Asteroid hyalosis removal during phacoemulsification: an anterior approach

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Purpose
The aim of this study was to evaluate the safety and efficacy of asteroid hyalosis (AH) removal by means of anterior vitrectomy through posterior capsulorhexis during phacoemulsification.
Patients and methods
The study was conducted on 16 eyes of 16 cataractous patients associated with AH. Phacoemulsification was performed, followed by removal of the AH through posterior capsulorhexis by means of anterior vitrectomy and before intraocular lens implantation. Patients were examined at 1 day, 1 week, 1, 3, and 6 months postoperatively. Data were analyzed using paired *t*-tests to compare the preoperative and postoperative uncorrected visual acuity and corrected visual acuity. The basic postoperative parameters at each follow-up visit were assessment of uncorrected visual acuity and corrected visual acuity and slit-lamp examination to evaluate the corneal condition and to detect any postoperative inflammation. The disappearance of AH was confirmed clinically using slit-lamp examination.
Results
All patients in this study showed a statistically significant improvement in postoperative visual acuity (P=0.001) at the last follow-up visit. One patient who had diabetic retinopathy and maculopathy showed deteriorated visual acuity at the last postoperative visit (P=0.2). Two patients had suboptimal best-corrected visual acuity after 6 months due to the presence of cellophane maculopathy detected clinically and using ocular coherence tomography (OCT) examination (P=0.01).
Conclusion
Removal of AH by means of anterior vitrectomy during phacoemulsification through a posterior capsulorhexis is safe and effective and enables the surgeon to treat undiagnosed missed retinal lesions that were not obvious preoperatively.

Keywords:
asteroid hyalosis, posterior capsulorhexis, vitrectomy

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Introduction

Asteroid hyalosis (AH) is a degenerative process of the vitreous humor, resulting in the formation of small white opacities, which consist of calcium phosphate and lipid deposits [1].

Ultrastructural studies with electron microscopy and radiography diffraction have confirmed calcium and phosphorus as the main constituents of these deposits, forming hydroxyapatite crystals [2,3].

AH is a common, usually asymptomatic, benign vitreous disease that affects older individuals [4].

Several publications [1,4,5] have found an association between AH and aging. Others have suggested an association between AH and diabetes mellitus [6–8], hypertension dyslipidemia, and elevated serum calcium levels [9].

AH is asymptomatic in most patients and diagnosis is mostly fortuitous in the context of a periodic ophthalmological examination. Most patients are observed regularly but no treatment is undertaken [10].

When dense AH occurs, it can sometimes lead to visual disturbances [11]. In such cases, pars plana vitrectomy (PPV) has been used to help these patients recover their visual acuity [12].

The aim of this study was to evaluate the safety and efficacy of AH removal by means of anterior vitrectomy through posterior capsulorhexis during phacoemulsification.

Patients and methods

The study was approved by the University Ethics Committee and followed the tenets of the Declaration of Helsinki. Participants were enrolled in a prospective, case–control study. This study was performed at the Department of Ophthalmology, Sohag University, Egypt. We obtained written informed consent from all participants.

The study was conducted on 16 eyes of 16 cataractous patients who also had concomitant AH with their cataracts and had posterior vitreous detachment. AH was detected either clinically using a slit lamp in cases of immature cataracts or ultrasonographically in cases of very dense or mature cataracts. Exclusion criteria were as follows: no detached posterior vitreous and a possible risk for retinal detachment.

Ophthalmological examinations consisted of uncorrected visual acuity, refraction, best-corrected visual acuity using the Landolt metric chart, slit-lamp examination to detect the type of cataract, intraocular pressure measurements, and fundus examination if possible.

A preoperative A-scan (Sonomed E-Z Scan AB5500; Sonomed Esacalon company, Wayne, Pennsylvania, USA) was used to measure the axial length and to calculate the power of the intraocular lens (IOL). A B-scan (Sonomed E-Z Scan AB5500) was performed to check the posterior segment, locate the site of AH, and confirm the presence of PDV.

All surgeries were performed by the author. Retrobulbar anesthesia was induced for all cases using mepivacaine HCl 2%.

Technique of the procedure

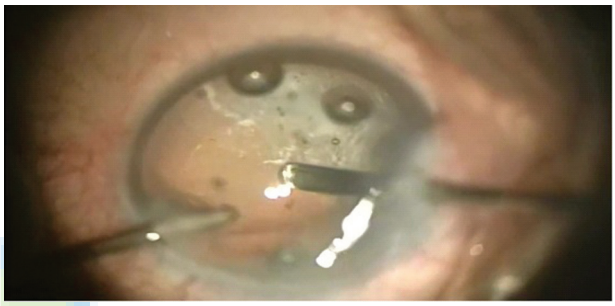
In all patients, phacoemulsification surgery was performed through a 2.4-mm sutureless superior clear corneal incision. The Alcon Infinity phacoemulsification machine was used in all cases (Alcon, Fort Worth, Texas, USA). The stop-and-chop technique was the preferred technique for nucleus emulsification.

