The Journal of International Medical Sciences Academy
2018; (October - December); Vol 31; No. 4

Case Report

Effectiveness of Ultrasound Biomicroscopy (UBM) in ensuring success in secondary IOL implantation

Shashi Prabha Prasad[1], Rupali Maheshgauri[2], Shivani P. Pattnaik[3], Priti Kumari[3], Richa B Naik [3], Pari S Desai[3], Brig. Amarjit Singh[4]

[1]Professor, [2]Associate Professor, [3] Junior Residents, [4] Professor (Radiology),
Principal Director & CEO, Dr. D. Y. Patil Medical College, Pimpri, Pune, Maharashtra, India

Abstract

Ultrasound biomicroscopy (UBM) provides high-resolution non-invasive in vivo imaging of the anterior segment. This study was carried out with the purpose of evaluating the role of ultrasound biomicroscopy (UBM) in safe and effective secondary IOL implantation in aphakes. The study was carried out between the period of January 2011 to January 2013at a tertiary eye care center and a total of 16 cases including post traumatic and surgically induced aphakia were included. Secondary IOL implantation in sulcus over the capsular remnants could be achieved in 14 out of 16 patients. (87.5%). UBM is an excellent modality for assessing anterior capsular integrity prior to secondary IOL implantation.

Keywords: UBM, Secondary IOL Implantation, Aphakia, Non - Invasive.

Introduction

UBM is a technique used to visualize the anterior chamber of the eye with high frequency ultrasound. The probe used for UBM has a frequency of 35-40 MHz with a resolution of 40 microns and penetration depth of 4mm. A shallow learning curve allows user to learn the scanning technique and protocol quickly and easily, typically with only a few scans learning curve.The cornea, anterior chamber, posterior chamber, the angle and ciliary body can be easily seen. The anterior lens surface also can be visualized. The angle of the anterior chamber can be assessed with the landmark being the scleral spur which is located where the trabecular meshwork meets the interface between sclera and ciliary body. The iris has a planar configuration with slight anterior bowing.

There are various uses of UBM highlighted in different ocular pathologies.Intraocular lens optics and haptics give foreign body type echoes. The capsular bag cannot be localized and so the position of the haptic is used to identify if the loop is in the sulcus, bag or is dislocated.A posterior chamber IOL appears on UBM as a highly reflective plate (corresponding to the lens optics) in the retro pupillary plane with reverberation artifacts behind it. The integrity or absence of the posterior capsule can be studied prior to secondary lens implantation. This is useful especially in cases with non-dilating pupils with extensive posterior synechiae. Synechiae can also be picked up on the UBM.

UBM is a useful tool in narrow angle glaucoma where the cause could be abnormal size or position of one of the structures in the angle. When view of the anterior segment structures is blocked by hyphaema, UBM can be used to assess the structural damage. Beyond that, UBM allows users to detect ciliary body cysts before lens implantation, fibrin and retained lens fragments, and anterior supra-choroidal effusions [1].

Address for correspondence
Dr. Shashi Prabha Prasad, Professor, Dr. D. Y. Patil Medical College, Pimpri, Pune-18, Maharashtra, India
Email: shshind2006@gmail.com

Received: 26.12.16
Accepted: 26.03.17

Case Report

The study was performed at tertiary care center. Sixteen eyes of previously aphakic patients were studied.

Inclusion criteria

1.) A minimum of two months between cataract extraction surgery which resulted in aphakia;

2.) No posterior segment or major structural anterior segment pathology secondary to trauma;

3.) Best corrected visual acuity to be better than or equal to 20/80;

4.) Those who had at least 3 clock hours of capsular integrity and similar one 180° opposite as confirmed by UBM. The ophthalmologic examination, which included refraction and measurement of best corrected visual acuity, slit lamp biomicroscopy, fundoscopy and applanation

tonometry.

Exclusion criteria

1.) Small pupils;

2.) Patients with corneal decompensation, inactive chronic uveitis or active uveitis, pseudo-exfoliation and anatomical congenital alterations;

3.) Retina and optical nerve diseases which might increase surgical risk or be potentiated by the new surgery;

4.) Uncontrolled glaucoma cases or glaucoma under clinical control but with a cup larger than 0.5;

5.) Corneal opacities;

6.) High myopia;

7.) Dislocated IOLs. 10 to 14 % of the pts.

