup area measurements in the Turkish population. Disc area and cup area did not vary significantly between male and female subjects or between different age groups.

**Table 2. Disc parameters in males and females according to the age groups**

| | | **Female** | | | **Male** | |
|---|---|---|---|---|---|---|
| | **Age** | **Median (Q1-Q3)** | **p** | **Pairwise Comparisons** | **Median (Q1-Q3)** | **p** |
| Cup area (right eyes) | 40-49 | 0.48 (0.33-0.68) | p=0.379 | NS | 0.51 (0.35-0.72) | p=0.189 |
| | 50-59 | 0.47 (0.33-0.65) | | | 0.45 (0.33-0.61) | |
| | 60-69 | 0.46 (0.32-0.62) | | | 0.44 (0.32-0.61) | |
| | 70+ | 0.45 (0.33-0.65) | | | 0.48 (0.37-0.67) | |
| Cup area (left eyes) | 40-49 | 0.45 (0.34-0.62) | p=0.806 | NS | 0.50 (0.33-0.71) | p=0.172 |
| | 50-59 | 0.45 (0.34-0.62) | | | 0.43 (0.31-0.59) | |
| | 60-69 | 0.44 (0.33-0.59) | | | 0.44 (0.33-0.59) | |
| | 70+ | 0.45 (0.34-0.64) | | | 0.44 (0.34-0.65) | |
| Disc area (right eyes) | 40-49 | 2.92 (2.56-3.26) | **p=0.029** | 60-69 vs 70+ | 2.88 (2.54-3.33) | p=0.071 |
| | 50-59 | 2.84 (2.53-3.22) | | | 2.84 (2.50-3.20) | |
| | 60-69 | 2.86 (2.49-3.22) | | | 2.86 (2.55-3.18) | |
| | 70+ | 2.91 (2.60-3.30) | | | 2.92 (2.63-3.29) | |
| Disc area (left eyes) | 40-49 | 2.90 (2.57-3.26) | p=0.540 | NS | 2.88 (2.57-3.23) | p=0.136 |
| | 50-59 | 2.89 (2.55-3.22) | | | 2.82 (2.53-3.22) | |
| | 60-69 | 2.89 (2.52-3.23) | | | 2.92 (2.61-3.24) | |
| | 70+ | 2.94 (2.58-3.31) | | | 2.94 (2.67-3.31) | |

NS: Not significant

**Ethics**

Ethics Committee Approval: Approval number 2008/263, Informed Consent: It was taken.

Peer-review: Externally and internally peer-reviewed.

**Authorship Contributions**

Surgical and Medical Practices: Leyla Niyaz, Nilgün Yıldırım, Ahmet Musmul, Concept: Leyla Niyaz, Nilgün Yıldırım, Ahmet Musmul, Design: Leyla Niyaz, Nilgün Yıldırım, Ahmet Musmul, Data Collection or Processing: Leyla Niyaz, Nilgün Yıldırım, Ahmet Musmul, Analysis or Interpretation: Leyla Niyaz, Nilgün Yıldırım, Ahmet Musmul, Literature Search: Leyla Niyaz, Nilgün Yıldırım, Ahmet Musmul, Writing: Leyla Niyaz, Nilgün Yıldırım, Ahmet Musmul.

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Case Report

# Intravitreal Dexamethasone Implant (Ozurdex) for Refractory Macular Edema Secondary to Retinitis Pigmentosa

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**Summary**

Macular edema (ME) in retinitis pigmentosa (RP) often impairs central vision dramatically. A 41-year-old woman diagnosed with RP was referred to our outpatient clinic due to severe visual deterioration in both eyes. The patient was treated with topical carbonic anhydrase inhibitors, topical corticosteroids and intravitreal triamcinolone acetonide injections, but her ME recurred. Intravitreal 0.7 mg dexamethasone implant (Ozurdex, Allergan) was administered into both eyes without complications. On the fourth day after both injections, visual acuity improved and ME almost totally resolved. No recurrence was observed at follow-up six months later.

**Keywords:** Macular edema, retinitis pigmentosa, dexamethasone implant

## Introduction

Macular edema (ME) in retinitis pigmentosa (RP) often impairs central vision dramatically. ME has been shown in at least one eye in 32% of patients and in both eyes in 18% of patients in a recent optical coherence tomography (OCT) study.[1] Although the pathogenesis of RP-related ME has not been fully established, general inflammatory response to degenerating photoreceptors and retina pigment epithelium, defective blood-aqueous barrier, and autoimmune process (antiretinal antibodies) have been proposed as the possible causes.[2,3,4]

Treatment options include carbonic anhydrase inhibitors, corticosteroids, anti-vascular endothelial growth factor (anti-VEGF) agents, grid laser photocoagulation and vitrectomy.[5,6,7,8,9] Off-label intravitreal injection of triamcinolone has also been found to be effective.[4] A sustained-release dexamethasone implant is available for the treatment of ME secondary to retinal vein occlusion and in recent years it has been shown to have favorable results in the treatment of ME secondary to RP.[5,6]

Here, we report a case with bilateral refractory ME secondary to RP which dramatically improved within the first week following dexamethasone implant.

## Case Report

A 41-year-old woman diagnosed with RP was referred to our outpatient clinic 3 years ago due to severe visual deterioration in both eyes. She had refractory ME secondary to RP for about 12 years. The patient had been unresponsive to both topical carbonic anhydrase inhibitors and topical corticosteroids.

On initial examination, anterior segment details were within normal ranges and intraocular pressure was below 21 mmHg in both eyes. Visual acuity was counting fingers (CF) in both eyes. She had severe ME with RP in both eyes (Figure 1). The diagnosis was confirmed using OCT and fundus fluorescein angiography. Full-field electroretinogram showed typical delays in both rod and cone b-wave implicit times. She received intravitreal triamcinolone acetonide (TA) injections in both eyes. Following the injections, visual acuity had increased to 20/320 in oculus dexter (OD) and 20/400 in oculus sinister (OS) according to Snellen chart (Figure 2). Eight months later, ME recurred and second TA injections were performed. Between the injections, the patient was treated with oral acetozolamide (Diazomid 250 mg, Sanofi-Aventis, Turkey) 125 mg twice daily. Over the follow-up period of 1 year, posterior subcapsular cataract developed in both eyes and vision decreased to preinjection levels. The patient underwent bilateral phacoemulsification surgery with intraocular lens implantation and intravitreal TA injections. Visual acuity improved from CF to 20/320 in OD but remained CF in OS.

Four months later, visual acuity decreased again to CF in OD. OCT revealed severe cystoid ME (CME) in both eyes, central foveal thickness was 613 µm in OD and 1071 µm in OS (Figure

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3). With informed consent, intravitreal 0.7 mg dexamethasone implant (Ozurdex, Allergan, USA) was administered as an off-label treatment to both eyes without complications on separate days. On the fourth day after injections, visual acuity improved to 20/320 in OD and 20/800 meter in OS, and the ME had almost completely resolved (Figure 4). No recurrence was observed during the follow-up examination 6 months later (Figures 5 and 6).

## Discussion

There are several recent reports of intravitreal injection of dexamethasone implant (Ozurdex) for the treatment of ME secondary to RP.[10,11,12,13] Srour et al.[10] administered intravitreal dexamethasone implant in 3 patients with mean central macular thickness (CMT) of 443±185 µm (range 213-619 µm) and mean visual acuity of 20/160 (20/50-20/200) at baseline. One month after dexamethasone implantation, mean CMT improved to 234±68 µm and mean BCVA improved to 20/100. Saatci et al.[11] reported a case with bilateral ME secondary to RP. Visual acuity of the patient was 2/10 in both eyes and he had been under topical dorzolamide treatment 3 times a day for nearly a year without any change in VA. One week after the injection his visual acuity improved to 4/10 and ME resolved. Buchaim et al.[12] also reported successfully using intravitreal dexamethasone implant for the treatment of ME due to RP. Very recently, Ahn et al.[13] treated a 24-year-old patient with RP who developed CME in both eyes that was refractory to oral acetazolamide and intravitreal bevacizumab treatment. Despite a second intravitreal dexamethasone implant injection, CME recurred in both eyes 6 months later.

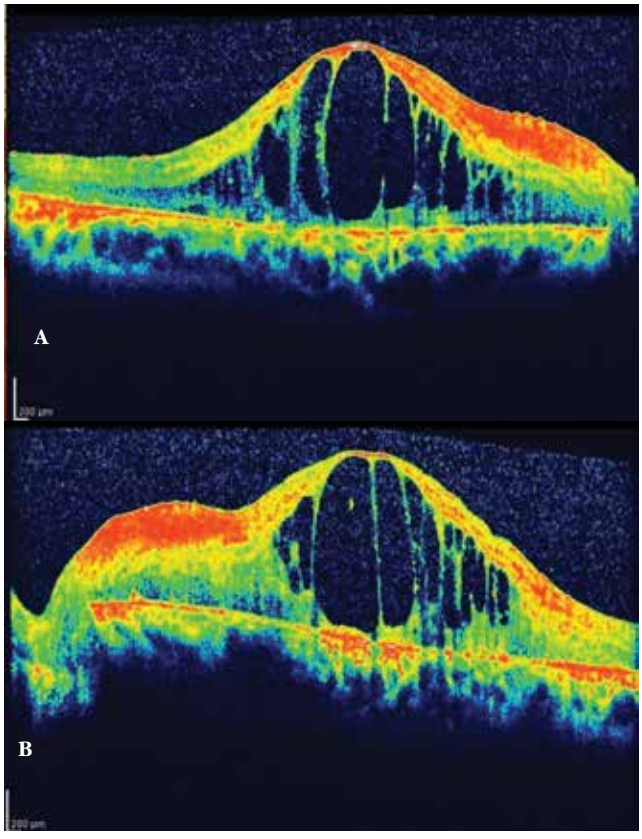


**Figure 1.** Optical coherence tomography imaging shows severe macular edema on initial admission (A: right eye, B: left eye)

