Research Article

Anterior Segment Optical Coherence Tomography in Phacotrabeculectomy

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Abstract
Introduction: Cataract and glaucoma are one of the leading causes of blindness worldwide. The prevalence of both diseases is increasing with aging (Friedman et al., 2002). **Aim of the work:** By using Anterior Segment Optical Coherence Tomography (AS-OCT) evaluating anterior chamber angle (ACA) preoperatively and evaluating ACA and filtering bleb postoperatively after phacotrabeculectomy. **Patients and Methods:** This is a prospective study that included 30 eyes of 30 patients with a diagnosis of: cataract and glaucoma from both sexes age from 42 to 72 years old underwent phacotrabeculectomy operation. **Results:** This is a prospective study detect diagnostic performance of AS-OCT in assessing the anterior chamber angle (ACA) pre and postoperatively and feltring bleb in phacotrabeculectomy. **Conclusion:** AS-OCT imaging of phacotrabeculectomy feltring bleb detect that we can diagnosed successful functioning bleb from its morphological character with controlled IOP, AS-OCT detect 9 cystic blebs, 12 diffuse, and 9 flat blebs with controlled IOP in all cases inspite of type of bleb and that explaend by cataract extraction.
Keywords: Cataract and glaucoma, blindness, Anterior Segment Optical Coherence

Introduction
Cataract and glaucoma are one of the leading causes of blindness worldwide. The prevalence of both diseases is increasing with aging [(1)]

The goal of glaucoma surgery is to lower intraocular pressure to prevent or slow down the progression of optic nerve damage and associated visual field loss. Although many patients present with these concomitant diseases, there is no general consensus on surgical management of coexisting cataract in patients with glaucoma. The surgeon has to decide which approach may be best suited for a particular patient, combined surgery or sequential surgeries, depending on the patient's severity of glaucoma and visual compromise from a cataract. The combined surgical treatment of glaucoma and cataract has been the subject of some controversy[(2)].

In the 1990s, phacoemulsification and the use of small incision foldable lenses increased the success of combined phacoemulsification/ trabeculectomy surgery 0 (phacotrabeculectomy). Early studies showed promising results[(3)].

Diagnosis and treatment of glaucoma are closely related to angle assessment techniques. Different approaches have been developed to aid in the assessment of the anterior chamber angle (ACA)[(4)]. These approaches include the following:

- **Gonioscopy:** is the current reference standard for evaluation of the anterior chamber angle .It has substantial inter-observer variability and relies on subjective assessment of ACA findings [(5)].
- **Anterior segment Optical Coherence Tomography** (AS-OCT) is a noninvasive, noncontact, in vivo imaging technique based on low-coherence interferometry [(6)]

Anterior segment OCT provide high-resolution cross sectional images of the anterior of the eye[(7)].

This technique uses infrared radiation to provide real-time images of the anterior segment and allow objective and qualitative assessment of anterior chamber angel structures [(8).]

It may be of help during the routine clinical assessment and treatment of patients with glaucoma, particularly when gonioscopy is not possible or difficult to interrupt [9].

Aim of the work

By using Anterior Segment Optical Coherence Tomography (AS-OCT) evaluating anterior chamber angle (ACA) preoperatively and evaluating ACA and filtering bleb postoperatively after phacotrabeculectomy.

Patients and Methods

This is a prospective study that included 30 eyes of 30 patients with a diagnosis of: cataract and glaucoma from both sexes age from 42 to 72 years old underwent phacotrabeculectomy operation.

Patients were recruited from El Minia University Hospital between January 2016 till March 2017. The duration of follow up was six months.

Inclusion criteria:

- Patients with both cataract and Glaucoma.

Exclusion criteria:

- Patients with history of previous intraocular surgery,
- History of penetrating trauma,
- Previous anterior segment laser treatment,
- Any corneal opacities that precluded AS-OCT imaging.

After taking a comprehensive medical and ophthalmic history, each patient underwent the following examination:

- Visual acuity and BCVA,
- Intraocular pressure,
- Anterior segment examination by Slit lamp,
- Posterior segment examination,
- Gonioscopy pre-operatively,
- And anterior segment OCT pre, and post-operatively.

Gonioscopy was performed preoperatively using Volk 3 mirror goniolens. The anterior chamber angle in each quadrant was graded using the Shaffer grading system (Table 1).

Results

This is a prospective study detect diagnostic performance of AS-OCT in assessing the anterior chamber angle (ACA) pre and post-operatively and feltring bleb in phacotrabeculectomy.

Demographic Data of patients

This study was carried out on 30 eyes of 30 patients diagnosed with cataract and glaucoma from both sexes (16 males and 14 females). The age of the patients ranged from 42 to 72 years (mean 54.68±8.23 years old). Underwent phacotrabeculectomy operation, 8 patients were diagnosed as primary open angle glau-coma (POAG) and 22 to be primary closed angle glaucoma (PCAG).

Patients were recruited from El-Minia University Hospital between January 2016 till March 2017. The duration of follow up was six months.

Table 1 Demographic data of the patients

Sex	16 males	14 females
Side of the eye	20 left	10 right
Type of Glaucoma	8 POAG	22 PCAG

In this study, the following items were compared preoperatively and postoperatively:

- Pre and post-operative visual acuity,
- Pre and post-operative IOP,
- Pre-operative Gonioscopy,
- Pre-operative and post-operative AS-OCT for anterior chamber angle,
- Post-operative AS-OCT for feltring bleb including bleb wall thickness, prescence of microcysts, reflectivity and bleb height.