After irrigation and aspiration of the lens matter using the bimanual technique, the capsular bag was filled with cohesive viscoelastic (Healon ovd; Abbott Medical Optics; Abbott Laboratories Inc., Abbott Park, Illinois, USA) and, through the paracentesis, posterior capsulorhexis was performed using a 23 G microrhexis forceps. Sometimes, when the AH was denser anteriorly, making the posterior capsulorhexis difficult, trypan blue (VisionBlue; DORC; Kerkweg 47e, 3214 VC Zuidland, The Netherlands) stain was used to enhance posterior capsule visualization.

Anterior vitrectomy was performed using an Alcon 20-G vitrectomy probe (Figs 1 and 2). The vitrectomy settings were as follows: cut rate of 800 cuts/min, vacuum of 150 mmHg, and a flow rate of 15 ml/min. A one-piece hydrophobic acrylic foldable IOL (Alcon AcrySof SN60; Alcon) was implanted into the capsular bag in all eyes.

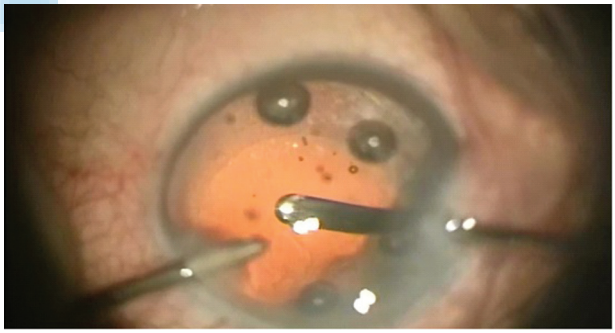
Figures 3 and 4 show the red reflex of the operating microscope before and after anterior vitrectomy of the AH, respectively.

Figure 1



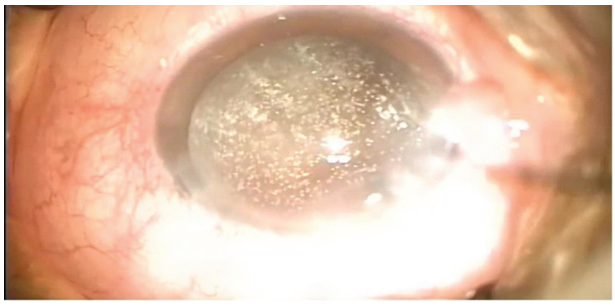
Anterior vitrectomy is performed using Alcon 23-G vitrectomy probe

Figure 2



Just before finishing the anterior vitrectomy

Figure 3



The red reflex before asteroid removal

Patients were examined at 1 day, 1 week, 1, 3, and 6 months postoperatively.

The basic postoperative parameters at each follow-up visit included assessments of uncorrected visual acuity and best-corrected visual acuity and slit-lamp examination to evaluate the corneal condition and to detect any postoperative inflammation. The disappearance of AH was confirmed clinically using slit-lamp examination.

Statistical analysis

Data were analyzed using Stata (StataCorp LLC: 4905 Lakeway Drive College Station, Texas 77845-4512, USA) intercooled, version 12.1. Quantitative data are represented as the mean and SD. Data were analyzed using paired *t*-tests to compare data at different time intervals with the preoperative data.

Results

The study consisted of 16 phacoemulsification cases for senile cataract associated AH.

The characteristics of the studied population as well as preoperative cataract morphology are shown in Table 1.

The preoperative visual acuity ranged from hand motion to 6/60 according to the cataract density. In the first postoperative week, visual acuity improved in 13 (81.25%) patients (P=0.001). Visual acuity did not improve in one (6.25%) patient due to the presence of proliferative diabetic retinopathy and macular exudations detected after asteroid clearance. Another two (12.5%) patients had suboptimal best-corrected visual acuity. Dilated fundus examination in these two patients revealed cellophane maculopathy, which was confirmed using ocular coherence tomography (OCT) examination.

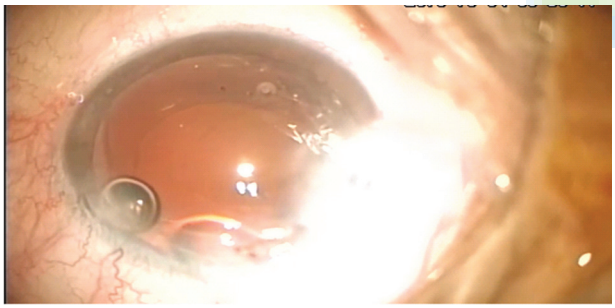
Preoperative OCT was not performed in these patients because they had mature cataracts.

Table 2 shows the comparison between the preoperative and the postoperative uncorrected and best-corrected visual acuity in all patients in the last follow-up visit.

All patients in this study showed statistically significant improvement in postoperative visual acuity (P=0.001) at the last follow-up visit. One patient who had diabetic retinopathy and maculopathy showed deteriorated visual acuity at the last postoperative visit (P=0.2). Two patients had suboptimal best-corrected visual acuity after 6 months due to the presence of cellophane maculopathy detected clinically and using OCT examination (P=0.01).

No patients encountered intraoperative or post operative complications.