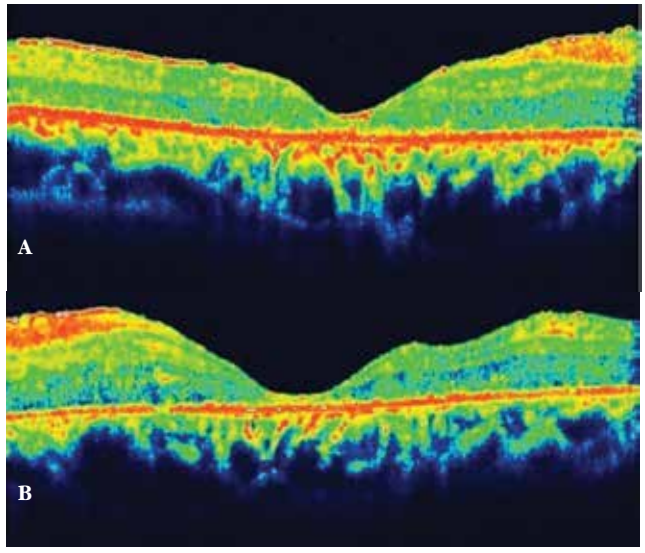


**Figure 2.** Macular edema resolved after the first triamcinolone acetonide injection (A: right eye, B: left eye)

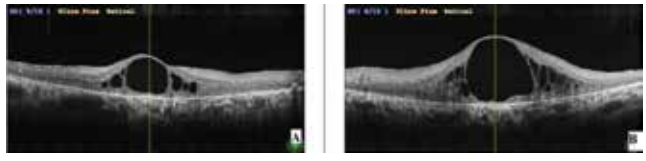

**Figure 3.** Severe macular edema prior to dexamethasone implant injection (A: right eye, B: left eye)

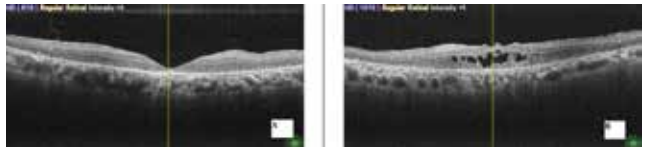

**Figure 4.** Macular edema had almost totally resolved 4 days after dexamethasone implant injection (A: right eye, B: left eye)

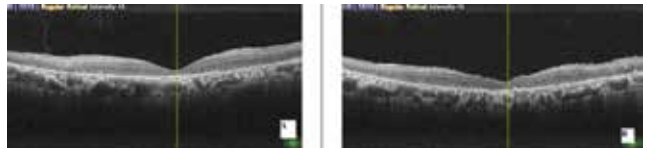

**Figure 5.** No macular edema in both eyes at third month (A: right eye, B: left eye)

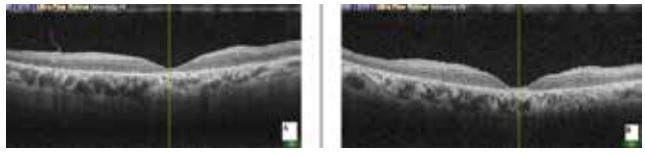

**Figure 6.** No recurrence at 6 months in both eyes (A: right eye, B: left eye)

The intravitreal dexamethasone implant may be useful for CME in patients with RP, but its efficacy seems to be limited over time. In our case, visual acuity improvement was almost the same with intravitreal triamcinolone acetonide injection and intravitreal dexamethasone implant. No recurrence was observed up to six months following the dexamethasone implant injection. ME and visual loss were more severe (CMT, 1071 µm) in the left eye due to damage to the external limiting membrane and photoreceptor layers. Despite severe structural changes in the macular area, ME resolved almost totally and visual acuity improved from CF to 20/800 at the 4th day visit, which made the patient very satisfied.

## Conclusion

Although the follow-up period of our patient was short, long-lasting refractory ME secondary to RP may respond very rapidly to intravitreal dexamethasone implant with satisfactory results both for the patient and ophthalmologist. Further studies with larger sample size and longer durations are needed to clarify this issue.

**Ethics**

Informed Consent: It was taken.

Peer-review: Externally peer-reviewed.

**Authorship Contributions**

Surgical and Medical Practices: Nurgül Örnek, Kemal Örnek, İnci Elif Erbahçeci, Concept: Nurgül Örnek, Kemal Örnek, İnci Elif Erbahçeci, Design: Nurgül Örnek, Kemal Örnek, İnci Elif Erbahçeci, Data Collection or Processing: Nurgül Örnek, Kemal Örnek, İnci Elif Erbahçeci, Analysis or Interpretation: Nurgül Örnek, Kemal Örnek, İnci Elif Erbahçeci, Literature Search: Nurgül Örnek, Kemal Örnek, İnci Elif Erbahçeci, Writing: Nurgül Örnek, Kemal Örnek, İnci Elif Erbahçeci.

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Case Report

# Bilateral Papillophlebitis in a Patient with Mutation of Metilenetetrahydrofolate Reductase Enzyme

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**Summary**
Papillophlebitis is known as central retinal vein occlusion seen in young patients. It usually presents as unilateral optic disc edema with cotton wool spots and hemorrhage in the peripapillary region. As it may be due to many autoimmune and inflammatory causes, a thorough systemic evaluation of the patient is warranted. In this case report we describe a bilateral, simultaneous papillophlebitis case thought to be related to hyperhomocysteinemia secondary to C677T polymorphism of methylenetetrahyrofolate reductase enzyme.
**Keywords:** Papillophlebitis, hyperhomocycteinemia, methylenetetrahyrofolate reductase mutation

## Introduction

Papillophlebitis, considered a subtype of central retinal vein occlusion (CRVO), is a clinical condition more common in young adults. It usually presents unilaterally and localized to the area surrounding the optic disc. Fundus signs include disc edema and varying degrees of cotton wool-like peripapillary exudate and hemorrhage. Because papillophlebitis does not extend to the macula, visual acuity is mildly affected, but a wider blind spot is common on visual field analysis.[1,2]

Unlike CRVO, papillophlebitis spontaneously resolves, and its etiology also differs from that of CRVO. Whereas CRVO is generally associated with thrombus in older patients, the etiopathogenesis of papillophlebitis involves inflammation secondary to venous congestion.[1] Therefore, it is advised to screen these patients for systemic diseases like hypertension, hyperlipidemia, aterosclerosis and diabetes mellitus as well as autoimmune and inflammatory diseases and thrombophilic risk factors such as Factor V Leiden mutation, vitamin $B_6$ deficiency, folic acid deficiency, hyperhomocysteinemia, and Protein C and S deficiency.[1,2]

In this case report we describe a bilateral, simultaneous papillophlebitis case thought to be related to hyperhomocysteinemia secondary to C677T polymorphism of the methylenetetrahyrofolate reductase (MTHFR) enzyme.

## Case Report

A 48-year-old male patient was referred from an eye clinic after presenting with complaints of transient loss of vision in both eyes. It was learned that the patient's symptoms started in both eyes at the same time, 3 weeks earlier. The patient had a 1-year history of hypertension and was being treated with an angiotensin II receptor antagonist and hydrochlorothiazide combination (valsartan/hydrochlorothiazide) plus an adrenoreceptor antagonist (doxazosin mesylate).

On ophthalmologic examination, his BCVA was 0.6 (refraction values were cylinder -0.75, axis 180 D) in the right eye and 0.7 (sphere +0.50, cylinder -1.00, axis 175 D) in the left eye. His color vision evaluated by Ishihara test was 6/12 in the right and 10/12 in the left eye. Intraocular pressure measured by applanation was 14 and 16 mmHg in the right and left eyes, respectively. Anterior segment structures appeared normal and no cells were observed on slit-lamp examination. On fundus examination the optic discs of both eyes showed edema, indistinct margins and splinter hemorrhages extending from

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the disc to the periphery; intraretinal hemorrhage and cotton-wool exudates were also observed. No vitreous cells were detected. There were no signs of retinopathy like hypertensive arterial attenuation or artery-vein compression. On fundus fluorescein angiography, early hyperfluorescence at the optic disc and surrounding fields of hypofluorescence corresponding to areas of intraretinal hemorrhage were observed, but leakage consistent with vasculitis was not detected (Figure 1). Central macular thickness on optic coherence tomography (OCT) was 260 µm in the right eye and 237 µm in the left. His visual field (Humphrey 30-2) showed larger blind spots in both eyes; superior altitudinal scotoma and inferior arcuate scotoma were detected in the left eye, while concentric scotoma was present in his right eye (Figure 2).

The patient's clinical findings were consistent with papillophlebitis, and visual evoked potential analysis revealed bilateral extended latencies. The patient was evaluated for etiologic factors. His arterial blood pressure was 180/90 mmHg and the Cardiology department was consulted for additional treatment. The patient had no history of an injury in his mouth, and pathergy test was negative. Sedimentation rate, level of C-reactive protein, and levels of protein C and protein S were normal. There were no signs on hepatic imaging suggesting tuberculosis or sarcoidosis. Cranial magnetic resonance imaging revealed bilateral gliotic changes in the temporal and parietal regions. In terms of thrombophilic risk factors, a homozygous (T/T) mutation of the *MTHFR* (C677T) gene was detected in the patient's genetic analysis. The A1298C locus of *MTHFR* was normal. The patient had no family history of consanguineous marriage. Although his folic acid and vitamin $B_{12}$ levels were within normal limits, his homocysteine level was measured as 32.63 µmol/L, twice the upper limit of the reference range (5.5-15 µmol/L). The hematology and cardiology departments were consulted and treatment for hyperhomocysteinemia was started.

