Is ultrasonography essential before surgery in eyes with advanced cataracts?

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ABSTRACT

Background: Ultrasonography is an important tool for evaluating the posterior segment in eyes with opaque media.

Aim: To study the incidence of posterior segment pathology in eyes with advanced cataract and to see whether certain features could be used as predictors for an abnormal posterior segment on ultrasound.

Setting: Tertiary care hospital in South India.

Methods and Materials: In this prospective study conducted over a 6-month period, all eyes with dense cataracts precluding visualization of fundus underwent assessment with ultrasound. Presence of certain patient and ocular "risk" factors believed to be associated with a higher incidence of abnormal posterior segment on ultrasound were looked for and the odds ratio (OR) for posterior segment pathology in these eyes was calculated.

Results: Of the 418 eyes assessed, 36 eyes (8.6%) had evidence of posterior segment pathology on ultrasound. Retinal detachment (17 eyes; 4.1%) was the most frequent abnormality detected. Among patient features, diabetes mellitus (OR= 4.9, P=0.003) and age below 50 years (OR= 15.4, P=0.001) were associated with a high incidence of abnormal ultrasound scans. In ocular features, posterior synechiae (OR= 20.2, P=0.000), iris coloboma (OR= 34.6, P=0.000), inaccurate projection of rays (OR= 15.1, P=0.002), elevated intraocular pressure (OR= 15.1, P=0.004), and keratic precipitates (OR= 22.4, P=0.004) were associated with high incidence of posterior segment pathology. Only four eyes (1.5%) without these features had abnormal posterior segment on ultrasonography.

Conclusions: Certain patient and ocular features are indicative of a high risk for posterior segment pathology and such patients should be evaluated by ultrasonography prior to cataract surgery. In the absence of these risk factors, the likelihood of detecting abnormalities on preoperative ultrasonography in eyes with advanced cataracts is miniscule.

KEY WORDS: Advanced cataract, cataract surgery, ultrasonography

Ultrasonography is a valuable tool for evaluating the posterior segment in eyes with advanced cataracts. Detection of significant abnormalities using ultrasound prior to cataract surgery helps in planning surgery and allows the surgeon to provide an appropriate prognosis to the patient. Studies of ultrasonographic evaluation in eyes with opaque media have shown incidence rates of posterior segment pathology to vary from 19.6% to 66%.[1,2] Although most patients with advanced cataract are currently encountered in developing countries, most hospitals in these areas do not have an easy access to ultrasound. This poses a dilemma to the operating surgeon as to whether to proceed with cataract surgery in the absence of ultrasonographic evaluation or to refer the patient to centers where ultrasound is available.

We aimed to study the incidence of significant posterior segment abnormalities in eyes with advanced cataracts precluding a direct visualization of fundus prior to cataract surgery. We also evaluated whether the presence of certain patient features and anterior segment findings correlated with a greater incidence of abnormalities on ultrasonography, which would allow surgeons to selectively refer cases to higher centers for ocular ultrasonographic evaluation prior to surgery. We further studied the ability of ultrasound to detect posterior segment pathology, which could affect visual results.

Materials and Methods

This prospective, nonrandomized interventional clinical trial was conducted at a tertiary eye care centre over a 6-month period beginning July 2003 after obtaining clearance from the institutional ethics committee. All eyes with advanced cataract that precluded a direct visualization of the fundus were evaluated by ultrasonographic A and B scans prior to cataract surgery.

Subjects younger than 16 years of age, those with a known

presence of posterior segment pathology in the eye to be operated or presence of recent penetrating or blunt ocular injury, or prior eye surgery were excluded from the study. Also, patients who were found to be suffering from a relative afferent pupillary defect (RAPD) were excluded from the study.

All enrolled patients underwent a standard preoperative examination protocol that included determination of visual acuity, slit-lamp examination, indirect ophthalmoscopy, and syringing of the nasolacrimal duct and ocular biometry. Patient features and ocular features that we believed to correlate with a higher incidence of posterior segment pathology on preoperative ultrasound (Table 1) were specifically looked for and noted when present.

The enrolled subjects were evaluated using the Alcon Ultrascan Imaging System (Alcon Laboratories, Fort Worth, Texas, USA) by one of the two experienced sonologists (AS, CGV). A combination of axial, longitudinal, transverse B scans, and vector A scans was used to study the eye. In patients with bilaterally advanced cataracts, both eyes were evaluated with ultrasonography.

