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Evaluation of posterior segment ocular disorders using B-scan ultrasonography in patients attending a tertiary care teaching hospital Telangana India

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Abstract---Background: Ultrasonography is one of the most useful non-invasive techniques for evaluation of the Posterior segment of the eye. Objectives: to evaluate the posterior segment and identify any posterior segment disorders, using diagnostic B - scan ultrasonography in patients presenting with opaque ocular media. Methodology: Patients with opaque media were subjected for evaluation of the Posterior segment using a standard Ultrasound unit - MARVEL B-scan, consisting of diagnostic B scan and A scan biometry. Ultrasound probe was placed over the globe of the closed eye after applying coupling gel over the probe. The globe was scanned thoroughly using transverse, longitudinal, oblique and axial scans. Ultrasound image was analysed for any abnormalities both in real time and after freezing the image and findings were documented Results: Almost $\frac{3}{4}$ th of the patients with ocular trauma were found to have detectable posterior segment pathologies on b scan. Retinal detachment combined with vitreous hemorrhage was most common b scan finding in patients with ocular trauma. Posterior

vitreous detachment was commonly observed pathology in 10 eyes followed by vitreous hemorrhage in 7 patients. Conclusion: B-scan ultrasonography is useful in the assessment of ocular traumatic and non – traumatic lesions and supplements clinical examination with valuable information.

Keywords---ultrasonography, posterior segment, eye, B-Scan, ocular disorder.

Introduction

Ultrasonography is one of the most useful non-invasive techniques for the evaluation of the Posterior segment of the eye. The primary use of ultrasound is to detect any intraocular anatomical abnormality in presence of opaque media that hinders routine examination by Ophthalmoscopy like :Corneal opacities and corneal edema, Severe anterior segment inflammation, Total Hyphema, Small miotic pupil, pupillary membranes, Lenticular opacities especially in complicated cataracts, Dense vitritis and Vitreous hemorrhages^{5,6,7,8}, Identifying and localizing intraocular foreign body. where diagnostic B-scan can accurately image the intraocular structures and provide information about the lens, retina, choroid, vitreous and sclera¹.

It can also be used in clear media in measuring dimensions of intraocular masses particularly Choroidal lesions, monitoring treatment response of the intraocular diseases, evaluating orbital disorders, where ultrasound can provide additional information which is not gained by clinical examination alone². There have been many technological advances over the 50 years since its introduction, with improved resolution and depth of imaging, clear visualisation of anterior segment structures using ultrasound biomicroscopy³, 3D imaging, recent advances are made in utilising Doppler^{9,10} for evaluating posterior segment tumors⁴.

Materials and Methods

This study titled “Evaluation of Posterior Segment Ocular disorders using B-Scan Ultrasonography in patients attending a Tertiary Care Teaching Hospital Telangana India” was carried out during the period of January 2019 to January 2021. The study was conducted on 200 eyes of 184 patients selected for the study in Government medical college and hospital, Nizamabad, Telangana, India with an aim to evaluate Posterior Segment Ocular disorders using B-Scan Ultrasonography.

Inclusion Criteria

- 1) Any age and both sex.
- 2) Patients Clinically presenting with opaque light-conducting ocular media where fundus cannot be viewed by ophthalmoscopy.
- 3) Patients with blunt ocular trauma with NO external disturbance in ocular anatomy.
- 4) Previous Vitreo Retinal surgeries.

- 5) Patients with an intraocular foreign body.

Exclusion Criteria

- 1) Patients with active ocular surface infection.
- 2) Patients presenting with Open Globe injury with extrusion and high risk of extrusion of intraocular contents.

Ethics

This study was approved by the Institutional Ethics Committee GMC, Nizamabad. An informed written consent was taken from all the patients involved in the study after explaining regarding the study.

Study Procedure

Patients satisfying the inclusion criteria are selected. Procedure and importance of ocular evaluation is explained to the patient and informed consent obtained. History regarding age, sex, occupation, address, chief complaints, history of presenting illness, relevant past medical and surgical history were noted. Systemic examination was done. In ocular examination - Visual acuity, Intraocular tension, Slit lamp examination of anterior segment was done. Pathology obscuring the visualisation of posterior segment with ophthalmoscopy was identified after dilating the pupil. These patients with opaque media were subjected for evaluation of the Posterior segment using a standard Ultrasound unit - MARVEL B-scan, consisting of diagnostic B scan and A scan biometry. The procedure was explained briefly to the patient for their cooperation. By contact method, the Ultrasound probe was placed over the globe of the closed eye after applying coupling gel over the probe. The globe was scanned thoroughly using transverse, longitudinal, oblique and axial scans. The study was conducted from a high sensitivity setting of 80db to 40db to differentiate various tissue densities. The ultrasound image was analysed for any abnormalities both in real time and after freezing the image and findings were documented.