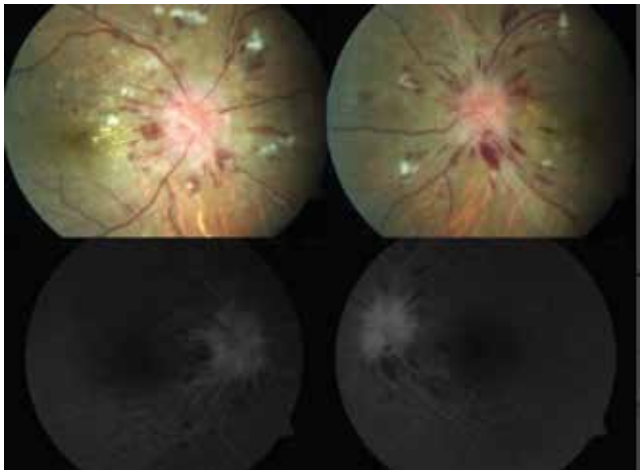

**Figure 1.** Fundus photography and fundus fluorescein angiography images of the patient at time of presentation

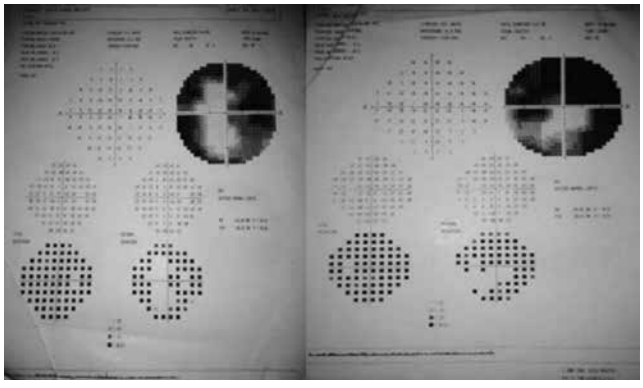

**Figure 2.** Right and left visual fields at presentation

Over a 12-month follow-up period, the patient's visual acuity reached 1.0 in both eyes. No neovascular signs were observed in the iris or angle on anterior segment slit-lamp examination. On fundus examination, regression of the optic disc edema and complete resolution of the intraretinal hemorrhage and cotton wool exudates were observed (Figure 3). Central macular thickness was 179 µm in the right eye and 180 µm in the left eye on OCT at 1 year.

## Discussion

Papillophlebitis has also been referred to in the literature as benign retinal vasculitis, optic disc vasculitis, peripapillary retinal vein occlusion, blind spot enlargement syndrome or venous papillopathy. In addition to the lack of consensus regarding the name of this disease, its pathogenesis is also not fully understood.[2] It has been proposed that papillophlebitis arises as a result of inflammation in the retinal veins near the

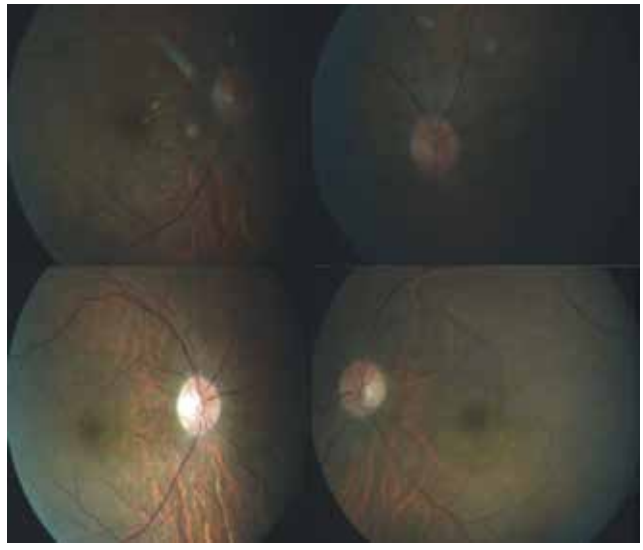

**Figure 3.** At 3 month follow-up (upper row), regression of the hemorrhage and sporadic exudate were observed; at 1 year follow-up (lower row), the exudates and hemorrhage were completely resolved

optic nerve head which leads to CRVO. Others believe it may be a nonspecific inflammatory process secondary to certain hematologic or rheumatologic diseases. However, it has not been clearly determined what precipitates the condition. Hayreh[3] described the disease as a unilateral vague haziness of vision and divided cases into two groups. The first group consisted of patients 30-35 years old with edema limited to the optic disc that resolved completely with nosequelae; the second group consisted of patients 26-55 years old with more severe peripapillary hemorrhage and CRVO involving the macula in 75% of cases.

Papillophlebitis is not generally associated with any comorbidities, though hypertension has been detected in 23-42% of patients and diabetes mellitus in 3-9%. Comparisons with other individuals in the same age groups revealed no differences in terms hyperlipidemia, hyperviscosity and hypercoagulability.[3] The presence of hypertension in our patient suggests a predisposition to papillophlebitis. However, we also investigated serologic, biochemical, genetic and thrombophilic factors associated with other conditions possibly underlying papillophlebitis. In addition, because the patient exhibited bilateral optic disc edema, magnetic resonance imaging was done to exclude intracranial causes of optic disc edema. Biochemical analyses performed on our patient revealed hyperhomocysteinemia, and genetic analysis demonstrated a homozygous (T/T) mutation of *MTHFR* (C677T).

Homocysteine is a sulfur-containing amino acid created during methionine metabolism. Methionine is an essential amino acid which must be obtained through the diet. Homocysteine is metabolized in the body by either the transsulfuration or remethylation pathways.[4,5] Vitamin B6 acts as a cofactor in the transsulfuration pathway, while folate and vitamin $B_{12}$ are cofactors in the remethylation period. Deficiencies in these vitamins are associated with increased homocysteine levels. Because estrogen lowers plasma homocysteine levels, women have lower levels than men. Normal plasma homocysteine level is 5-15 µmol/L, and a value of 16 µmol/L or higher is considered hyperhomocysteinemia.[6] Hyperhomocysteinemia is a major risk factor for paralysis,[7] and is also a risk factor in arterial or venous thrombosis, myocardial infarction and chronic kidney failure.

Homocystinuria, an accepted variant of hyperhomocysteinemia, has been associated with lens dislocation, mental retardation and thromboembolic conditions. MTHFR deficiency is one of the common causes of hyperhomocysteinemia. Homozygous mutations in *MTHFR* lead to moderate to severe hyperhomocysteinemia and can cause early death. The most common *MTHFR* mutation is the C-T replacement in codon 677. The frequency of homozygotes for this polymorphism varies between 5-10% depending on the population. Homocysteine levels in these patients are in the 20-40 µmol/L range.[8] Turaka et al.[9] reported the case of a 15-year-old girl with unilateral papillophlebitis who had hyperhomocysteinemia and homozygous mutations in *MTHFR* C677T and A1298C. Smoking has also been determined as a risk factor for hyperhomocysteinemia. Our patient had a smoking history of 30 pack/years.

Although papillophlebitis resolves spontaneously, there have been attempts to speed recovery using different treatment protocols. Steroid therapy and anticoagulant therapy are two treatment protocols that have been administered to patients. There are proponents of intensive steroid therapy, while others cite that this may mask serious underlying conditions. Hayreh[3] recommended systemic steroid therapy. He did not observe any beneficial effect of anticoagulant therapy. In the present case, the patient was followed without any steroid or anticoagulant treatment and his visual acuity returned to normal.

## Conclusion

Although visual prognosis is good, papillophlebitis may arise as the result of serious underlying systemic disease; therefore, performing the necessary genetic analyses to detect predisposing systemic, biochemical or thrombophilic etiologic factors is crucial for papillophlebitis patients. Hyperhomocysteinemia secondary to MTHFR mutation should be kept in mind as one of the possible causes of papillophlebitis.

**Ethics**

Informed Consent: It was taken.

Peer-review: Externally peer-reviewed.

**Authorship Contributions**

Surgical and Medical Practices: Hüseyin Güzel, Banu Turgut Öztürk, Concept: Hüseyin Güzel, Banu Turgut Öztürk, Design: Hüseyin Güzel, Banu Turgut Öztürk, Data Collection or Processing: Şansal Gedik, Berker Bakbak, Abdullah Beyoğlu, Nadir Koçak, Analysis or Interpretation: Hüseyin Güzel, Banu Turgut Öztürk, Literature Search: Hüseyin Güzel, Banu Turgut Öztürk, Şansal Gedik, Berker Bakbak, Abdullah Beyoğlu, Nadir Koçak, Writing: Hüseyin Güzel, Banu Turgut Öztürk.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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Case Report

# Paradoxical Worsening of Tubercular Serpiginous-Like Choroiditis after Initiation of Antitubercular Therapy

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**Summary**

In this study, a case with tubercular choroiditis showing severe macular edema and progression of choroidal lesions following initiation of antitubercular treatment is presented and the management of posterior uveitis associated with tuberculosis is evaluated. A 40-year-old female patient was admitted with decreased vision in her right eye and her fundoscopic examination revealed serpiginous choroiditis. It was learned from her medical history that she had taken antitubercular therapy 9 years ago. Mantoux tuberculin skin test showed an area of induration measuring 15 mm and a positive interferon-gamma release assay was documented. Additionally, sequelae lesions due to previous tubercular infection were remarkable on her chest imaging. By excluding other causes of uveitis, the patient was considered presumed ocular tuberculosis and a full standard course of 4-drug antitubercular therapy was initiated. On the seventh day of the treatment existing choroidal lesions showed progression, new foci of choroiditis appeared and severe macular edema occurred. After adding systemic corticosteroid to the treatment, the macular edema resolved and choroidal lesions began to inactivate. In patients with tubercular choroiditis, continued progression may develop after initiation of antitubercular therapy. This paradoxical worsening is thought to be a hyperacute immunologic reaction occurring against antigen load released after antitubercular therapy. This phenomenon may be suppressed by the addition of systemic corticosteroids to the treatment.

