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Role of Real Time Ultrasound B-Scan in Eyes with Advanced Cataract, by Documenting Frequency of Different Posterior Segment Pathologies

Urossa Asim, Ayesha Niaz*

Department of Radiology, Shaheed Mohtarma Benazir Bhutto Institute of Trauma, Karachi Pakistan,
*Department of Radiology, Combined Military Hospital, Sialkot/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To determine the role of real time ultrasound B-scan in postoperative prognosis among patients with advanced cataract by documenting preoperative frequency of different posterior segment pathologies.
Study Design: Cross-sectional study.
Place and Duration of Study: Radiology Department, Pak Emirates Military Hospital, Rawalpindi Pakistan, from Jan to Oct 2011.
Methodology: The study utilized ultrasound eye, carried on the patients with closed eyes in supine position with ultrasound transmission gel applied to prevent transducer touching eyelid. Scan was performed in both sagittal and transverse plane.
Results: A total of 336 patients were included in this study, with mean age of 56.92±12.89 years, 162(48.21%) male rest female. Cataracts were found in 144 (42.86%) left eyes and 154 (45.83%) right eyes. Mature cataract was seen in 292 (86.9%) patients, while 32(9.52%) had traumatic and 304(90.47%) had non-traumatic cataract. In non-traumatic cataract, retinal detachment (RD) was in 14(4.6%) patients, vitreous detachment (VD) in 13(4.3%) and vitreous detachment/hemorrhage in 21(6.9%) patients. Optic disc cupping was seen in 6(2.0%) non-traumatic cases and other pathologies were seen in 7(2.3%) patients having non-traumatic and 3(9.38%) patients having traumatic cataract.
Conclusion: Preoperative posterior segment evaluation with ultrasound in patients with dense cataract can be used to detect pathologies that may influence the surgical strategy and postoperative visual prognosis.

Keywords: B-scan ultrasound, Cataract, Posterior segment pathology.

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INTRODUCTION

The changes in transparency of natural lens inside the eye that gradually damage the visual quality are termed as cataracts as the pathway of light through lens might be interrupted with severity of cataracts producing visual symptoms and complaints.[1] Cataracts are very common, especially in older age group and over the age of 60 years it affects around 60% of the people resulting in difficulties in various activities requiring clear vision such as driving at night or in un-acquainted areas, reading and playing sports.[2] There is great variation in incidence of pathologies identified by ultrasonographic studies with the incidence of pathologies varying from 19.6-66% in different populations undergoing sonographic evaluation having opaque intraocular lens.[3] Cataract is the most common cause of reversible blindness in Pakistan and intraocular lens implantation with cataract extraction is the most common surgery performed.[4] B scan ultra-sonography provides valuable information about the lens from the anterior capsule through its matter up to the posterior capsule, and use of this imaging tool, particularly in traumatic cases, greatly improves understanding regarding the lens and the posterior segment, thus helping in planning a better treatment strategy.[5] Ultrasound examination helps when direct/indirect ophthalmoscopy is inaccessible because of dense cataract and allows adequate evaluation of posterior segment to exclude abnormalities such as retinal detachment, vitreous detachment and hemorrhage, choroid malignant melanoma, choroidal hemangioma, posterior staphyloma, asteroid hyalosis and cupping of optic disc, thus structural changes in the posterior segment of the eye in such patients can be assessed by ultrasonography.[6] The study was carried out to determine the role of real time ultrasound B-scan in postoperative prognosis among patients with advanced cataract by documenting preoperative frequency of different posterior segment pathologies.

METHODOLOGY

The study was conducted at the Department of Diagnostic Radiology, Pak Emirates Military Hospital, Rawalpindi Pakistan, from January to October 2011

Correspondence: Dr Ayesha Niaz, Department of Radiology, Combined Military Hospital, Sialkot Pakistan
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after taking approval from Hospital Ethics Committee (certificate number ERC/6/2019). A total of 336 cases were enrolled by non-probability consecutive sampling for the study, after calculating the sample size with WHO sample size calculator on the basis of anticipated reference proportion of 8.6% population with posterior chamber pathologies.[3]

Inclusion Criteria: Patients of either gender, aged above 35 years, with cataract precluding visualizing of fundus, were included.

Exclusion Criteria: Patients having history of prior eye surgery were excluded.