Results

A total of 200 eyes of 184 patients were selected for the study and the following observations were obtained.

Table 1: Laterality

Laterality	Number of patients	No. eyes	Percentage
Right eye	92	92	46.00 %
Left eye	76	76	38.00 %
Bilateral	16	32	16.00 %
Total	184	200	100.00 %

Media opacities were noted to be higher in the right eye than the left eye. In this study 46 % (92 eyes) had media opacities in the right eye, 38 % (76 eyes)

had media opacities in the left eye and 16 % (32 eyes) had bilateral opaquemedi

The media opacities which are the indications of B scan are as follows :

Table 2: Indications Of B Scan Ultrasound In Various OpaqueOcular Media

Indication	Total number ofeyes	Percentage
Lenticular opacities	120	60 %
Vitreous opacities	46	23 %
Anterior chamber membranes and hyphema	18	9 %
Corneal opacities	16	8 %
Total	200	100.00 %

Table 3 : Distribution Of B Scan Findings

Finding	No. of cases	Percentage
Normal	109	54.5 %
Vitreous disorders (posterior vitreous detachment, vitreous degenerations, vitritis, asteroid hyalosis, vitreous hemorrhage)	53	26.5 %
Vitreous hemorrhage combined with retinal detachment	16	8.00 %
Retinal detachment	14	7.00 %
Choroidal detachment	2	1.00 %
Endophthalmitis	2	1.00 %
Staphyloma	2	1.00 %
Dislocated PCIOLs in vitreous	1	0.5 %
Intraocular tumors	1	0.50 %
Total	200	100.00 %

In this study 109 patients (54.5 %) had normal B-scan findings. Vitreous disorders were the major pathological changes seen in 53 patients (26.5%) , followed by combined retinal detachment and vitreous disorders seen in 16 patients (8 %), isolated retinal detachments were seen in 14 patients (7 %). Choroidal detachment, Endophthalmitis and Staphyloma were seen in 2 patients each (1%). Intraocular tumors and dislocated PCIOLs were seen less frequently in 1 patient each (0.5 %).

Table 4 : Distribution Of Vitreous Disorders

Vitreous disorder	Number of cases	Percentage
Vitreous hemorrhage	30	56.60 %
Posterior vitreous detachment	14	26.41 %
Vitreous degenerations	4	7.54 %
Asteroid hyalosis	3	5.66 %

Vitritis	2	3.77%
Total	53	100.00 %

From the above table it was observed that out of the 53 patients with vitreous disorders, vitreous hemorrhage was the most common disorders seen in 30 patients constituting 56.6 %, followed by posterior vitreous detachment seen in 14 cases with 26.4 % , followed by vitreous degenerations in 4 patients with 7.5 %, asteroid hyalosis in 3 patients with 5.7 % and the least common vitreous pathology was vitritis seen in 2 patients with 3.77 %

Table 5: B Scan Findings In Cases With Vitreous Opacities

Vitreous pathology on b scan	No. of cases	Percentage
Normal	10	21.73 %
Vitreous hemorrhage	12	26.08 %
Retinal detachment + vitreous hemorrhage	8	17.39 %
Retinal detachment	6	13.04 %
Posterior vitreous detachment	4	8.69 %
Miscellaneous findings :	(6)	13.04 %
Vitritis	2	
Endophthalmitis	2	
Choroidal detachment	1	
Intraocular tumor	1	
Total	46	100 %

Out of the 46 patients with vitreous opacities, 10 patients (21.73 %) had central lenticular opacities along with vitreous opacities and showed normal findings on b scan. The most common pathological finding in this group was vitreous hemorrhage observed in 11 patients (26.1 %) and the 2nd most common pathology was retinal detachment combined with vitreous hemorrhage in 8 cases (17.4 %). Isolated retinal detachment was seen in 6 cases (13 %). Miscellaneous group of disorders comprising of Vitritis with vitreous membranes, Choroidal detachment, Endophthalmitis, Intraocular tumors were seen in 6 cases which constitute 13 % and the least common pathology noted was posterior vitreous detachment seen in 4 cases (8.7 %)