**Keywords:** Tubercular choroiditis, antitubercular therapy, paradoxical worsening, steroid

## Introduction

Serpiginous choroiditis is a rare, idiopathic, chronic inflammatory disease. It is characterized by geographic lesions affecting the choroid and the neighboring retinal pigment epithelium (RPE) and outer retinal layers. There are reports in the literature that patients with tuberculosis (TB) infection exhibit similar choroidal signs and it has been emphasized that the two entities must be evaluated separately. The clinical presentation of patients with definite or presumed ocular TB diagnosis has been termed 'serpiginous-like choroiditis'.[1] Serpiginous choroiditis is believed to be an autoimmune disease and responds well to systemic steroids; in contrast, treating serpiginous-like choroiditis with steroids can lead to serious systemic and local complications if not accompanied by antitubercular therapy (ATT).

In patients with tuberculous choroiditis, ATT accelerates the healing process and reduces recurrence risk by decreasing the number of bacilli.[2] In some patients, the rapid destruction of bacilli that occurs with initiation of ATT may cause existing lesions to worsen and new lesions to form. This paradoxical phenomenon occurs more often during the treatment of systemic TB infections, but has also been reported in a few cases of ocular TB. Here we present a case of TB-related choroiditis that exhibited choroidal lesion progression and severe macular edema following initiation of ATT.

## Case Report

A 40-year-old female patient presented with complaints of vision loss in the right eye beginning 2 months earlier. It was learned that the patient had no known systemic diseases and had received ATT for 6 months 9 years earlier. On ophthalmologic examination, her visual acuity was counting fingers from 2 meters in the right eye and 20/20 in the left eye. Anterior segment examination and intraocular pressure were normal in both eyes. Fundus examination of the right eye revealed multiple round, whitish-yellow, active subretinal lesions and gray sequelae

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lesions with definite borders and pigment aggregation at the margins. Adjacent to the inactive foci, new foci that tended to converge were noted (Figure 1a). Fundus examination of the left eye was normal. On fundus fluorescein angiography of the right eye, active foci exhibited hypofluorescence in the early arterial phase but were hyperfluorescent in the late venous phase due to leakage. Staining due to pigment epithelium atrophy was observed at the margins of the inactive lesions (Figure 1b). Optical coherence tomography (OCT) revealed hyperreflectivity in the outer retinal layers and choroid as well as intraretinal fluid (Figure 1c).

The patient's hemoglobin level was 8.3 g/dL and hematocrit was 25.8%; all other biochemical, serologic and rheumatologic test results were normal (antistreptolysin O, C-reactive protein, and rheumatoid factors were within reference ranges; antinuclear antibody, anti-DNA, and human leukocyte antigen B27 tests were negative; no positive results were returned for cytomegalovirus, toxoplasma, herpes simplex virus, hepatitis B or C, human immunodeficiency virus, *Salmonella, Brusella*, Lyme disease and syphilis tests). Pathergy test was negative. Chest X-ray and computed tomography (CT) showed calcified hilar lymph nodes on the left and peribronchial nodular lesions of soft tissue density in the anterior and posterior segments of the right upper lobe. Mantoux tuberculin skin test (TST) produced an induration of 15 mm at 72 hours, and QuantiFERON TB-Gold test was positive. Following consultation with the Department of Pulmonary Diseases, the patient was considered consistent with previous pulmonary TB with no active pulmonary infection. Systemic investigation by the Department of Infectious Diseases revealed no signs of active or latent extrapulmonary TB. Treatment for iron deficiency was recommended by the Hematology Department. There was no evidence of rheumatologic or dermatologic disease which could cause uveitis.

Due to the presence of choroiditis, TST ≥15 mm, positive QuantiFERON TB-Gold test, previous TB findings on chest X-ray and CT, and with the exclusion of other causes of uveitis, the patient was presumed intraocular TB and diagnosed with serpiginous-like choroiditis. The patient was started on a 4-drug ATT regimen: isoniazid 300 mg/day, rifampicin 600 mg/day, pyrazinamide 30 mg/kg/day, and ethambutol 25 mg/kg/day.

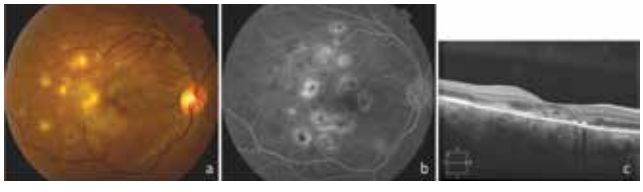

**Figure 1.** The patient's clinical findings at presentation: a) Fundus photograph of the right eye showing multiple round, whitish-yellow active subretinal lesions at the posterior pole as well as gray, demarcated sequelae lesions with marginal pigment aggregation, inactive foci and convergent newly activated foci; b) Fundus fluorescein angiography of the right eye showing hypofluorescence in the early arterial phase and hyperfluorescence in the late venous phase due to leakage; c) Optical coherence tomography showing subretinal fluid and hyperreflectivity of the outer retinal layers and choroid

On day 7 of treatment the patient's visual acuity was decreased to counting fingers from 50 cm. Fundus examination revealed progression of the existing lesions, multiple new choroiditis foci, and subretinal fluid leading to serous macular detachment (Figure 2). Oral methylprednisolone (1 mg/kg, 72 mg) was added to the treatment. The subretinal fluid began to regress immediately after the initiation of steroid treatment and had completely resolved 1 week later (Figure 3). After 1 month of treatment, the patient's visual acuity had increased to 1/10 and a majority of the choroiditis foci were inactive. Extended ATT was planned with 2 months of the 4-drug regimen followed by 10 months of a 2-drug regimen (isoniazid and rifampicin), and reduction of the oral steroid was initiated. After 3 months of treatment, the steroid dose was 24 mg/day. The patient's visual acuity had increased to 5/10 but new active choroiditis foci were observed. The steroid dose was increased to 54 mg/day and the new foci began to inactivate shortly thereafter. The ATT was continued with the same steroid dose.

At the patient's final follow-up examination after 6 months of treatment, his visual acuity was 10/10. Multiple diffuse pigmented inactive lesions were observed in the fundus. OCT revealed disorganization of the RPE and outer retinal layers and disruption of the inner segment/outer segment band due to photoreceptor layer damage (Figure 4).

## Discussion

A definite ocular TB diagnosis is usually not possible because the direct demonstration of TB bacilli in ocular tissues is difficult. Ocular findings alone are not sufficient to

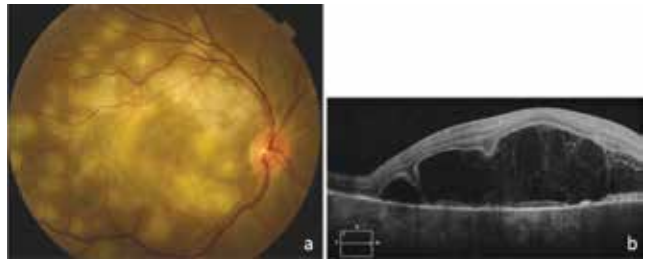

**Figure 2.** Clinical findings 1 week after initiation of antitubercular therapy: a) Fundus photograph showing progression of existing lesions and multiple new choroiditis foci; b) Optical coherence tomography showing subretinal fluid leading to serous macular detachment

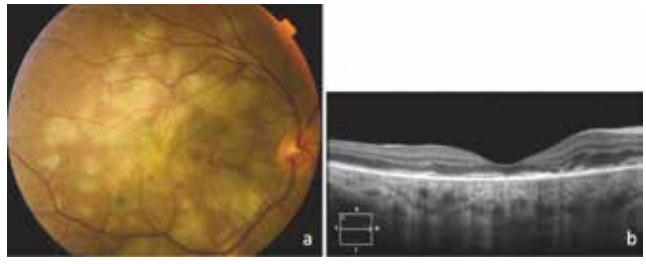

**Figure 3.** Clinical findings 1 week after adding oral steroid to the treatment regimen: a) Fundus photograph showing choroiditis foci becoming inactive and serous detachment regressing; b) Optical coherence tomography showing minimal intraretinal fluid and disorganized outer retinal layers

diagnose ocular TB due to the many clinical conditions that can simulate it. When other causes of uveitis have been ruled out, a patient with signs of active or latent TB is referred to as presumed ocular TB.[3] Especially in endemic areas, patients with findings suggestive of TB uveitis such as granulomatous uveitis, choroiditis, retinal vasculitis, retinal granuloma, and panuveitis should have TB tests included in their systemic evaluation. A TST result of 15 mm or larger is considered positive in vaccinated patients. However, this does not always correspond to a real infection, as the TST can give false positive results, especially in vaccinated individuals. In populations with routine vaccination, the QuantiFERON TB-Gold® (Cellestis Limited, Carnegie, Australia) test may be preferable because it analyzes interferon gamma release and only returns positive results for patients infected with *Mycobacterium tuberculosis* bacilli.[4] Like the TST, however, this test cannot discriminate between active and latent infections. Together with medical history and clinical findings, we also confirmed our patient's infection with TB bacilli using the QuantiFERON test.