Doppler ultrasound [4] at compressed or narrowed segment of celiac artery reveals variation of peak systolic velocity (PSV) during respiration with a marked increase during expiration with PSV greater than 200 cm/s. A greater than 3:1 ratio of PSV in the celiac artery in expiration 3.

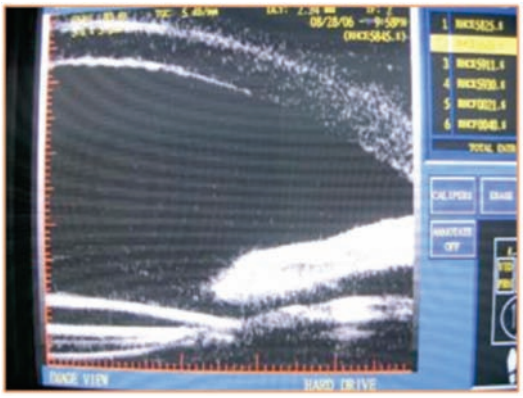

Fig. 1 : A preoperative UBM

A preoperative UBM (Fig. 1) was done in all 16 patients to assess the capsular integrity. All surgeries were performed by a single surgeon.A large 7mm limbal incision was taken 90° away from the intact capsular remnants. A good anterior vitrectomy was done. A single piece all PMMA IOL with 6.5mm optic and 13mm overall length was used. Hydroxypropylmethyl cellulose was injected behind the iris to increase the space in the sulcus for assisting in easy IOL implantation.The haptics were placed over the capsular remnants which had been identified preoperatively by UBM. AC was washed off the viscoelastic and formed with air. The limbal wound sutured with 5 sutures of 10'0 polyamide.

Postoperatively the patients were examined on day 1,2,7,14 and 30 and detailed slit lamp evaluation was done.

On the return visit after 1 month, ultrasound biomicroscopy was performed using a Humphrey model 840 Ultrasound Biomicroscope with a 50 MHz transducer to see the location of IOL and the haptics.It was confirmed by UBM that all cases had the haptics resting on capsular remnants.

On UBM examination, the following were evaluated:

1.) Positioning of the intraocular lens haptics at the 3 and 9 hour regions;

2.) Measurement of the distance between the posterior surface of the iris and the anterior surface of the intraocular lens, at the 4 quadrants. This measurement was performed at 4 mm from the scleral spur, tracing a straight line perpendicularly to the surface of the intraocular lens at the 3, 6, 9 and 12 hour meridians (Fig. 1).

Results

This study involved 16 patients. 8 males (50%) and 8 females (50%) who underwent secondary intraocular lens implantation in sulcus over the capsular remnants. Patients who were aphakic owing to prior cataract surgery or trauma rendering them aphakic were selected for this study. 48% patients were post-surgical aphakes and 52 % were post traumatic aphakes.

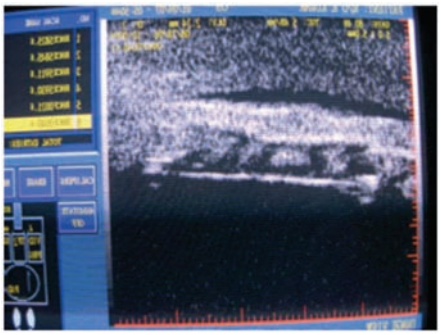

Fig. 2: Post-operative UBM showing PCIOL in sulcus.

Secondary IOL implantation in sulcus over the capsular remnants could be achieved in 14 out of 16 patients (87.5%).

Out of the sixteen patients that were operated, 2 patients did not have a successful secondary IOL implantation procedure. One suffered intra-operative damage to the remnants of the posterior capsule so the IOL could not be placed on it. And the other patient suffered post-operative subluxation of IOL. (Table)

Table. Complications encountered postoperatively

Subluxated IOL	1
Dislocated IOL	0
IOL drop in vitreous	0
Tearing of posterior capsule	1

Discussion

Loss of a good capsular support is one of the intraoperative complications that may interfere with the decision of primary intraocular lens implantation at the time of surgery, whereas the decision of secondary implantation might be considered later aiming for proper optical correction of the resultant aniseikonic condition following unilateral postoperative aphakia.