Table 6 : Causes Of Vitreous Hemorrhage (Including Subhyaloid Hemorrhage)

Cause	Number of cases	Percentage
Diabetes mellitus	11	36.66 %
Trauma	10	33.33 %
Hypertension	4	13.33 %
Diabetes mellitus + hypertension	3	10.00 %
Idiopathic	2	6.66 %
Total	30	100.00 %

In the present study, Diabetes with proliferative diabetic retinopathy was the main cause of vitreous hemorrhage observed in 11 patients constituting 36.7 % , followed by trauma in 10 patients with 33.33 %, hypertension in 4 patients with 13.3 %, hypertension combined with diabetes in 3 patients with 10 % and no cause is detected in 2 cases which constitutes 6.7 %.

Table 7: Posterior Segment Findings In Ocular Trauma

Posterior segment findings	Patients with ocular trauma	Percentage
Normal	11	22%
Posterior segment pathology	39	78 %
Total	50	100 %

Out of the 50 patients presented with ocular trauma, 11 patients (22 %) had normal posterior segment findings whereas posterior segment pathology was found in 39 patients (78 %).

Table 8 : Distribution Of Findings In Ocular Trauma

Findings	No. of patients	Percentage
Vitreous hemorrhage + Retinal detachment	13	33.33 %
Retinal detachment	11	28.20 %
Vitreous hemorrhage	10	25.64 %
Posterior vitreous detachment	4	10.25 %
Dislocated PCIOL into vitreous cavity	1	2.56 %
Total	39	100 %

Among the 39 patients with ocular trauma, vitreous hemorrhage combined with retinal detachment was the most common b scan finding seen in 13 patients constituting 33.33 % , followed by isolated retinal detachment seen in 11 patients with 28.21 %, and 10 patients had vitreous detachment constituting 25.64 %. 4 patients had posterior vitreous detachment constituting 10.26 %, and the 1 patient had PCIOL dislocated into the vitreous cavity constituting 2.56 %.

Table 9 : Distribution Of Lenticular Opacities

Lenticular opacity	Number of patients	Percentage
Mature cataract	71	59.16 %
Brown cataract	33	27.5 %
Complicated cataract	8	6.66 %
Traumatic cataract	5	4.16 %
Congenital and developmental cataracts	3	2.5 %
Total	120	100.00 %

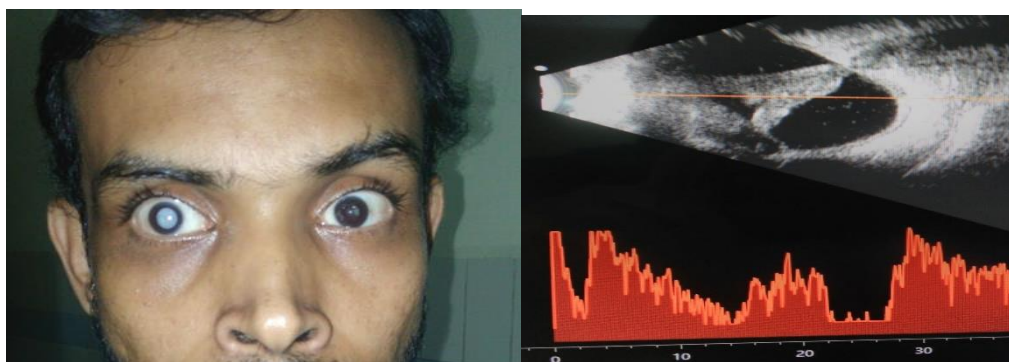
Mature cataract was the most common type of lenticular opacities seen in 71 patients (59.16%), followed by brown cataract seen in 33 patients (27.5 %). 8 patients (6.66 %) had complicated cataract followed by traumatic cataract in 5 patients (4.16 %) and 3 patients (2.5 %) had congenital and developmental cataracts which were the least commonly observed lenticular opacities.