Posterior uveitis is the most common clinical manifestation of ocular TB. One of the clinical findings of this manifestation is serpiginous-like choroiditis, which is believed to result from an immune-mediated hypersensitivity reaction against TB bacilli.[2] This reaction can arise against both bacilli found in the ocular tissue and against remote *Mycobacterium tuberculosis* antigens.[5] Treatment response in these patients is relatively slow; it is therefore recommended to start treatment with a 4-drug regimen for 2 months, then continue for 9-12 months with a 2-drug regimen.

When ATT begins destroying TB bacilli, the tubercular antigen load increases and this may further exacerbate the reaction. This paradoxical presentation is the ocular form of Jarisch-Herxheimer reaction that emerges in systemic TB infections like TB meningitis, intracranial tuberculoma, pleural effusion and abdominal TB.[2] Worsening of clinical findings may be observed in the form of progression of existing lesions and the formation of new lesions. Paradoxical worsening can also occur upon initiation of antibiotic therapy in other ocular infections like syphilis, Lyme's disease, and leptospirosis. There are other case reports in the literature of ATT inducing clinical exacerbation of ocular TB, similar to our case.[2,6,7,8] These patients were managed by adding systemic steroids to treatment, increasing the dose of steroid started with ATT, or adding immunosuppressant therapy. Our patient responded well to a high dose of oral steroid and her inflammation rapidly regressed.

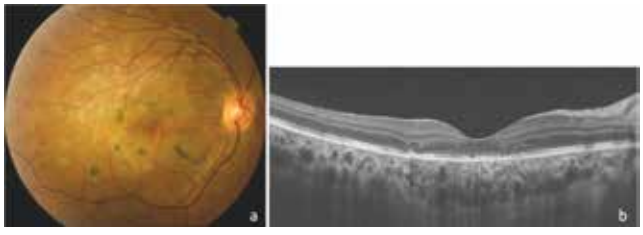

**Figure 4.** Clinical findings after 6 months of treatment: a) Fundus photograph showing geographic atrophic lesions in the posterior pole and pigment aggregates in the posterior pole; b) Optical coherence tomography showing disorganization of the retinal pigment epithelium and outer retinal layers and inner segment/outer segment band disruption

There is no standard treatment protocol for TB-related posterior uveitis. Although successful outcomes have been reported with the use of ATT alone, the more common approach is to begin systemic steroid with ATT.[2,9,10,11] This approach is believed to reduce late stage hypersensitivity-related tissue damage and yield better visual and anatomic improvement. However, it should be noted that steroids can reactivate a latent infection or cause an intraocular infection to spread. Some studies have recommended adding systemic steroids at least 2 weeks after starting ATT.[12] Treating TB is a long process which requires patience. Especially for the first 2 months, patients must take quite a few pills each day. For patients who have difficulty complying with treatment, the addition of oral steroids may further reduce their compliance with the ATT. For such patients, it may be prudent to make decisions about steroid therapy based on the patient's clinical course.

Paradoxical worsening may also occur in patients started on both ATT and systemic steroid simultaneously. One reason for this is the very severe inflammation and inadequate suppression. Another reason may be that rifampicin increases steroid metabolism.[13] In that case, increasing the steroid dose or adding immunosuppressive therapy may resolve the issue. In our patient, new foci of inflammation developed at the steroid maintenance dose of 24 mg/day and the lesions regressed when the dose was increased.

## Conclusion

The possibility of the paradoxical phenomenon upon ATT initiation should be kept in mind, particularly for patients with TB-related posterior uveitis, and ATT should not be discontinued with the assumption that the treatment is not effective. Systemic steroid therapy may be beneficial to suppress inflammation and control progression.

**Ethics**

Informed Consent: It was taken.

Peer-review: Externally and internally peer-reviewed.

**Authorship Contributions**

Surgical and Medical Practices: Ebru Esen, Selçuk Sızmaz, Zeynep Kunt, Nihal Demircan, Concept: Ebru Esen, Selçuk Sızmaz, Zeynep Kunt, Nihal Demircan, Design: Ebru Esen, Selçuk Sızmaz, Zeynep Kunt, Nihal Demircan, Data Collection or Processing: Ebru Esen, Selçuk Sızmaz, Zeynep Kunt, Nihal Demircan, Analysis or Interpretation: Ebru Esen, Selçuk Sızmaz, Zeynep Kunt, Nihal Demircan, Literature Search: Ebru Esen, Selçuk Sızmaz, Zeynep Kunt, Nihal Demircan, Writing: Ebru Esen, Selçuk Sızmaz, Zeynep Kunt, Nihal Demircan.

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Case Report

# Unilateral Recurrent Anterior Uveitis as the Presenting Sign of Bladder Carcinoma

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**Summary**

A 79-year-old male patient was followed for unilateral uveitis with 3 attacks in 10 months, despite initial improvement with steroid therapy. The patient had visual acuity (VA) of counting fingers in right eye, hypopyon and vitritis with no chorioretinal lesions. The left eye was normal. The patient was evaluated for intraocular foreign body, intraocular lymphoma and associated systemic disease and malignancy. Computed tomography of the abdomen showed a mass in the bladder. Biopsy confirmed bladder carcinoma. After resection of the mass, intraocular inflammation improved completely and no attack was noted in the follow-up. In his last examination, two years after the operation, VA was light perception; seclusio pupilla and mature cataracts were seen on biomicroscopy. There was no sign of vitritis on ocular ultrasonography. Evidence is discussed that suggests a link and potential etiology between refractory uveitis with hypopyon and bladder carcinoma. This is the first case of unilateral recurrent uveitis with hypopyon as the initial presenting sign of bladder carcinoma.

**Keywords:** Anterior uveitis, bladder carcinoma, paraneoplastic syndrome

## Introduction

The association between uveitis and concurrent malignancies has been described as pseudouveitis. Masquerade syndromes are a group of disorders that mimic ocular inflammatory disease, which are thought to be immune responses to concurrent intraocular tumors.[1] Masquerade syndromes usually do not respond well to steroid treatment. Another possible diagnosis to be considered is the paraneoplastic syndrome, the remote effect of a systemic malignancy presenting as ocular inflammatory disease. The pathogenesis of paraneoplastic syndromes is thought to be autoimmune, and they also do not respond well to steroid treatment.[2]

To our knowledge, the presentation of bladder carcinoma with unilateral anterior uveitis with hypopyon has not been reported to date. Here we report a case in which unilateral uveitis led to the detection of bladder carcinoma.

## Case Report

A 79-year-old male patient presented with loss of vision in the right eye for the previous 4 days. Ophthalmic examination revealed corrected visual acuity (VA) of counting fingers in the right eye and 20/20 in the left eye. On biomicroscopic examination, marked conjunctival hyperemia with remarkable fibrin strands and hypopyon in the anterior chamber were detected in the right eye, while the anterior segment of the left eye was normal. The fundus of the right eye could not be examined because of fibrin strands in the anterior chamber, but ocular ultrasonography showed no vitreous inflammation. Specific tests such as peripheral blood count, serum liver enzyme levels, rheumotological markers, bone marrow cytology with cellular morphology, pathergy test and chest radiography were performed to rule out any concurrent rheumatologic disease. We ruled out the presence of an intraocular foreign body with a computed tomography scan and orbital and cranial

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magnetic resonance imaging for possible intraocular or central nervous system lymphoma was performed. The results did not reveal any pathology. He was initially prescribed topical 0.1% dexamethasone sodium phosphate eye drops (Dexasine, Liba Lab., İstanbul, Turkey) hourly, tropicamide (Tropamid, Bilim Drug, İstanbul, Turkey) and 1% cyclopentolate HCl eye drops (Siklоplejin, Abdi İbrahim Drug Co., İstanbul, Turkey) three times daily and subconjunctival dexamethasone (Dekort, Deva Holding, İstanbul, Turkey) injections twice a day. At follow-up 5 days later, reduction of anterior chamber reaction and hypopyon was observed. The topical and subconjunctival steroid treatments were tapered. The hypopyon and anterior chamber reaction completely resolved in two weeks.

One month later in the follow-up, the patient presented with anterior chamber reaction with hypopyon once again. Best corrected VA (BCVA) was 20/200 in the right eye and 20/20 in the left eye. After one week of topical steroid treatment, VA increased to 20/63 and intraocular inflammation improved significantly. The patient continued to use topical steroids but, despite the initial improvement, two weeks after the onset of the second attack his vision deteriorated and the anterior chamber reaction increased. Fundus examination revealed moderate vitritis, cystoid macular edema (CME) and increased vascular tortuosity (Figure 1). Ocular coherence tomography (Heidelberg Spectralis, Heidelberg Engineering, Germany), confirmed CME in the right eye (Figure 2). Fundus fluorescein angiography showed leakage at the optic disc, leakage with "flower pattern" appearance in the macula, peripheral vascular leakage and ischemia. Sub-Tenon's triamcinolone acetonide injection was administered in the superior temporal quadrant of the right eye. After two weeks, there was a decrease in CME, anterior chamber reaction and vitritis, therefore topical steroid was tapered.