Informed, written consent was taken from all patients. Demographic information, such as age and gender, was recorded in a predesigned data collection tool. Ultrasound using high frequency 10 MHz transducer Aloka ultrasound machine was used on all patients. Ultrasound eye was done using closed eye technique with patient in supine position and a water-soluble ultrasound transmission gel was applied to patients closed eyelids to prevent the transducer from touching the eyelid and both eyes were scanned through closed eyes, in both sagittal and transverse plane by the researcher. The ultrasound findings include Mature Cataract (Lens having completely opaque cortex and seen as a very dense echogenic structure), Immature Cataract (a scattered opacities on anterior and posterior surface of lens separated by clear zone.), Vitreous Detachment (a hyper-reflective mobile undulating membrane), Retinal Detachment (a V-shaped echogenic membrane extending from ora serrata anteriorly up to optic nerve posteriorly), Choroidal Detachment (a membrane extending from ciliary body anteriorly to exit foramina of vortex vein posteriorly, causing convex indentation of globe) and Choroidal Melanoma (an acoustically silent zone with in the melanoma, choroidal excavation and acoustic shadowing of the orbit).

Statistical Package for Social Sciences (SPSS) version 21.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test and Independent sample t-test were applied to explore the inferential statistics. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

In this study, a total of 336 patients of cataract surgery were included. The mean age of the patients was 56.92±12.89 years with minimum age of 35 years and maximum of 88 years. In our study sample there were 162(48.21%) male patients and 174(51.79%) female patients. Cataract in left eye was found in 144(42.86%) cases, while 154(45.83%) cases had cataract in right eye and 38(11.31%) patients had cataract in both eyes. Mature type of cataract was observed in 292(86.9%) cases while 44(13.1%) cases had immature cataract. 32(9.52%) patients had traumatic cataract and 304(90.47%) had non-traumatic cataract, among which, Retinal detachment was observed in 14(4.6%) cases, 13(4.3%) cases showed vitreous detachment and vitreous detachment/hemorrhage was observed in 21(6.9%) cases. In patients with traumatic cataract, retinal detachment, vitreous detachment, and vitreous detachment/hemorrhage was observed in 5(15.63%), 2(6.25%) and 0(0%) patients respectively, with a significantly (*p*-value <0.05) higher rate of retinal detachment in patients having traumatic cataract. Optic disc cupping was observed in 6(2.0%) cases of non-traumatic cataract and 1(3.13%) patient having traumatic cataract. Other pathologies like choroid malignant melanoma, choroidal hemangioma, posterior staphyloma and asteroid hyalosis were observed in 7(2.3%) and 3(9.38%) patient having non-traumatic and traumatic cataract. Among non-traumatic cataract patients, it was observed that 242(79.6%) patients did not have any pathology while 62(20.4%) showed different pathologies in either eye or in both eyes on real time ultrasound B-scan. Similarly, among patients having traumatic cataract 21(65.63%) patients had normal eyes and 11(34.38%) had pathology as listed in Table-II.

Table-I: Distribution of Demographic Characteristics (n=336)

Characteristics	n(%)
Age of the Patients (Mean±SD)	56.92±12.89 years
Gender of Patients	
Male	162(48.21%)
Female	174(51.79%)
Eye Side Involved	
Left	144(42.86%)
Right	154(45.83%)
Both eyes	38(11.31%)
Type of cataract	
Mature	292(86.90%)
Immature	44(13.10%)

DISCUSSION

There are 31 million blind patients in the world and 15 million patients with reduced vision. 80% of these are patients with reversible blindness having treatable conditions and the main cause is the

Table II: Posterior Segment Pathologies Observed by B-Scan (n=336)

	Non-Traumatic Cataract		Traumatic Cataract		*p*-value
	Frequency	Percent	Frequency	Percent	
Retinal Detachment					
Yes	14	4.60%	5	15.63%	0.01
No	290	95.40%	27	84.38%	
Vitreous Detachment					
Yes	13	4.30%	2	6.25%	0.607
No	291	95.70%	30	93.75%	
Vitreous Detachment/Hemorrhage					
Yes	21	6.90%	0	0.00%	<0.001
No	283	93.10%	32	100.00%	
Optic Disc Cupping					
Yes	6	2.00%	1	3.13%	0.1881
No	298	98.00%	31	96.88%	
Other Pathologies					
Yes	7	2.30%	3	9.38%	0.089
No	297	97.70%	29	90.63%	
Normal Eye					
Normal eye	242	79.60%	21	65.63%	0.110
Pathology in eye	62	20.40%	11	34.38%	

cataract.[7-10] There are various surgical indications, but trying to re-establish visual acuity to the highest level allowable by the patient's conditions is the most important. Ocular B-mode ultrasonography has an imperative role for the clinical assessment of a various ocular diseases. When ophthalmoscopy is not possible, largely due to opacification of the transparent media (e.g., mature cataract or vitreous hemorrhage), ultrasonography can help the ophthalmologist in diagnosing disease and choosing treatment. This technique is often routinely performed before mature cataract extraction to rule out possible contraindications to surgery, such as retinal detachment or tumors that cannot be seen on the ophthalmoscopic examination because of the cataract. Therefore ultrasound could influence the choice of treatment and prognosis.[11] Ultrasonographic evaluation of the posterior pole in patients with opacities is vital in determining the most appropriate surgery.[12]