Several alternatives for the surgical correction of aphakia have been suggested (i.e., a posterior chamber intraocular lens (PCIOL) placed in the ciliary sulcus, or preferably in the capsular bag if possible); however in the absence of a good capsular support, an anterior chamber IOL, an iris-fixated IOL, glued IOL or a sutured PCIOL would be suggested [2].

The optical correction of aphakia has been considered as being a challenging situation, with the option of IOL implantation to be considered in the majority of cases.

In aphakic eyes with sufficient capsular support, implantation of a PCIOL has been reported to be more superior than the anterior chamber IOL, being away from the corneal endothelium and being more anatomically placed [3].

Two technical difficulties have to be overcome in implantation of posterior chamber intraocular lenses (PCIOLs), especially in eyes with previous anterior vitrectomy and decreased scleral rigidity: first, good structural integrity of sulcus and second, good posterior capsular support. Incongruence of the two may lead to long-term complications [4,5].

Ultrasound biomicroscopy (UBM) is a high resolution ultrasound technique that allows imaging of structural details of anterior segment at near microscopic resolution in living patients.

The ultrasound biomicroscope works on the principle of an ultrasound but at a higher frequency. The normal B scan probe works at a resolution of 10 to 12 MHz while the UBM probe works at a frequency of 35 - 50 MHz or higher. The basic parts of a UBM are the same as that of a standard ultrasound and consist of a hand piece with transducer, a computer console which has the required hardware and software specific for the purpose, a monitor, a printer and a foot switch. The UBM software has special measuring features for measuring thickness of tissues or measuring angles. Unlike a B scan probe where the transducer is sealed inside along with its coupling media the UBM probe requires a medium. The machines have a silicon cup with water or methylcellulose as used these days as the coupling media. The probe sweep can be set for a sweep of 200 or 300. The transducers in the newer machines are threaded on and can easily be interchanged for one of a different frequency.

It provides detailed two dimensional gray scale images of epibulbar conjunctiva, cornea and anterior sclera, aqueous chambers, anterior chamber angle structures, ciliary body, crystalline lens, zonules and anterior vitreous.

The transducer frequency of UBM is 50MHZ in contrast to 7.5-10 MHZ of conventional ultrasound.

It produces cross sectional images of anterior segment structures providing a lateral resolution of 59 μ and axial resolution of 25μ with a depth of penetration of approximately 4-5mm (upto pars plana region of the eye).

Ultrasound biomicroscopy, a technique that allows for a real time panoramic view to image the anterior segment, revealing the ciliary body and peripheral retina, was found as an adjuvant tool to evaluate, Manabe et al. used ultrasound biomicroscopy to study eyes with secondary IOL implantation and found that only 37% of the haptics were located adequately in the ciliary sulcus and also demonstrated that 48% of the haptics in their series were caught in the vitreous, even though anterior vitrectomy had been performed, that might induce vitreous traction and cause complications such as retinal detachment or macular hole and edema [8].

In the current study, UBM visualization at the haptics sites revealed no vitreous bands entrapped between the haptics and ciliary body at the insertion site.

In 1992, Pavlin et al. described biometric criteria that could be used for reproducible measurement of various anterior segment structures [9,10].

He has described the usefulness of ultrabiomicroscopy in evaluation of the state of posterior capsule and anatomy of ciliary sulcus for the prognosis of secondary IOL implantation [11,12].

Pavlin etal. also described the usefulness of ultrabiomicroscopy in eyes in various diseases, including glaucoma, ciliary body tumors, plateau iris syndrome, pigment dispersion syndrome to evaluate the condition of the angle and the progress of glaucoma [13,14].

It has a wide range of clinical applications ranging from cornea, glaucoma, retina, trauma and a host of others. It displays the anterior segment anatomy of angle, iris, ciliary body, lens and anterior vitreous clearly in cloudy/ opaque corneas.

Postoperatively, UBM can show the site and location of IOL and the positioning of the haptics. A posterior chamber IOL appears on UBM as a highly reflective plate

(corresponding to the lens optics) in the retro pupillary plane with reverberation artifacts behind it.

In most eyes with posterior chamber IOL an UBM imaging can show whether the IOL haptics are in the capsular bag, in the ciliary sulcus or in some other anatomic location.