Figure 4



The red reflex after asteroid removal

Table 1 Characteristics of the study population

Characteristics	Study population
Age	62.40±6.77
Sex [*n* (%)]	
Female	9 (56.25)
Male	7 (43.75)
Associated systemic diseases [*n* (%)]	
Diabetes mellitus	3 (18.75)
Cataract morphology	
Nuclear grade 2	2
Nuclear grade 3	5
Cortical	2
Posterior subscapsular	3
Mature	4

Discussion

AH is an age-related disease. This was indicated by the Beaver Dam Study [5] in Wisconsin that included 4952 patients.

Table 2 Comparison between the preoperative and the postoperative uncorrected and best-corrected visual acuity

Preoperative visual acuity	Postoperative visual acuity (uncorrected)	Postoperative visual acuity (corrected)	*P*-value
6/60	6/18	6/7.5	0.001
2/60	6/20	6/10	
3/60	6/10	6/9	
6/48	6/7.5	6/7.5	
6/60	6/9	6/9	
5/60	6/7.5	6/9	
6/24	6/6	6/6	
6/120	6/10	6/10	
Hand motion	6/18	6/9	
6/60	6/9	6/9	
Hand motion	6/20	6/10	
6/120	6/10	6/10	
6/120	6/12	6/12	
Hand motion	6/30	6/30	0.01
Hand motion	6/38	6/38	0.01
6/120	6/240	6/240	0.2

The overall prevalence of AH is 1.2%, ranging from 0.2% in people 43–56 years of age and 2.9% in people 75–86 years of age.

In the Blue Mountains Eye Study [4], 3654 patients were included; the prevalence of AH was estimated to be 1%, with 0.2% in individuals between 49 and 55 years and 2.1% in the age group between 75 and 97 years.

In this study, AH was removed during cataract surgery by means of anterior vitrectomy through a posterior capsulorhexis followed by IOL implantation. This study is the first to perform the removal of AH using an anterior approach during phacoemulsification. Thus, the results of this study will be compared with old studies in which AH was removed through PPV.

After 6 months of follow-up, 13 (81.25%) out of 16 patients included in this study showed a statistically significant improvement in their visual acuity. Two patients were found to have macular pucker diagnosed clinically and using OCT, and one patient was discovered to have severe diabetic retinopathy and maculopathy.

PPV [12–15] was performed in several previous studies for the removal of visually significant AH.

In a relatively similar study performed by Galveia *et al.* [10], five eyes underwent PPV and phacoemulsification with IOL implantation. Initial best-corrected visual acuities were 0.28±0.16 preoperatively and 0.98±0.04 postoperatively, with an average gain of seven lines. In a recent case report published in 2015 by Yokoyama *et al.* [13], they found a concomitant association between internal high-order aberrations and the presence of AH. They reported three AH cases in which internal higher-order aberrations were improved along with improved visual symptoms after vitrectomy. Moreover, in another case report by Jingami *et al.* [11], the authors concluded that PPV should be considered as a potentially effective treatment option for retinitis pigmentosa patients with dense AH when a large decrease in the visual acuity is noted shortly after cataract surgery.

Boissonnot *et al.* [15] performed PPV in three patients and found an improvement in visual acuity in two patients from 1/10 to 6/10. They stated that vitrectomy may be indicated in patients with a substantial decrease in visual acuity. However, the result is dependent on the macular status. In a retrospective study by Olea Vallejo *et al.* [16], PPV was performed on 17 eyes of 15 patients. The average visual acuity before surgery was 20/60, the best was 20/40, and the final visual acuity was 20/50. Unlike the present study, they found that visual improvement was less than expected.

In a relatively older study by Parnes *et al.* [12], the results obtained after vitrectomy on nine of 10 eyes (10 patients) had at least one line of improvement in nonstandardized best-corrected visual acuity. In one eye, vision was unchanged postoperatively.

The average gain was 3.44 lines. Moreover, unlike the present study, they found that a small percentage of patients with AH had decreased visual acuity caused solely or primarily by AH. Vitrectomy in these patients may alleviate symptoms and improve visual acuity.

In this study, two patients were found to have macular pucker, which resulted in a suboptimal improvement in visual acuity. Olea Vallejo *et al.* [16] also found an association, with macular pucker observed in 15% of eyes in the follow-up period. In a study by Hwang *et al.* [17], four eyes of seven had macular pucker associated with AH diagnosed by OCT. This result matches the results of this study. Galveia *et al.* [10] found two cases of 11 with epiretinal membranes in the course of their study after PPV.

One case in our study was diagnosed with diabetic retinopathy and AH revealing diabetes in a previously healthy man.

The presentation was consistent with proliferative diabetic retinopathy with bilateral AH.

In this study, no intraoperative or postoperative complications were encountered.

The points in this study to be considered are, first, the obvious lack of a control group subjected to isolated phacoemulsification without asteroid removal; this is likely due to the rare coexistence of cataracts and AH. The second limitation is the short follow-up period.

In conclusion, removal of AH by means of anterior vitrectomy during phacoemulsification through a posterior capsulorhexis is safe and effective and enables the surgeon to treat undiagnosed missed retinal lesions that were not obvious preoperatively.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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