

Evaluating the Role of B- Scan Ultrasound in Ocular Disease- A Retrospective Clinical Trial in North Indian Urban PopulationDr. Bhushan¹, Dr. Anand V. Deshpande^{2*}, Dr. Priyadershini Rangari³^{1,2*,3} Assistant Professor, ^{1,2*} Department of Ophthalmology, Teerthankar Mahaveer University Medical College and Hospital, Moradabad, Uttar Pradesh³ Department of Dentistry, ^{2*,3} Sri Shankaracharya Medical College, Bhilai, Durg, Chhattisgarh**Corresponding Author:** Dr. Anand V. Deshpande, Department of Ophthalmology, Sri Shankaracharya Medical College, Bhilai, Durg, Chhattisgarh, PIN- 490020**Type of Publication:** Original Research Paper**Conflicts of Interest:** Nil

Abstract**Background:** Eye is affected by spectrum of pathological conditions occurring in all age groups from newborn to old age. Although clinical examination and ophthalmoscope are the basis of diagnosis in most of the patients with eye disease, in many cases, especially when the clinical examination of the ocular fundus is difficult, B-scan ultrasound being most effective to diagnose ocular diseases.**Objectives:** To evaluate role of B- scan ultrasound in ocular diseases.**Materials and methods:** It was a hospital based observational, retrospective study with a sample size of 280 eyes of 210 patients during a period of nine months in the department of ophthalmology in medical college situated in urban region of western Uttar Pradesh. Patients undergoing B-scan as advised by their treating physicians were included in this study.**Results:** In our study, 280 eyes of 210 patients underwent B scan for diagnosing various pathologies of the orbit out of which maximum number of patients were in the age group of more than 40 years. Sex distribution revealed more number of cases in male. The highest cases found to be of cataract in 110 eyes (39.28%) cases, 45(16.07%) patients with history of trauma, 21 (7.5%) cases with intraocular pathologies and 25(8.92%) cases of retinal disorders were found in the study.**Conclusion:** B-scan found was to be reliable, safe and rapid investigation in evaluating the ocular pathologies is useful for preoperative planning.**Keywords:** B-Scan Ultrasound, Intraocular Pathologies, Ocular Disorders, Orbit, Retinal Detachment, Vitreous Hemorrhage.**Introduction**

Eye is affected by spectrum of pathological conditions occurring in all age groups from newborn to old age. Although clinical examination and ophthalmoscope are the basis of diagnosis in most patients with eye disease, in many cases,

especially when the clinical examination of the ocular fundus is difficult, other techniques will be required, ultrasound being one of them.¹

Ultrasound is a safe technique, cheaper and more affordable compared to other techniques that would also provide good data (such as OCT, CT, MRI).² Although CT and MRI are invaluable in many orbital conditions, they lack the immediacy and simplicity of ultrasound, cannot produce real time images, and have considerable limitations when imaging the vitreous and the retina whereas ultrasound contributes more to tissue diagnosis. Dynamic examination is important to study characteristics of the motion and topography of pathological intra ocular conditions, enabling identification of detachment of vitreous membranes and vitreous retinal adhesions with B scan ultrasound.³

Both A (Amplitude) scan and B (Brightness) scan techniques are important for the diagnosis of posterior segment lesions. B scan (brightness) mode is useful for a better demonstration of the shape and topographic relationship of lesions in the posterior segment.²

With understanding of the indications for ultrasound and proper examination technique, one can gather a vast amount of information not possible with clinical examination alone. Over the last 30 years, ultrasound has greatly advanced and now its most common use is in contact mode for evaluation of the posterior segment in eyes with media opacification.² Situations that prevent normal examination of fundus include lid problems (eg., severe edema, partial or total tarsorrhaphy), corneal opacities (eg., scars, severe edema), hyphema, hypopyon, meiosis, pupillary membranes, dense cataracts, or vitreous opacities (eg., hemorrhage, inflammatory debris). In such cases, diagnostic B-scan ultrasound can accurately image intraocular structures and give valuable information on the status of the lens, vitreous, retina, choroid, and sclera.^{4,5,8}