Discussion

Application of ultrasound biomicroscopy (UBM) and optical coherence tomography (OCT) for assessment of the anterior segment in Glaucoma are a major diagnostic methods, OCT systems use lowcoherence, near-infrared

light to provide detailed images of anterior segment structures at resolutions exceeding that of UBM**.** Anterior segment optical coherence tomography (AS-OCT) uses diode laser to obtain real-time images of the anterior chamber angle, and provide a rapid non-contact method for detecting eyes at risk for angle closure[(10)]**.**

This study demonstrated that the AS-OCT detected more eyes with closed anterior chamber angles especially in superior and inferior quadrants from the studied 30 eyes, Superior quadrants showed the highest rates of closed angles. Sakata and colleagues found that the anterior chamber angle is most frequently closed in the superior quadrant on Gonioscopy[(11)]**.**

Kunimatsu and colleagues investigated the anterior chamber angle of 80 patients with a shallow peripheral anterior chamber using ultrasound biomicroscopy and reported that the highest rates of closed angles were found on the superior quadrants (79%), followed by the inferior (64%), nasal (33%),and temporal (26%) quadrants(12)**.** This study agree with these findings by using AS-OCT among studied 30 patients, that the percentage of closed anterior chamber angles from 30 eyes with cataract and glaucoma preoperatively were: superior quadrant (73%), inferior (66.7%), nasal (53%), and temporal (26.7%). On the other hand there were 8 eyes with opened anterior chamber angle in 4 quadrants (26.7%) from those 30 eyes.

This study demonstrated that postoperative AS-OCT measurement of anterior chamber angle in patients underwent phacotrabeculectomy were opened in 4 quadrants in the all studied eyes (100%).
Anterior segment optical coherence tomography was useful in showing cross-sectional images of internal bleb structure that were previously inferred from clinical examination[(13)]**.**

Conclusion

AS-OCT imaging of phacotrabeculectomy feltring bleb detect that we can diagnosed successful functioning bleb from its morphological character with controlled IOP, AS-OCT detect 9 cystic blebs, 12 diffuse, and 9 flat blebs with controlled IOP in all cases inspite of type of bleb and that explaend by cataract extraction.

AS-OCT is a promising tool to image phacotrabeculectomy blebs. It was able to detect angle changes pre and postoperative and demonstrate features of the bleb that are not apparent at the slit lamp It has advantage over UBM in being non-contact, non-invasive procedure allowing early postoperative management.

This information enhances our understanding of bleb function and may aid the clinician in making decisions regarding postoperative bleb management. Its role in the management of successful, failed, or failing blebs in the early and late postoperative periods is under further investigation.

Successful function bleb can be diagnosed according to bleb morphology (characterized with presence of multiple microcysts, subconjunctival hypo-reflective fluid filled spaces, and to some extent bleb height), with controlled intraocular pressure.

References

1. Bald M, Li Y and Huang D. Anterior chamber angle evaluation with fourier-domain optical coherence tomography. Journal of ophthalmology. 2012; 2012: 103704. doi: 10.1155/2012/103704.
2. Ciancaglini M, Carpineto P, Agnifili L, Nubile M, Lanzini M, Fasanella V, Mastropasqua L. Filtering bleb functionality: a clinical, anterior segment optical coherence tomography and in vivo confocal microscopy study. Journal of glaucoma. 2008 Jun 1; 17(4):308-17.
3. Friedman DS and He M. Anterior chamber angle assessment techniques. Survey of ophthalmology. 2008 May 1;53(3):250-73.
4. Friedman DS, Jampel HD, Lubomski LH, Kempen JH, Quigley H, Congdon N, Levkovitch-Verbin H, Robinson KA and Bass EB. Surgical strategies for coexisting glaucoma and cataract: An evidence-based update1. Ophthalmology. 2002; 109(10): 1902-1913.
5. Ishikawa H, Gürs-Özden R, Hoh ST, Dou HL, Liebmann JM and Ritch R. Grayscale and proportion-corrected optical coherence tomography images. Ophthalmic Surgery, Lasers and Imaging Retina. 2000; 31(3): 223-228.

6. Leung CK and Weinreb RN. Anterior chamber angle imaging with optical coherence tomography. Eye.2011; 25(3): 261
7. Liu S, Yu M, Ye C, Lam DS and Leung CK. Anterior chamber angle imaging with swept-source optical coherence tomography: an investigation on variability of angle measurement. Investigative ophthalmology & visual science. 2011; 52(12): 8598-8603.
8. Nolan WP, See JL, Aung T, Friedman DS, Chan YH, Smith SD, Zheng C, Huang D, Foster PJ and Chew PT. Changes in angle configuration after phacoemulsification measured by anterior segment optical coherence tomography. Journal of glaucoma. 2008; 17(6):455-459.
9. Rollins AM and Izatt JA. Optimal interferometer designs for optical coher-ence tomography. Optics letters. 1999; 24 (21): 1484-1486.
10. See JL, Chew PT, Smith SD, Nolan WP, Chan YH, Huang D, Zheng C, Foster PJ, Aung T and Friedman DS. Changes in anterior segment morphology in response to illumination and after laser iridotomy in Asian eyes: an anterior segment OCT study. British Journal of Ophthalmology. 2007; 91(11):1485-1489.
11. Tun TA, Baskaran M, Zheng C, Sakata LM, Perera SA, Chan AS, Friedman DS, Cheung CY and Aung T. Assessment of trabecular meshwork width using swept source optical coherence tomography. Graefe's Archive for Clinical and Experimental Ophthalmology.2013;251(6): 1587-1592.
12. Wylęgała E, Teper S, Nowińska AK, Milka M and Dobrowolski D. Anterior segment imaging: Fourier-domain optical coherence tomography versus time-domain optical coherence tomography. Journal of Cataract & Refractive Surgery. 2009; 35(8):1410-1414 .