Table 10: Distribution Of Posterior Segment Findings In Patients With Lenticular Opacities

B scan finding	No. of cases	Percentage
Normal	85	70.83 %
Posterior vitreous detachment	10	8.33 %
Vitreous hemorrhage	7	5.83 %
Retinal detachment	4	3.33 %
Retinal detachment + vitreous hemorrhage	4	3.33 %
subhyaloid hemorrhage	3	2.5 %
Asteroid hyalosis	3	2.5 %
Vitreous degenerations	2	1.66 %
Staphyloma	2	1.66 %
Total	120	100.00 %

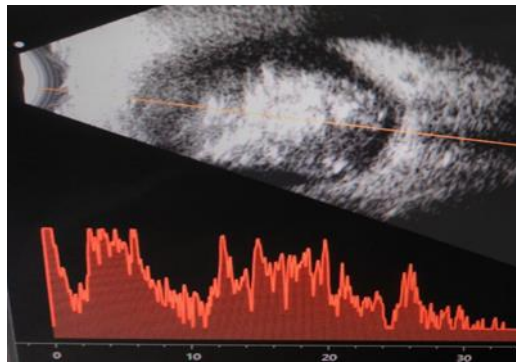
In patients with lenticular opacities, 85 cases (70.83 %) had normal posterior segment findings on b scan. Posterior vitreous detachment was observed in 10 cases (8.33 %), followed by vitreous hemorrhage seen in 7 cases (5.83 %), retinal detachment seen in 4 cases (3.33 %), vitreous hemorrhage with retinal detachment was seen in 4 cases (3.33 %). Subhyaloid hemorrhage and asteroid hyalosis seen in 3 cases each (2.5 %). Vitreous degenerations and Staphyloma were present in 2 cases each (1.66 %).

Figure 1 : B scan ultrasound images

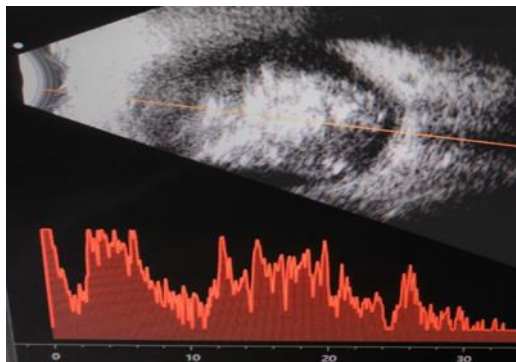


MATURE CATARACT

B scan of the above patient showing Funnel shaped retinal detachment



B scan image of the above patient showing vitreous hemorrhage



B scan of the same child showed a mass filling the vitreous cavity with multiple hyper reflective spikes on corresponding A scan due to calcification

Discussion

In the present study 200 eyes of 184 patients presenting with opaque ocular media obscuring the fundus view underwent posterior segment examination using B scan ultrasonography. Lenticular opacity was the leading cause for opaque media in 120 eyes (60%) and happens to be the main indication for performing B scan ultrasonography. The next leading cause of hazy media was vitreous opacities seen in 46 eyes (23%) followed by anterior chamber opacities and hyphema in 18 eyes (9%) and the least common indication was corneal opacities in 16 eyes (8%). In our study 54.5% of patients (109 eyes) were found to have normal B scan findings. Posterior segment pathology was detected in the remaining 45.5% (91 eyes) of the patients. The results of our study on 200 eyes demonstrated that Vitreous disorders were the most common pathological findings on the B scan, seen in 53 patients which constitute 26.5% of the study group.

Vitreous disorders - Among the vitreous disorders, vitreous haemorrhage was seen in 30 patients (56.60%) which was the leading vitreous pathology. Vitreous hemorrhage appears as small granular dot-like echoes on the screen as the beam is directed at involved areas (Vashisht et al 1994)²⁸ echoes and membranes are predominantly in the dependent portion of vitreous cavity. The next vitreous disorder noted was - Posterior vitreous detachment seen in 14 patients (26.41