The patient was lost to follow-up. Eight months later, the patient admitted to our clinic with vision loss in the right eye with severe anterior chamber reaction with fibrin stands and hypopyon (Figure 3). The right fundus could not be visualized due to hypopyon and fibrin strands in the anterior chamber. B-scan ultrasonography showed clear vitreous and no choroidal thickening (Figure 4). The patient was prescribed topical steroids, cycloplegics, subconjunctival steroid and antibiotics. He was diagnosed as recurrent chronic anterior uveitis. The oncology department was consulted for a systemic evaluation for a possible malignancy. Computed tomography of the abdomen revealed a mass in the bladder (Figure 5). Therefore, the patient was referred to the urology clinic. Biopsy of the mass confirmed bladder carcinoma. The patient underwent transurethral resection of the mass. Pathologic investigation revealed low grade papillary urethelial carcinoma (Figure 6). Intraocular inflammation decreased after the resection of the bladder mass and no recurrence of the uveitis attacks has been noted since. In his last examination, two years after the operation, the VA was light perception, seclusio pupilla was seen in biomicroscopic examination and clear vitreous was observed by ultrasonograpy.

## Discussion

The incidence of true immune-mediated uveitis declines in the elderly. Infection endophthalmitis, especially arising after surgery, and malignancy occur at higher frequency. In this age group, the possibility of a masquerade or paraneoplastic syndrome should always be considered.[3,4]

We report a patient with bladder carcinoma whose initial symptoms led him to consult an ophthalmologist. The patient presented with hypopyon and anterior chamber reactions three times within a span of ten months.

Carcinomas predominate as the primary lesions that produce ocular metastases. Ocular metastases are hematogenously disseminated and most commonly affect the uveal tract. In our case, the presentation was in the form of a rather benign unilateral anterior uveitis without the involvement of the posterior segment, which misled us to a diagnosis of idiopathic anterior uveitis after an initial etiological investigation overlooking

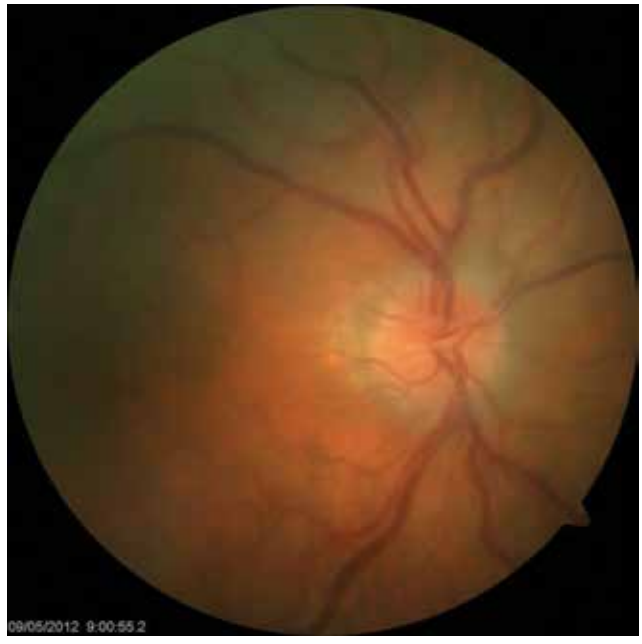

**Figure 1.** Fundus photograph of the right eye showing mild vitritis with increase in vascular tortuosity

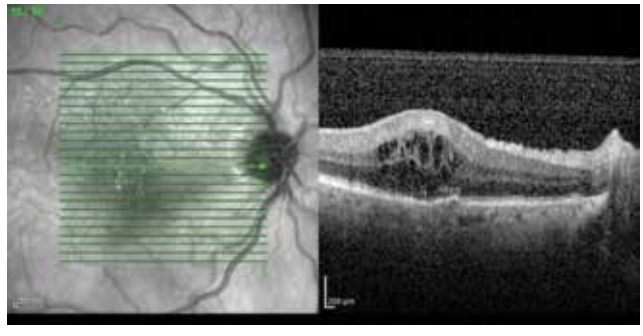

**Figure 2.** Optical coherence tomography appearance of the cystoid macular edema in the right eye

the possibility of a malignancy. The patient had no sign of an intraocular mass at initial presentation or during follow-up.

Initial clinical presentation of urinary bladder carcinoma with distant metastasis is rare.[4] Urothelial metastases of the most common sites are regional lymph nodes, liver, lungs, and bone.[5] To our knowledge, initial clinical presentation with ophthalmologic pathology such as anterior uveitis and hypopyon has not been previously reported for bladder carcinoma.

Intraocular inflammation presenting as hypopyon may occur in acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), and chronic myeloid leukemia (CML). Isolated presentation of hypopyon uveitis is very rare in AML, with only two similar reported cases.[6] Due to the patient's age being over 60 years and isolated presentation of hypopyon and uveitis, the investigation of the patient for leukemia and lymphoma was recommended by other reports.[3,4] There was no clinical or laboratory evidence of hematologic malignancy.

The term 'masquerade syndrome' refers to a wide variety of disorders whose clinical features include the presence of cells either in the anterior chamber, vitreous or both, but are unrelated to any immune-mediated uveitic diseases. Paraneoplastic retinopathies constitute a subgroup of this syndrome, which is defined as carcinoma-associated retinopathy (CAR) and melanoma-associated retinopathy. CAR patients usually present with bilateral vision loss due to extensive retinopathy and uveitis. Small-cell lung, gynecologic and breast cancers are diagnosed in most of the patients.[7]

The coexistence of bladder carcinoma and ocular inflammation in our patient may be explained by several possible pathophysiological mechanisms. The presence of bladder carcinoma with the anterior chamber reaction may be completely coincidental. Nevertheless, the cessation of ocular inflammatory findings after the resection of the tumor led us to search for a relationship between the two entities. The cessation of ocular inflammation despite the absence of a curative treatment for the ocular disease or a systemic chemotherapy supported the evidence of absence of any malignant cells in the ocular tissues and pointed to the remote effects of the malignancy presenting as ocular inflammation. The cytologic examination of the aqueous

**Figure 3.** Severe anterior chamber reaction and hypopyon in the right eye

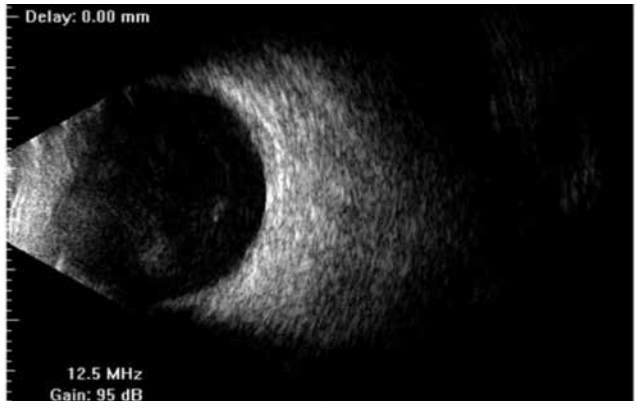


**Figure 4.** B-scan ultrasonography showing clear vitreous with no choroidal thickening and no exudative retinal detachment in the right eye

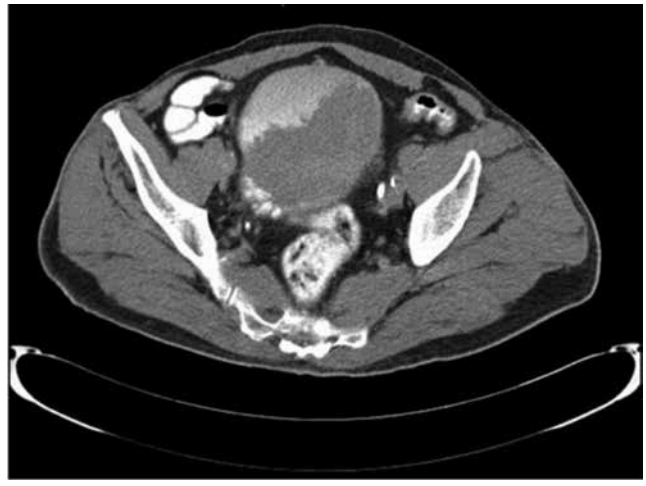

**Figure 5.** Abdominal computed tomography showing mass in the bladder

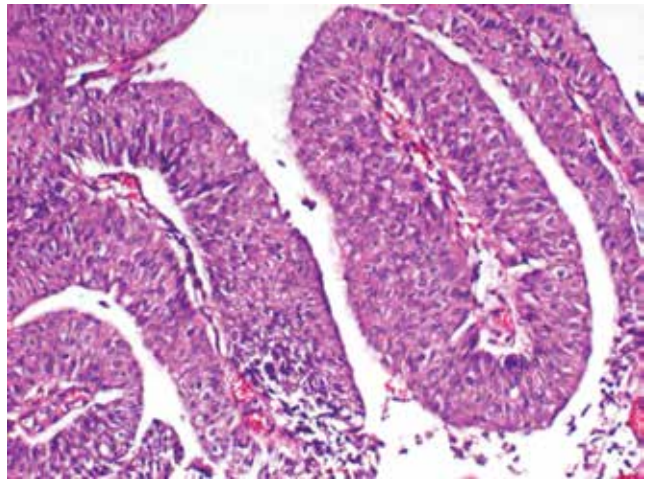

**Figure 6.** Hematoxylene and eosin staining of the bladder mass showing low grade papillary urethelial carcinoma with scarce atypical mitotic figures with no invasion. (x100)

humor or the vitreous, which we failed to obtain, may be of great help in the diagnosis.

## Conclusion

To our knowledge, this is the first case of bladder carcinoma with an initial presentation of anterior uveitis. The case demonstrates the problems encountered in reaching a diagnosis and stresses the importance of a high index of suspicion of metastatic disease in elderly patients presenting with uveitis. Timely diagnosis is essential, particularly if the suspicion of ocular or systemic malignancy needs to be validated, as early diagnosis in ocular malignancy or metastasis can preserve sight and improve survival.