Significant posterior segment pathology on ultrasonography was defined as that likely to affect the visual result. This included retinal detachment (with or without macular involvement), dense vitreous opacities, large cupping of the optic nerve head, posterior staphyloma, and choroidal coloboma.

Patients with significant posterior segment pathology underwent surgery only after being informed about prognosis for vision. Patients underwent cataract surgery using different techniques (extracapsular cataract extraction, manual small incision cataract surgery, or phacoemulsification), depending on the choice of the operating surgeon. Following cataract surgery, every enrolled patient underwent direct examination of the posterior segment to confirm or rule out posterior segment pathology. Visual acuity was determined postoperatively in all eyes and presence of any abnormality affecting visual acuity that had not been detected on ultrasonography was recorded.

Table 1: Patient features and ocular features associated with possible presence of posterior segment pathology on ultrasonography

Patient features
Diabetes mellitus
Hypertension
Bilateral advanced cataract
Young age (age < 50 years)
Ocular features
Posterior synechiae
Subluxated lens
Corneal opacity
Esotropia >30°
Exotropia >30°
Iris coloboma
Elevated intraocular pressure
Keratic precipitates
Inaccurate projection of rays
Ocular hypotony

Significant association between patient and ocular "risk" factors and abnormal ultrasonogram was tested using the odds ratio (OR) with 95% confidence interval (CI). The χ^2-test was used for analysis and a value of $P<0.05$ was considered significant.

Results

Demographic data

Four hundred and eighteen eyes of 394 patients were included in the study. Twenty-four patients had bilateral dense cataracts. Mean age of the patients was 55.7 + 13.8 years (range 18-80 years). Three hundred and thirty one patients (84%) were from rural areas and belonged to low socioeconomic strata, whereas 63 patients (16%) were from an urban/semiurban area and belonged to middle or higher socioeconomic strata. Three hundred and ten eyes (74.2%) had mature cataracts, 60 eyes (14.4%) had nuclear cataract, 41 eyes (9.8%) had hypermature cataract, and 7 eyes (1.7%) had lens-induced glaucoma.

Thirty-six eyes (8.6%) had findings suggestive of posterior segment pathology on ultrasonography. The most common finding was retinal detachment in 17 eyes followed by optic disk cupping in six eyes and vitreous opacities in four eyes. Other abnormal findings are listed in Table 2. Three hundred and eighty two eyes (91.4%) had a normal posterior segment on ultrasonography.

Two hundred and seventy one (64.8%) of the 394 patients had no apparent patient risk factor for abnormal posterior segment on ultrasonography. Among the significant patient risk factors identified prior to surgery, young age was present in 67 patients (17%), diabetes mellitus was present in 21 (5.3%), hypertension in 11 (2.8%), and bilateral dense cataracts precluding examination of either fundus in 24 (6.1%).

The odds ratios with 95% CI for patients with these features to have an abnormal posterior segment on ultrasonography are detailed in Table 3. None of the patients without patient risk factor had an abnormality on ultrasonography. Abnormal posterior segment findings on ultrasound tended to occur significantly more frequently in patients with diabetes mellitus (OR= 4.9, $P = 0.003$) and younger age (OR= 15.4, $P = 0.001$). Systemic hypertension (OR= 1.9, $P = 0.35$) and

Table 2: Incidence of abnormalities detected on preoperative ultrasonography

Abnormal finding on ultrasonography	Frequency (n=418)
Retinal detachment	17 (4.1)
Retinal detachment with choroidal coloboma	1 (0.2)
Retinal detachment with posterior staphyloma	1 (0.2)
Tractional retinal detachment	2 (0.5)
Tractional retinal detachment with vitreous hemorrhage	1 (0.2)
Vitreous hemorrhage/vitritis	4 (1.0)
Choroidal coloboma	2 (0.5)
Posterior staphyloma	2 (0.5)
Cupping of optic nerve head	6 (1.4)

Figures in parentheses indicate percentage

bilateral advanced cataracts (OR = 1.7, P = 0.17) were not significantly associated with posterior segment pathology on ultrasonography.