Conclusion

UBM is a useful device to evaluate aphakic eyes before secondary IOL implantation through good evaluation of the anterior segment with special attention to the anterior capsular integrity, ciliary sulcus, anterior chamber depth, corneal thickness, and detection of any structural changes in the anterior segment resulting from the remote cause of aphakia.

UBM is an excellent modality to determine anterior capsular integrity prior to secondary intraocular lens implantation. Preoperatively UBM can exactly delineate the available capsular support for placing the haptics especially in non-dilating pupils.Without UBM there will be a dilemma whether to attempt secondary IOL without quantification of the remnants of the anterior capsule based only on slit lamp examination. The sulcus IOL implantation is a far simple proposition as compared to more challenging surgeries as glued IOL, scleral fixated IOL or iris fixated IOL implantation.

Thus UBM is imperative in cases of aphakia where capsular remnants could not be identified.

Conflict of interest:	All authors declare no COI
Ethics:	There is no ethical violation as it is based on voluntary anonymous interviews
Funding:	No external funding
Guarantor:	Dr. Shashi Prabha Prasad will act as guarantor of this article on behalf of all co-authors.

References

1. JOphthalmol. August 2016; 2016: 8501842.
2. Kamal A. M., Hanafy M., Ehsan A., Tomerak R. H. Ultrasound biomicroscopy comparison of ab interno and ab externo scleral fixation of posterior chamber intraocular lenses. Journal of Cataract and Refractive Surgery. 2009;35(5):881–884.
3. McAllister A. S., Hirst L. W. Visual outcomes and complications of scleral-fixated posterior chamber intraocular lenses. Journal of Cataract & Refractive Surgery. 2011;37(7):1263–1269.
4. Sewelam A., Ismail A. M., El Serogy H. Ultrasound biomicroscopy of haptic position after transscleral fixation of posterior chamber intraocular lenses. Journal of Cataract and Refractive Surgery. 2001;27(9):1418–1422.
5. Bhutto I. A., Kazi G. Q., Mahar P. S., Qidwai U. A. Visual outcome and complications in Ab-externo scleral fixation IOL in aphakia in pediatric age group. Pakistan Journal of Medical Sciences. 2013;29(4):947–950.
6. Alp M. N., Buyuktortop N., Hosal B. M., Zilelioglu G., Kural G. Ultrasound biomicroscopic evaluation of the efficacy of a transillumination technique for ciliary sulcus localization in transscleral fixation of posterior chamber intraocular lenses. Journal of Cataract & Refractive Surgery. 2009;35(2):291–296.
7. Hudde T., Althaus C., Sundmacher R. Postoperative ultrasound biomicroscopic evaluation of the haptic position in transsclerally sutured posterior-chamber lenses as compared with the intraoperative endoscopic position. German Journal of Ophthalmology. 1996;5(6):449–453.
8. Manabe S.-I., Oh H., Amino K., Hata N., Yamakawa R. Ultrasound biomicroscopic analysis of posterior chamber intraocular lenses with transscleral sulcus suture. Ophthalmology. 2000;107(12):2172–2178.
9. Pavlin CJ, Rootman D, Arshinoff S, Harasiewicz K, Foster FS. Determinationof the haptic position of transsclerally fixated posterior chamber intraocularlenses by ultrasound biomicroscopy. J Cataract Refract Surg 1993;19:573-7
10. Pavlin CJ, Sherar MD, Foster FS. Subsurface ultrasound microscopic imaging of the intact eye. Ophthalmology. 1990;97:244–50.
11. Pavlin CJ, Harasiewicz K, Sherar MD, Foster FS. Clinical use of ultrasound biomicroscopy. Ophthalmology. 1991;98:287–95
12. Pavlin CJ, Harasiewicz K, Foster FS. Ultrasound biomicroscopy of anterior segment structures in normal and glaucomatous eyes. Am J Ophthalmol. 1992;113:381–9.
13. Pavlin CJ, Foster FS. Ultrasound biomicroscopy in glaucoma. Acta Ophthalmologica – Suppl. 1992;204:7–9.
14. 10. Pavlin CJ, Ritch R, Foster FS. Ultrasound biomicroscopy in plateau iris syndrome. Am J Ophthalmol. 1992;113:390–95.