%), followed by vitreous degenerations in 4 patients (7.54 %), Asteroid hyalosis in 3 patients (5.66 %) and Vitritis in 2 patients (3.77%) was the least common vitreous disorder. In the study conducted by OP Sharma et al.¹¹ on 122 cases, vitreous haemorrhage was the most common intraocular pathology seen in 41.7%. In another study done by Dawood et al.¹² 98 (44.95%) patients showed vitreous disorders on the ultrasound when performed on the total of 218 patients with hazy media. In their series, vitreous haemorrhage (35 patients) was the commonest vitreous disorder followed by posterior vitreous detachment (19 patients). In another study done by Jamil Ahmed et al.¹³ 14 out of 73 eyes with vitreous opacities (29 %) showed isolated vitreous hemorrhage, which was the major pathology noted in their study. This is comparable to the results obtained in our study, where isolated vitreous hemorrhage among the vitreous opacities is 26.08 % (12 out of the 46 eyes) and also the leading pathology noted in eyes with vitreous opacities. Out of the 30 patients with vitreous hemorrhage, 11 patients (36.66 %) had diabetic eye disease which was the leading cause followed by a history of trauma in 10 patients (33.33 %), 4 patients (13.33 %) had hypertension, diabetes mellitus with hypertension was seen in 3 patients (10 %) and no primary cause was detected in 2 cases (6.66 %).

Rabinowitz et al.¹⁴ study showed that proliferative diabetic retinopathy (35%) and ocular trauma (33%) were the most common causes of vitreous hemorrhage. This observation is comparable to our study in which diabetes was the main cause (36 %) followed by trauma (33.33%). In the study done by Ridham Nanda et al.¹⁵ b scan was found to be useful in detecting the posterior segment pathology in patients presenting with trauma. 77.04% of patients had detectable posterior segment pathology in their study. This is comparable to the posterior segment pathologies detected in our study which was 78 % (39 out of 50 patients).

In ocular trauma vitreous hemorrhage combined with retinal detachment was the most common pathology in our study 33.33 % followed by retinal detachment in 28.20 %. One patient with blunt trauma presented with anterior chamber membranes and hyphema underwent b scan examination. PCIOL was dislocated and was located inferiorly in the vitreous cavity. 2 cases of Choroidal detachment were seen out of the 200 eyes. One had a history of trauma and presented with anterior chamber inflammation, the other case had a history of cataract surgery prior and presented with vitreous inflammatory membranes. Among them one patient had choroidal detachment with classical 'kissing choroids' sign on b scan. 2 cases of endophthalmitis presented with dense vitreous membranes following small incision cataract surgery. In endophthalmitis, diffuse vitreous opacification with vitreous echoes and membranes were seen with thickened and ill defined retinochoroidal-scleral complexes on B-scan. Ultrasound is useful to determine the severity and extent of inflammation in clinically suspected cases of endophthalmitis. Staphylococcus which appears as smooth focal areas of posterior excavation of sclera was seen in 2 cases. (1 %) one of them had developmental cataract and the other patient had mature senile cataract.

One child presented with white pupillary reflex obscuring the fundus, was subjected to b scan examination. Highly echogenic mass projecting into the vitreous cavity with areas of suspected calcifications within the mass suggestive of Retinoblastoma is noted. It accounts to 0.5 % of the pathologies noted on b scan. But a study done by Sen et al¹⁶ showed retinoblastoma as 3% of various ocular abnormalities. Retinoblastoma has a rare incidence of 1:1800 live births and 328 eyes were selected in their study which was comparatively more than our sample size. The results and observations of the current study are in accordance with the available literature. B-scan ultrasound helped in arriving at a provisional diagnosis in cases posted with dense lenticular opacities in whom cataract extraction was planned. The role of ultrasound in routine preoperative evaluation and its influence on the postoperative visual outcomes in patients with hazy media needs to be studied further in detail.

Conclusion

Diagnostic ocular ultrasonography is indicated in conditions where opacities of ocular media doesn't allow the examination of the posterior segment. It is non invasive, safe, rapid, cost effective investigation which can be performed as an outpatient procedure even in children without use of topical anesthesia or sedatives. It is the first line of investigation in suspected cases of vitreo retinal disorders especially in diabetics presenting with opaque media. Cause of diminished vision in cases of trauma with opaque media can be identified. Presence of Intra ocular foreign body, extent of damage to intraocular structures can be detected, which help in planning vitreo retinal surgeries. Patients with dense cataracts with no posterior segment view can be evaluated so that surgical interventions can be planned accordingly and post operative visual prognosis can be explained. Diagnosis of intraocular tumors, their size, location, acoustic characters can be seen. This study confirms that b scan ultrasonography is useful in assessing ocular traumatic and non traumatic lesions and supplements clinical examination with valuable information.

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