Three hundred and six (73.2%) of the 418 eyes had no apparent ocular risk factor for abnormal posterior segment findings on ultrasound, whereas in the remaining 112 (26.8%) eyes had one or more ocular risk factor. The odds ratios with 95% CI for eyes with various risk factors for having abnormal ultrasound scans are detailed in Table 4. Presence of posterior synechiae (OR= 20.2, P=0.000), iris coloboma (OR= 34.6, P=0.000), inaccurate projection of rays (OR= 15.1, P=0.002), elevated intraocular pressure (OR= 15.1, P=0.004) and keratic precipitates (OR= 22.4, P=0.002) were significantly associated with risk of abnormal posterior segment findings on ultrasound. Corneal opacity (OR= 0.5, P = 0.368), exotropia (OR= 1.8, P = 0.3), esotropia (OR= 0.3, P = 0.48), ocular hypotony (OR= 5.4, P = 0.069), and subluxated lens (OR= 2.2, P = 0.26) were not associated with increased incidence of posterior segment pathology on ultrasonography. Only four eyes (1.5%) without any ocular risk factor had abnormal findings on ultrasonography. This included two eyes with posterior staphyloma in a lady with bilateral mature cataract and two eyes with vitreous opacities in a man with bilateral mature cataract. Post operatively, the second patient was found to be suffering from intermediate uveitis with vitritis.

Three hundred and ninety eight eyes (95.2%) underwent cataract surgery. Of these, 356 eyes (89.4%) had a postoperative visual acuity of 6/12 or better, whereas 42 eyes (10.6%) had a postoperative visual acuity of 6/18 or less. Seven (16.7%) of these 44 eyes had poor visual outcome owing to surgical complications (severe striate keratitis in 5 eyes, endophthalmitis in 1 eye, and expulsive hemorrhage in 1 eye). Thirty-five eyes had poor visual outcome owing to pre-existing posterior segment pathology. In 14 eyes (40%), the pathology could be detected prior to surgery by ultrasonography. In the other 21 eyes (60%), the preoperative ultrasonography failed to detect any pathology. Causes for poor visual outcome following surgery and their correlation with preoperative ultrasound findings are detailed in Table 5.

Discussion

Cataracts constitute an important cause of blindness in developing countries such as India and many of these cases have advanced cataracts that preclude visualization of fundus prior to cataract surgery. Such visualization is considered important to provide accurate prognosis for vision after cataract surgery. Under such circumstances ultrasonographic examination can provide information regarding such abnormalities. However, it should be remembered that although facilities and personnel for performing cataract extraction with intraocular lens implantation are widely available in these countries, facilities for more sophisticated tests such as ultrasonography are less commonly available. Even in centers where ultrasonography is possible, routine evaluation of all patients with advanced cataracts by ultrasonography is time-consuming and of questionable cost-effectiveness. A recent study showed that the results of ultrasonography influenced surgical management in only 7% of eyes with cataract as compared with 17% of eyes with noncataract media opacities.[3]

On the other hand, studies have shown a significant incidence

Table 3: Patient "risk factors" and incidence of abnormal ultrasonograms

Patient "risk factor"	No. of patients with risk factor (n=394)	No. of patients with abnormal USG[a]	Odds ratio for posterior segment pathology on USG[a] (95% CI)	P^b
None	271	0		–
Diabetes mellitus	21	4	4.9 (3.8–6.6)	0.003
Hypertension	11	0	1.9 (1.5–2.2)	0.35
Age less than 50 years	67	15	15.4 (8.4–19.1)	0.001
Bilateral cataract	24	2	1.7 (0.9–2)	0.17

[a]USG, ultrasonogram, [b]χ^2-Test.

Table 4: Ocular risk factors and incidence of abnormal ultrasonograms

Ocular risk factor	No. of eyes affected (n=418)	No. of eyes with abnormal USG[a]	Odds ratio for posterior segment pathology on USG[a] (95% CI)	P^b
Nil	306	4	0.03 (0.01–0.08)	0.87
Posterior synechiae	39	19	20.2 (13.3–27.9)	0
Corneal opacity	20	1	0.5 (0.1–3.7)	0.368
Exotropia >30°	14	2	1.8 (0.5–6.1)	0.30
Esotropia > 30°	4	0	0.3 (0.03–1.9)	0.48
Iris coloboma	4	3	34.6 (16.6–53.3)	0
Elevated intraocular pressure	11	6	15.1 (9.5–18.8)	0.004
Ocular hypotony	3	1	5.4 (2.5–7.8)	0.069
Inaccurate projection of rays	11	6	15.1 (10.4–28.3)	0.002
Keratic precipitates	3	2	22.4 (11.7–33.9)	0.002
Subluxated lens	12	2	2.2 (0.4–8.8)	0.26

Total number of eyes exceeds 418 and number of eyes with abnormal findings on ultrasonography exceeds 36, as some eyes had more than one ocular risk factor, [a]USG, ultrasonogram, [b]χ^2-Test.