Ophthalmic B-scan ultrasound is an imaging modality that can be useful in proliferative diabetic retinopathy (PDR). B-scan ultrasound creates an image of the eye by using sound waves transmitted at a high frequency from a transducer to the target tissue, which then return to the transducer at varying times and amplitudes. These signals are then interpreted and summed to construct a two-dimensional (2D) image of the eye.^{1,3,13} While it is most useful in patients with VH or other media opacity. It can demonstrate if a RD is present and can show other retinal pathology such as a VH or posterior vitreous detachment (PVD).¹⁴

Orbital B scan covers a wide range of diseases where clinical assessment is not possible like foreign bodies and trauma, retinal or choroid detachment, congenital or acquired structural anomalies and tumors, also in extra ocular orbital diseases such as optic neuritis, abscess, foreign bodies or tumors. Doppler US increases the ability to diagnose orbital vascular anomalies and tumors and to assess blood flow in the vessels.^{9,10}

Aim of this study was to determine usefulness of B scan in ocular disorders.

Materials And Methods

It was a hospital based observational, descriptive study with a sample size of 280 eyes of 210 patients during period of 9 months. The main source of data for the study was patients attending the outpatient Department Of Ophthalmology, Teerthankar Mahaveer University Medical College, Moradabad, Uttar Pradesh. The study took place in between September 2009 to June 2010. Each patient was subjected to undergo for detailed history taking, followed by

- External ocular examination

- Visual acuity for near and distance using Snellen's chart
- Refraction and correction
- Slit lamp examination
- Tonometry using applanation Tonometry
- Fundoscopy
- B-scan ocular ultrasound

The study included the patients, of all age groups, in the event of non visualization of fundus, irritation, swelling, redness in eye and any kind of trauma regarding orbit or periorbital region. The study was excluded with cases suspected to have isolated anterior segmental and orbital lesions and subject with high risk of / with extrusion of intraocular contents.

Patients undergoing B-scan as advised by their treating physicians were included in this study. Based on outcome variables derived from previous literature, the most common pathological finding in B-scan in Indian population is that of vitreous hemorrhage. Vitreous hemorrhage constitutes a proportion of 28% amongst the cases referred for B-scan in previous Indian literature. Based on this, considering an expected proportion of 0.28, with 95% confidence Interval and width of confidence interval 0.1535, the sample size required for our study was found to be 280. The same sample size was also obtained utilizing incidence of orbital trauma of 73.3%, which is a common indication for patients undergoing B-scan with a 95% confidence interval.

To confirm safety procedures with regard to eye imaging in the current study, the guidelines for probe and ultrasound scanner used were concentrated on several variables as initial power setting, exposure time and stationary probe. The initial power setting for the ultrasound scanners used during eye ultrasound was set up so that the default setting of the acoustic output power control is low. The output power was only increased during the investigation if this was necessary to produce a satisfactory result. Also, the overall examination exposure time for each case was kept as short as was necessary to produce a useful diagnostic result. The used ultrasound transducer for eye ultrasound was not held in a fix position for any longer than was necessary, and was removed from the patient whenever there was no need for a real time image. For example, the authors used the freeze frame or cine loop facilities to allow images to be reviewed and discussed without continuing the exposure. Particular care should be taken to reduce the risk of thermal and non-thermal effects during investigations of the eye.

Results will be expressed as frequency of occurrence and percentages of various lesions which will be compared with clinical findings and other investigations.

Results

Age and gender wise distribution of B- scan in eyes (N=280) was denoted by the table 1. Out of 280 cases 211 (75.04%) were male and 69 (24.96%) were female patients. Ocular pathologies were considerably more prevalent in males than females. Most of the ocular pathologies were found in more than 40 years of age.

B-scan ultrasound findings of ocular pathologies are shown in table 2. Out of 280 eyes of 210 patients, total 201 (71.78) eyes had pathologies. The highest cases found to be of cataract in 110 eyes (39.28%) cases, 45(16.07%) patients with history of trauma, 21 (7.5%) cases with intraocular pathologies and 25(8.92%) cases of retinal disorders were found in the study.