**Ethics**

Informed Consent: It was taken.

Peer-review: Externally peer-reviewed.

**Authorship Contributions**

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Case Report

# A Rare Cause of Proptosis in Childhood: Langerhans Cell Histiocytosis

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**Summary**
A three-year-old male patient was admitted to the clinic with proptosis in his right eye. He had a history of fever with an unknown etiology. In examination, right proptosis was observed and an immobile mass was palpated at the lateral wall of the right orbita. Eye movement was unrestricted in all directions and anterior and posterior segment examination was normal in both eyes. On computed tomography, diffuse bone destruction and expansion was observed in the right orbital lateral wall and other cranial bones. Langerhans cell histiocytosis was diagnosed by bone biopsy. Malignancy is an important cause of proptosis in childhood. Pediatric patients who are admitted to clinic with proptosis should be carefully examined and Langerhans cell histiocytosis should also be considered as an etiology.
**Keywords:** Histiocytosis, proptosis, orbital mass, childhood

## Introduction

Langerhans cell histiocytosis (LCH) is the most common form of histiocytosis, with an annual incidence of 4-5 per million.[1] The average age at diagnosis is 30.2 months and the disease occurs in males more often than females.[2] Although both genetic and environmental factors have been implicated in its etiology, a clear relationship has not been demonstrated. Eighty percent of LCH patients have bone involvement, and half of these cases occur in the skull and facial bones. Orbital involvement occurs in 20% of LCH patients.[3] Swelling is usually the first sign of cranial involvement due to bone expansion. The probability of organ involvement rises with lower age of disease onset; liver, lung and bone marrow involvement are associated with worse prognosis.[4] Malignancy is etiologically important in terms of the prognosis of pediatric proptosis, and 22% of orbital lesions in pediatric patients are malignant.[5] LCH is detected in 1-7% of orbital biopsies.[6] Here we present a case presenting with proptosis which was diagnosed as LCH as a result of tests.

## Case Report

The ophthalmology clinic was consulted regarding a 3-year-old male patient with proptosis of the right eye. It was learned that the patient had a 4-month history of persistent subfebrile temperature; tests revealed pancytopenia and hepatosplenomegaly. He was being followed in the pediatric inpatient clinic to establish an etiologic cause. On examination, the patient was able to track a light source, his eye movement was unrestricted in all directions, and anterior and posterior segment examinations were normal. Proptosis was observed in the right eye (Figure 1). An immovable mass of 1x2 cm was palpated in the lateral wall of the right orbita. Computed tomography (CT) revealed diffuse bone destruction and expansion in the right orbital lateral wall and other cranial bones (Figure 2). Microcystic formations were observed on thoracic CT (Figure 3). Suspecting histiocytosis based on the clinical and radiological findings, skeletal scintigraphy was performed. Pathologic involvement was observed in the walls of both orbita and the pelvis. The diagnosis was confirmed by pelvic bone marrow biopsy (Figure 4), which stained positive for CD1a. A treatment protocol of oral prednisolone (40 mg/m$^2$/day) and intravenous vinblastin (6 mg/m$^2$) was initiated. When this protocol failed, treatment was changed to a rescue protocol of cytosine arabinozid (1 g/m$^2$/day) + chlorodeoxyadenosine (8.9 mg/m$^2$/day). Despite some treatment response, the patient died due to pneumonia secondary to neutropenia.

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## Discussion

Malignant infiltrations are one of the primary diagnoses that should be considered in pediatric proptosis. Particularly in cases of proptosis accompanied by signs like leukocoria, restricted eye motility, sudden-onset asymmetric eye position, afferent pupil defect, and pseudohypopyon, malignancies should be seriously considered and must be excluded. Twenty-two percent of orbital lesions seen in pediatric patients are malignant lesions, with 65% of these being primary, 29% secondary and 6% metastatic lesions.[5] The differential diagnosis for proptosis should include medulloepithelioma as a primary ocular tumor; rhabdomyosarcoma and optic nerve glioma as primary orbital tumors; fibroma, fibrous dysplasia and osteosarcoma as orbital bone tumors; and leukemia, lymphoma and neuroblastoma as metastatic tumors.[7]

LCH is a malignancy characterized by abnormal proliferation of Langerhans cells, but its etiology is not fully understood. Skeletal involvement occurs in 80% of LCH cases; the cranial bones are involved in more than half of these patients, while about 20% exhibit orbital involvement.[3] The most common cranial finding is a mass located at the zygomaticofrontal suture, as in our patient. Initial ocular signs of LCH include proptosis, ptosis, eyelid edema and redness around the eyes.[8] As in the current case, patients may present with proptosis alone. Direct imaging is the most effective way to visualize skeletal involvement in LCH, and typically reveals lytic lesions. Pulmonary involvement of LCH begins as nodular lesions that develop with disease progression into thin-walled cystic structures which are easily detected by high-resolution CT.[9] Biopsy of these nodular lesions is recommended for histopathologic confirmation of pulmonary LCH. However, the Histiocytosis Society reported that the observation of typical cystic lesions on high-resolution CT is sufficient to diagnose pulmonary involvement.[10] Our patient presented with typical lytic bone lesions as well as microcystic pulmonary lesions, so lung biopsy was deemed unnecessary. The Histiocytosis Society also created a guideline for diagnosing splenic and hepatic involvement through clinical examination and ultrasonography, without histopathologic sampling.

LCH most often arises in childhood but onset is known to occur in patients of every age group. Prognosis worsens with lower age at diagnosis. Clinical manifestation varies from benign unifocal skeletal involvement to aggressively malignant multisystem disease. Prognosis is poor in cases with disease spread and organ dysfunction.[11] For patients with unifocal skeletal involvement, local treatment or observation may be adequate.[8,12] However, these patients should be followed closely due to the risk of progression to multisystem disease. Systemic chemotherapeutic agents are used to treat multisystem LCH. The current case exhibited multifocal skeletal

**Figure 1.** Mild proptosis of the right eye and expansion of the lateral wall of the right orbita

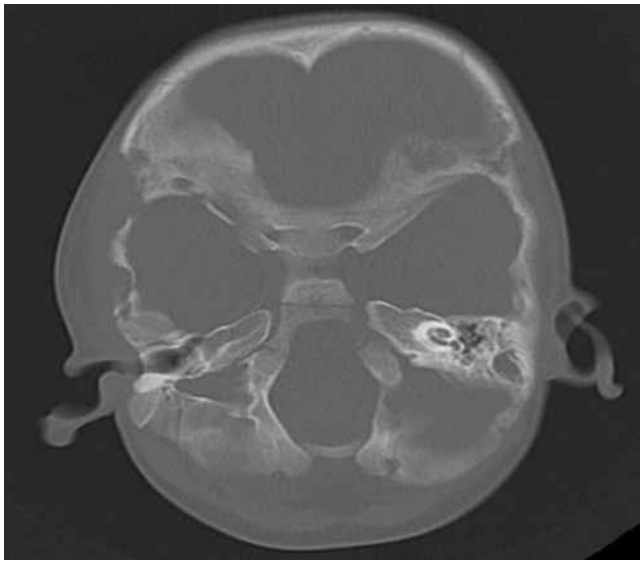

**Figure 2.** Multiple lytic lesions detected in the cranial bones on computed tomography

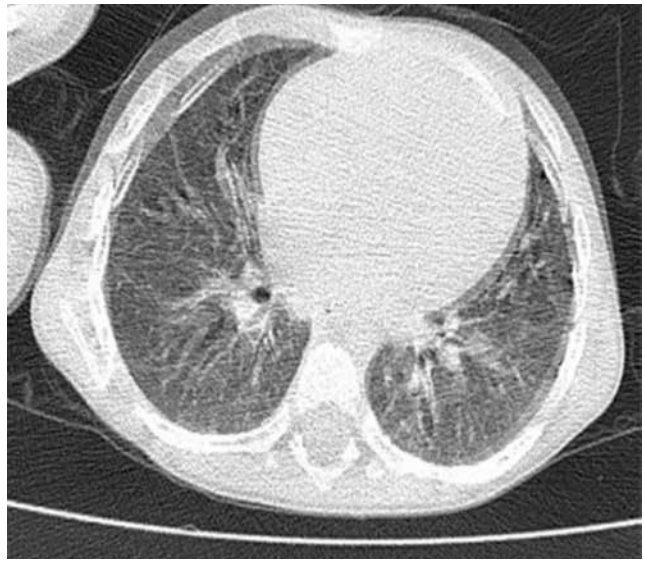

**Figure 3.** Microcystic formations visible on pulmonary computed tomography

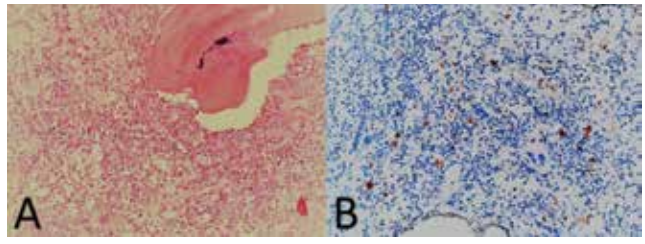


**Figure 4.** a) Characteristic Langerhans cells (hematoxylin & eosin, x200) and b) cytoplasmic CD1a staining (x200) in the patient's bone marrow biopsy

involvement; despite the absence of hematopoietic, hepatic, splenic, or pulmonary involvement, he was considered at risk for multisystem disease and systemic chemotherapy was initiated. Patients with hematopoietic, hepatic, splenic or pulmonary involvement are considered at risk for multisystem disease in the risk stratification system of the Histiocytosis Society, and treatment protocols were designed accordingly.[10] The prognosis of LCH patients with multisystem involvement is poor.