Table 5: Causes for poor postoperative visual acuity and correlation with preoperative ultrasonography

Cause for poor vision after surgery	No. of affected eyes detected after surgery (n=398)	No. (%) of affected eyes detected by preoperative USG[b]
Branch vein occlusion	2	0 (0)
Central retinal vein occlusion	2	0 (0)
Age-related macular degeneration	7	0 (0)
Glaucomatous cupping	8	5 (62.5)
Vitritis	2	2 (100)
Macular hole	2	0 (0)
Optic atrophy	1	0 (0)
Choroidal coloboma	2	2 (100)
Posterior staphyloma	2	2 (100)
Vitreous hemorrhage	1	1 (100)
Diabetic retinopathy	6	2 (33.3)

Figures in parentheses indicate percentages, [a]USG, ultrasonogram.

of posterior segment pathology in eyes with dense cataracts.[1,2] Also, most patients in developing countries have never had an ophthalmic examination till they present to the hospital with an advanced cataract for cataract surgery. We noted the occurrence of significant posterior segment abnormalities on ultrasonography in 36 eyes (8.6%) with advanced cataract, which was lower than the incidence reported in the study by Anteby *et al.*[1] (19.6%) and very much less than that in the study by Haile and Mengistu[2] who found a 66% incidence of detectable abnormalities. However, the latter study included cases with orbital pathology and clear media (10%) and it was not clear whether ultrasonography was being performed routinely on all eyes prior to cataract surgery or only on eyes where intraocular pathology was suspected. The study by Anteby *et al.*[1] included eyes with ocular trauma, and this could have led to a higher incidence of posterior segment abnormalities. In our study, we excluded patients with a definite history of trauma because we believe that preoperative ultrasonographic evaluation is mandatory in these eyes, and that such patients should be referred to a higher center if facilities for the same do not exist.

Our data suggest that about 9% of eyes undergoing surgery for advanced cataract will have significant posterior segment pathology. Considering the large number of advanced cataracts encountered in most Indian hospitals, this would amount to a substantial number of eyes. In the absence of access to ultrasonography, the operating surgeon is faced with the choice of operating without being able to provide a proper prognosis of the postoperative outcome. The other alternative is to refer such patients to centers where ultrasound is available. However, this option is fraught with inconvenience and increased costs.

We studied whether certain patient and ocular features could be used as predictors for pathological findings on ultrasonography as, based on our clinical experience, we had noted that certain patients and eyes were more likely to have abnormal posterior segment on ultrasonography.

Among the patient features studied, diabetes mellitus and young age were associated with a significantly greater incidence of abnormalities on ultrasonography. When considering ocular features, presence of posterior synechiae, iris coloboma, elevated intraocular pressure, inaccurate projection of rays (PR) and keratic precipitates were associated with a significantly higher incidence of posterior segment pathology.

Ultrasonography also did not prove to be a very effective predictor of good postoperative visual results, as among the 35 eyes had a poor visual result owing to posterior segment pathology, the preoperative ultrasound was normal in 21. It should be noted that no eye with central or branch retinal vein occlusion, macular hole, age-related macular degeneration, or optic atrophy could be diagnosed with preoperative ultrasonography. Also, only one-third of the eyes with diabetic retinopathy could be identified on preoperative ultrasound. Thus, it is advisable that patients undergoing cataract surgery should be warned of these limitations of ultrasonography. Of the eight eyes with advanced glaucomatous cupping, preoperative ultrasound could detect the cup in five eyes (62.5%). Other authors[4] have also found ultrasonography to be useful in providing a reliable estimate of cupping in eyes with opaque media.

In conclusion, presence of certain patient and ocular features is associated with a high incidence of posterior segment abnormalities. Patients with these features should be referred for preoperative ultrasonographic evaluation if facilities for the same are not available. In the absence of these risk factors, the likelihood of detecting abnormalities on preoperative ultrasonography in eyes with advanced cataracts is low.

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