B-scan findings in cataract and retinal disorders of eye are expressed in table 3.

Out of 148 cases referred for cataract, 38 cases were found to be normal. 48 cases showed retinal detachment, 50 cases showed vitreous hemorrhage and Posterior vitreous detachment was found to be in 32 cases.

Out of 35 cases referred for retinal disorders 10 cases were normal. Retinal detachment was found to be in 21 cases, RD+VH found in 13 cases and retinoblastoma found in 3 cases.

B-scan findings in trauma and suspected intraocular pathology patients are showed in table 4.

Out of 64 B-scans referred for trauma cases, 45 found to be pathological in which 33 cases were having Vitreous hemorrhage, 24 cases had Choroid detachment, 20 cases showed retinal detachment, foreign bodies found in 6 cases, RD+CD in 18 cases, Endophthalmitis in 11 cases and Phthisis bulb found in 8 cases.

Out of 33 B-scans referred for intraocular pathologies found to be in 21 cases, Vitreous hemorrhage in 13 cases, Colobomin 6 cases, Retinal detachment found in 15 cases, Chorioretinitis in 11 cases, Tumor infiltrating globe in 4 cases, VH+PVD in 8 cases RD+VH in 10 cases. Images of B-scan pathologies are shown at the end of this article.

Discussion

B-scan was used simultaneously in all cases to see the vascularity of the different pathologies related to anterior and posterior segment of orbit. B-scan imaging was very effective in the detection of the vascular lesions of the orbit like lidhemangioma, thyroid ophthalmopathy, retinal detachment and ocular tumors like retinoblastoma and melanoma.

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We noted the occurrence of significant ocular abnormalities in 201 cases (71.78%) out of 280 eyes referred from department of ophthalmology, which was higher than the incidence reported in the study by Salman et al¹⁶ and Byrne et al¹⁷ and less than that in the study by Hajir Dadgostar¹¹ who found a 66% incidence of detectable abnormalities.

In table-3 the results showed that ultrasound is an accurate method of diagnosing vitreous hemorrhage which was also concluded by Lindgren G et al.¹⁸ This is important in cases where vitreous hemorrhage is suspected behind dense cataract, posterior synechia etc. In the majority of cases an underlying pathology was identified on B scan ultrasound. In cases where retinal breaks were suspected, serial B-scan examinations were required to detect early development of retinal detachment or until media were sufficiently clear to allow funduscopy.

Table-4 shows the most frequent findings recorded ultrasonically, amongst the group under consideration was that of Vitreous Hemorrhages, which is almost similar to the incidence reported in the study by Bhatia et al.¹⁰ The various other changes which could be detected were retinal detachment, choroid detachment and intraocular foreign bodies.

In the study conducted by Byrne et al¹² showed 7.6% and Coleman DJ¹³ showed 25%. Bounik M et al¹⁴ in their study of cataract patients found 41 cases of RD among 295 patients screened for posterior segment abnormality accounting for 13.8% of all abnormalities. Comparatively, in our study RD was due to non-traumatic causes accounted for 18(6.4%) and these were observed in cataract cases that were screened for evaluation of posterior segment preoperatively. Five cases of traumatic RD (including one case of RD with CD) was found. In the study done by Manzoor A et al²⁵ on B scan ultrasound, the study concluded that B scan ultrasound can be one of the diagnostic tool for the detection of hidden posterior segment lesion and can be preformed routinely in pre-op cataract patients as this would help in surgical planning.²⁵

A retrospective and observational study done by E A Javed et al³⁰ 463 cases having opaque media, it was found that, 20 had only corneal pathology, 90 had mature cataract, 60 had only vitreous hemorrhage, 68 had only retinal detachment, 51 had fractional retinal detachment, 4 had retinoblastoma, 2 had optic nerve anomaly, 2 had choroidal pathology, 2 had persistent hyperplastic primary vitreous, and 1 had asteroid hyalosis. The study concluded that B-scan proved to be a valuable diagnostic modality in opaque media and had remarkable prognostic importance.³⁰

In the study conducted by Das T et al,³¹ Contact ultrasound was done in 175 cases of recent and old traumatized eye in the presence of opaque ocular media. The more common pathological lesions detected were vitreous hemorrhage (34%), dislocated lens + retinal detachment + cataract (33%), intraocular foreign body (12%), globe rupture (14%), traction detachment (10%). So this study helped in predicting possible prognosis in addition to proper planning and execution of surgery.³¹ These findings were near about supporting to the results gained by our study.