In a study conducted in Bahawalpur a total of 237 eyes were analyzed with B-Scan ultrasonography and 17(7.17%) eyes were found to have posterior segment pathologies. Most common pathologies include retinal detachment and vitreous hemorrhage.[7] Posterior globe of a total of 336 patients were examined under B-scan ultrasound in 25-65 years old patients, divided into two groups. Majority of the patients (90.47%) belonged to the non traumatic cataract group and a small number (9.53%) to traumatic cataract group. Similar trends were observed in study conducted in Hyderabad Sindh, Pakistan Querashi *et al*. in Jan 2010 showing 90.53% patients with non traumatic cataract while 9.46% cases with traumatic cataract. Posterior segments pathologies were found in 13.04% patients.[9] According to our survey, a total of 336 patients of cataract surgery were included. The mean age of the patients was 56.92±12.89 years. Anteby *et al.* found that the prevalence of retinal detachment was increased in the traumatic cataract subgroup (14.8% compared with 3.9%), but this difference did not reach statistical significance.[13]

In our study, there were 162(48.21%) male patients while 174(51.79%) female patients presented with cataract. According to another study, there were 68.97% male and 31.03% female paients. In a previous study, of the 200 patients 116(58%) were male and 84(42%) females.[14] In another Pakistani study, 54.37% were male and 45.63% females.[15] According to the analysis done on the data collected in our survey, Cataract in left eye was found in 144(42.86%) cases, 154(45.83%) cases had cataract in right eye and 38(11.31%) patients had cataract in both eyes. Mature type of cataract was observed in 292(86.9%) while 44(13.1%) cases had immature type of cataract. These results were compatible with other studies who had range of mature cataract type 70-74%.[3,14] Real time B-scan ultrasonography was utilized on 304 cases of non traumatic and 32 traumatic cataract patients and it was revealed that in non-traumatic cataract patients a total 242(79.6%) eyes were normal or simply say did not have any pathology while 62(20.4%) showed different pathologies in any of the either eye or in both eyes on B-scan ultrasound. These results were incompatible with other studies as other studies showed a range of abnormalities in cataract eye from 55-66%.[14,15] But one Saudi (7.5%) and one Pakistani (7.9%) studies showed lower percentage of pathologies detected on B-scan ultrasound.[14,16]

The frequency of pathologies in both groups were observed on real time ultrasound B-scan was as follows: In non-traumatic cataract patients, retinal detachment was observed in 14(4.6%) cases, 13(4.3%) cases showed vitreous detachment and Vitreous detachment/hemorrhage was observed in 21(6.9%) cases. In patients with traumatic cataract, retinal detachment, vitreous detachment and Vitreous detachment/hemorrhage was observed in 5(15.63%),

2(6.25%) and 0(0%) patients respectively, indicating a significantly (p-value<0.05) higher rate of retinal detachment in patients having traumatic cataract. Almost same frequency of these pathologies on B-scan as results of our study had shown by Salman *et al*.[3] Anteby *et al*.[13] and Shaikh *et al*.[15] and concluded that if ultrasonographic examination is routinely done in cataract patients preoperatively routine, it will benefit us in the diagnosis of additional posterior segment pathologies. Studies showed slightly higher frequency of these pathologies on B-scan. Retinal detachment was 9.3%, vitreous detachment was 47.4%, and vitreous hemorrhage was 12.1%.[17,18] According to Corrêa *et al*. posterior vitreous detachment was most commonly found using ultrasound (26.1%), followed by retinal detachment (9.7%) and vitreous hemorrhage (8.6%).[19] Some studies showed high percentages of these pathologies. The most common abnormality was retinal detachment (range: 39-55%) followed by vitreous opacities (31-36%), eye ball size abnormalities (12-33%), which can be a natural occurrence during senescence.[20]

Similarly, according to results of this study, optic disc cupping was observed in 6(2.0%) cases of non-traumatic cataract and 1(3.13%) patient having traumatic cataract. Other pathologies like choroid malignant melanoma, choroidal hemangioma, posterior staphyloma and asteroid hyalosis were observed in 7(2.3%) and 3(9.38%) patients having non-traumatic and traumatic cataract. According to the results of the data collected, among non-traumatic cataract patients it was observed that 242(79.6%) patients had normal findings that is did not have any pathology while 62(20.4%) showed different pathologies in any of the either eye or in both eyes on real time ultrasound B-scan.

CONCLUSION

Preoperative posterior segment evaluation with ultrasound in patients with dense cataract can be used to detect pathologies that may influence the surgical strategy and the postoperative visual prognosis. In conclusion, patients with these features should be referred for pre-operative 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.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

UA & AN: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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