Due to the inability of pediatric patients to express themselves and the subtlety of the signs and symptoms of orbital malignancy, the families of these patients may overlook or disregard their symptoms. This may lead to delayed diagnosis and worse prognosis. Unfortunately, our patient's family disregarded his proptosis and orbital mass.

## Conclusion

All pediatric patients presenting with proptosis should undergo a thorough examination, and the possibility of an underlying malignancy should be considered even in cases with subtle signs. It should be kept in mind that LCH is among these malignancies and that an initial diagnosis is possible with careful radiologic imaging.

**Ethics**

Informed Consent: It was taken.

Peer-review: Externally and internally peer-reviewed.

**Authorship Contributions**

Surgical and Medical Practices: Mustafa Vatansever, Esra Vatansever, Erdem Dinç, Ayça Sarı, Tuba Kara, Concept: Mustafa Vatansever, Esra Vatansever, Erdem Dinç, Ayça Sarı, Tuba Kara, Design: Mustafa Vatansever, Esra Vatansever, Erdem Dinç, Ayça Sarı, Tuba Kara, Data Collection or Processing: Mustafa Vatansever, Esra Vatansever, Erdem Dinç, Ayça Sarı, Tuba Kara, Analysis or Interpretation: Mustafa Vatansever, Esra Vatansever, Erdem Dinç, Ayça Sarı, Tuba Kara, Literature Search: Mustafa Vatansever, Esra Vatansever, Erdem Dinç, Ayça Sarı, Tuba Kara, Writing: Mustafa Vatansever, Esra Vatansever, Erdem Dinç, Ayça Sarı, Tuba Kara.

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Case Report

# Isolated Anterior Lens Capsule Rupture Secondary to Blunt Trauma: Pathophysiology and Treatment

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**Summary**
A 25-year-old man suffered an isolated lens anterior capsular tear and mature cataract formation following blunt injury to his right eye. One week after the trauma, best-corrected visual acuity (BCVA) in the right eye was hand motion. B-scan ultrasonography showed that the lens posterior capsule was intact; no vitreous foreign body or retinal pathology were observed. Orbital computed tomography revealed narrowed anterior chamber and increased lens material volume and lens reflectivity in the injured right eye. The globe was intact and no bone fractures were observed. The cataractous lens material was removed by phacoemulsification and a foldable, acrylic, posterior chamber intraocular lens was implanted in the bag. Postoperative BCVA in the right eye was 20/20.
**Keywords:** Blunt eye trauma, lens anterior capsule rupture, traumatic cataract

## Introduction

Isolated anterior lens capsule tears due to blunt ocular trauma are rare.[1,2,3,4,5] In this report we aimed to describe the clinical findings, mechanism of development, and surgical treatment applied in the case of a patient with isolated anterior lens capsule rupture due to blunt trauma with a wooden object.

## Case Report

A 25-year-old male presented with periocular pain the day after sustaining a blunt trauma to the right eye with a piece of wood. At presentation, his best corrected visual acuity (BCVA) was 1/10 in the right eye and 10/10 in the left eye. Intraocular pressure (IOP) was 10 mmHg in the right and 12 mmHg in the left eye. Slit-lamp examination of the right eye revealed mild eyelid edema, 1+ conjunctival injection, clear cornea, an anterior lens capsule rupture bissecting the lens capsule along the 7 to 11 o'clock line extending under the superior and inferior iris margins to the lens equator, and traumatic cataract that did not yet seriously impede visualization of the fundus (Figure 1). Retinal examination done at this stage revealed no pathology in the posterior pole, midperipheral or peripheral retina.

Visual acuity was 1/10 on the third day after the trauma; however, due to increasing lens opacity, it decreased to hand motions by day 7 (Figure 2). B-scan ultrasonography and orbital computed tomography (CT) were performed to rule out foreign body and globe rupture and to document the patient's current status. No intravitreal foreign body or retinal pathology was detected on B-scan ultrasonography (Figure 3). Orbital CT revealed narrowed anterior chamber and increased lens volume and reflectivity compared to the healthy eye. Furthermore, the globe was observed to be intact and no fractures were detected in the bones of the orbit (Figure 4).

The patient's trauma was graded using the Birmingham Eye Trauma Terminology (BETT) and Ocular Trauma Score (OTS). BETT grade C was determined based on the injury being closed globe and contusional as well as the patient's visual acuity at presentation. No relative afferent pupillary defect was observed. The extent of the injury was zone II. The patient's OTS raw points value was 90, corresponding to an OTS of 4.

Surgery was planned to restore the visual acuity lost due to progressive traumatic cataract. The procedure consisted of entering the anterior chamber via a 2.8 mm clear cornea incision made temporally with 20 gauge MVR blades, trypan blue capsule staining under air and lens extraction by the bimanual

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irrigation/aspiration technique. A foldable, acrylic posterior capsule intraocular lens was implanted by injection into the sac and anterior capsulorhexis was performed in half-circles on the temporal and nasal sides in the pupillary plane. The zonules and posterior capsule were observed as intact after the procedure. The corneal incisions were closed using hydration, without sutures (Figure 5). Uncorrected visual acuity was 20/20 on the first postoperative day.

## Discussion

Crystalline lens damage secondary to blunt ocular trauma can result in lens dislocation, subluxation or posterior capsule rupture.[6,7,8]

Posterior capsule rupture occurs more frequently than anterior capsule rupture.[6,7,8] Gampanella et al.[9] stated that the mechanism of posterior capsule rupture due to blunt trauma involves the anatomic relationship between the vitreous and the lens interface. According to this theory, the Wiegert ligament, which connects the anterior cortical vitreous and the posterior lens capsule, usually attaches in the midperipheral region of the lens. This connection weakens with age. Secondary to the rapid compression of the eye on the anterior-posterior axis and the expansion that immediately follows, the Wiegert ligament causes the posterior lens capsule to tear.

**Figure 1.** Biomicroscopic anterior segment photograph of the isolated anterior lens capsule extending from 7 to 11 o'clock

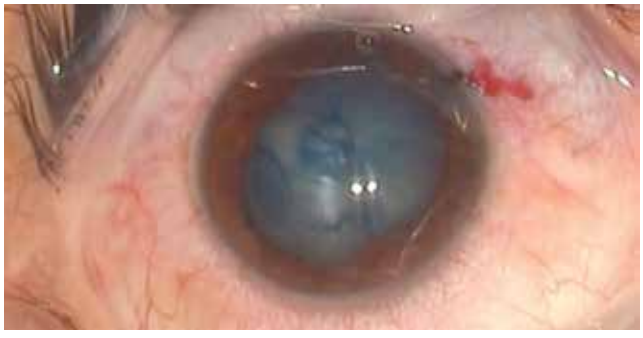

**Figure 2.** Intraoperative image of the severe traumatic cataract and the anterior lens capsule rupture visualized with trypan blue

**Figure 3.** Preoperative B-scan ultrasonography image

According to a hypothesis from Banitt et al.,[3] isolated anterior lens capsule tear secondary to blunt trauma probably occurs as a result of the rapid focal indentation of the cornea onto the lens (coup injury) or a rebound effect secondary to the trauma in which the vitreous applies high pressure to the lens (countrecoup injury).[3]

We believe that with less severe injuries, expansion following ocular compression on the anterior-posterior axis leads to posterior capsule tear, while in more severe injuries the anterior-posterior axis compression may cause anterior capsule rupture before the subsequent expansion. Especially in young patients like the current case in which the anterior hyaloid is tight, the vitreous compact, and the zonules intact, the anterior capsule rupture is limited to the equatorial plane and does not continue to the posterior capsule. The tight anterior hyaloid likely buffers the force of the direct impact but transfers the energy toward the lens due to the countrecoup effect. Therefore, although the retina and posterior pole are protected from trauma, the impact results in anterior capsule rupture because of the elasticity of the lens material. In cases like this, in which the patient is young and the tissues are resilient, the damage is limited and cataractous lens material can be removed by irrigation-aspiration alone, resulting in favorable anatomic and visual outcomes.

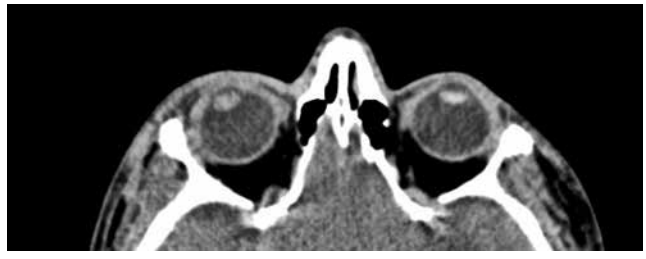

**Figure 4.** Preoperative orbital computed tomography image

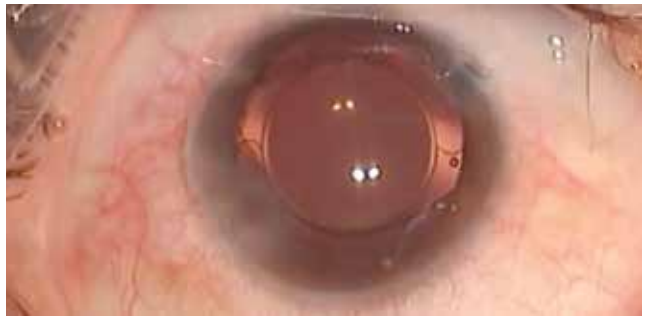

**Figure 5.** Postoperative anterior segment image

**Ethics**

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**Authorship Contributions**

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