Study conducted by Haile M et al³² in Ethiopia showed that when Real time B-scan ultrasound was utilized on 318 eyes of 298 patients for evaluation of 285 (90%) eyes with opaque media, three (1%) eyes with clear media but suspected intraocular abnormalities and for proptosis in 30 (9%) cases; Two hundred and nine (66%) eyes had one or more detectable abnormalities. The most common abnormality was retinal detachment (39%) followed by vitreous opacities (31%), eye ball size abnormalities (12%), intraocular foreign bodies (4%), posterior staphyloma (3%) and retinal detachment with vitreous opacities (2%). In areas where other imaging techniques are not available the procedure is a valuable method of evaluating the eye and orbit for any detectable abnormalities and for planning management.³²

Conclusion

B- Scan is quick technique and allows fast evaluation of orbit and it provides valuable information in the short time. B-scan with dynamic imaging technique gives us real time images of lesions with respect to ocular movements. B scan is cost-effective and non-invasive imaging modality and best tool for follow up of much ocular pathology. It is free of ionizing radiation and requires no contrast agents as required in the cross sectional imaging techniques like CT and MRI. It is a sensitive and accurate diagnostic technique for Vitreo-retinal pathologies, ocular neoplasms like retinoblastoma, melanoma and patients with trauma. B scan is accurate in detecting and localizing foreign bodies. It plays a key role in emergency conditions and for management of ocular trauma. Color Doppler Imaging is an important part of the evaluation of the various ocular pathologies like retinal detachment, vascular lesions like hemangioma, lymphangioma. It is a very effective imaging modality in conditions with opaque media where indirect ophthalmoscope is not possible for pathologies of the posterior segment of the globe.

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Tables And Images

Table 1: Age and gender wise distribution of B- scan in eyes (N=280).

Age groups (years)	No. of eyes (%)	Male (%)	Female (%)
0-5	28 (10)	22(12.72)	6(2.1)
6-20	63 (22.5)	51(18.21)	12(4.2)
21-40	52 (20)	38(13.57)	14(5)
41-60	68 (24.28)	52(18.57)	16(5.7)
>60	69 (24.29)	48(17.14)	21(7.5)
Total	280 (100)	211(75.04)	69(24.96)

Table 2: common pathological findings by B- scan.

Pathologies	Abnormal	Normal
Cataract	110(39.28)	38(13.57)
Trauma	45(16.07)	19(6.78)
Intraocular pathology	21(7.5)	12(4.28)
Retinal disorders	25(8.92)	10(3.57)
Total	201(71.78)	79(28.22)

Table 3: B-scan findings in cataract and retinal disorders in patients.

Findings in Cataract	Number of eyes	Findings in Retinal disorders	Number of eyes
Normal	38	Normal	10
Retinal detachment	48	Retinal detachment	21
Vitreous hemorrhage	50	RD+VH	13
Posterior vitreous detachment	32	Retinoblastoma	3
		Colobomin	12

Table 4: B-scan findings in trauma and suspected intraocular pathology patients.

Findings in Trauma	Number of eyes	Findings in intraocular pathology	Number of eyes
Normal	19	Normal	12
Vitreous hemorrhage	33	Vitreous hemorrhage	13
Choroid detachment	24	Colobomin	6
Retinal detachment	20	Retinal detachment	15
Foreign body	6	Chorioretinitis	11
RD + CD	18	Tumor infiltrating globe	4
Endophthalmitis	11	VH+PVD	8
Phthisis bulb	8	RD+VH	10

Images of B-scan pathologies



A B C



D E F