

ROLE OF B-SCAN IN EVALUATION OF OCULAR AND EXTRA OCULAR PATHOLOGIES

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ABSTRACT

BACKGROUND

B- scan is ideal and accurate for evaluating ocular and extra ocular structures especially for small tumours of less than 3mm in size and fine detachments of layers. The main objective of this study is to evaluate the usefulness of high resolution B-mode ultrasonography in ocular and extra ocular lesions of eye in correlation with clinical and ophthalmological investigations.

MATERIALS AND METHODS

All patients referred to the Department of Radio-Diagnosis who are suspected to have ocular and extra ocular lesions in a period of 2 years from November 2014 to October 2016 were scanned using standard ultrasonography with 7-12 Mhz linear array transducer in real time along with colour doppler when required.

RESULTS

50 cases presented with suspected ocular and extra ocular lesions of eye were evaluated with B-mode ultrasonography. Retinal detachment was seen in 12 patients, posterior vitreous detachment in 10, vitreous haemorrhage in 7, choroid retinal thickening in 6, vitreous floaters in 3, choroidal detachment in 3, retinoblastoma in 2, foreign body in posterior segment in 1, subluxated lens in posterior segment in 2, optic nerve thickening in 1, mucocoele in 1, extra ocular muscle thickening in 1.

CONCLUSION

High resolution B-mode ultrasonography helps in diagnosing several pathologies of eye with accuracy, high clarity and high predictive value.

KEYWORDS

B-Mode Ultrasonography, Diagnostic Accuracy, Colour Doppler.

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BACKGROUND

Examination of eye lesions by mere ophthalmic examination is incomplete and inadequate. B-scan provides real time and dynamic range of examination during movement of eye which provides good information in size, location, and differentiation of ocular and extra ocular lesions. B-scan helps in diagnosis of a wide range of lesions ranging from the cataract, corneal opacities, anterior chamber lesions, vitreous haemorrhage, inflammatory changes and it is also employed in evaluation of retinal tears and detachments whether complete or partial, ocular and extra ocular tumours, unexplained choroiditis, retinitis, optic neuritis, ophthalmic vessel aneurysms, sub retinal haemorrhages, disc lesions and extra ocular pathologies.^{1,2} It also provides

diagnostic information of all kinds of foreign bodies which cannot be diagnosed by x-rays and which are under diagnosed and overlooked in CT and MRI. It gives exact location of the foreign bodies and damages caused by them to the adjacent structures like lens, retina, globe wall, extra ocular muscles and vessels.

High sensitivity to flow makes high resolution B-scan ultrasonography a best option for colour doppler imaging and detecting the flow in ophthalmic vessels and evaluation of vascularity of tumours. It is safe, non-invasive, painless, cost effective, radiation free with no adverse effects.

Aims and Objectives

- To study various ocular and extra ocular pathologies of eye with high resolution B-mode ultrasonography, Colour doppler whenever necessary and to evaluate role of high-resolution B-scan ultrasonography in evaluation of ocular and extra ocular lesions of eye in correlation with clinical and ophthalmological investigations.
- To evaluate the usefulness of high resolution B-scan ultrasonography in ocular and extra ocular lesions when direct ophthalmoscopy is not possible due to opacities or any other reasons.

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MATERIALS AND METHODS

Inclusion Criteria

The study includes-

1. Cases of all age groups
2. All patients who are suspected to have ocular and extra ocular lesions.

Exclusion Criteria

The study excludes-

1. Patients who underwent Orbital trauma.
2. All patients who are suspected to have anterior segment isolated lesions.

Equipment and Methodology Used-

Patients were scanned using standard ultrasonography with 7-12 Mhz linear array transducer in real time along with colour doppler when required. Ultrasound machines used were Philips Envisor CHD Doppler machine and GE Logiq F8 at Katuri Medical College and Hospital.

Patient laid supine, directing towards ceiling with eyes closed. Gel applied on closed eyes and examiners hand placed on orbit bones meticulously avoiding unwanted pressure. Colour Doppler flow imaging available in both machines was used to evaluate vascular patterns, mass lesions, study extra ocular vessels, differentiate tumours from haemorrhage and detachments from bands.

RESULTS

50 cases presented with suspected ocular and extra ocular lesions of eye.

Age (years)	Numbers	Percentage (%)
0 to 1	1	2
1 to 10	6	12
11 to 20	8	16
21 to 30	5	10
31 to 40	6	12
41 to 50	9	18
51 to 60	7	14
61 to 70	7	14
71 to 80	1	2
Total	50	100

Table 1. Age Wise Distribution of Ocular and Extra Ocular Lesions of Eye

Maximum number of patients were in 41 to 50 years of age.

Sex	Numbers	Percentage (%)
Male	26	52
Female	24	48

Table 2. Sex Wise Distribution of Ocular and Extra Ocular Lesions of Eye

There was slight male preponderance in the study.

Side	Numbers	Percentage (%)
Bilateral	17	34
Right	18	36
Left	15	30

Table 3. Side Involvement

Symptoms	Number of Cases
Decreased vision (DV)	31
Complete vision loss (CVL)	15
Leucocoria (LU)	3
Irritation (pricking sensation) of eye (I)	13
Watering of eye (W)	9
Redness of eye (RE)	7
Blurring of vision (B)	7
Retro orbital pain (RP)	4

Table 4. Clinical Presentation

Sl. No.	Type of Pathology	Abbreviation	RT eye	LT eye	Total
1.	Retinal detachment	RD	7	5	12
2.	Posterior vitreous detachment	PVD	4	6	10
3.	Vitreous haemorrhage	VH	4	3	7
4.	Choroid retinal thickening	CRT	3	3	6
5.	Vitreous floaters	VF	2	1	3
6.	Choroidal detachment	CD	2	1	3
7.	Retinoblastoma	RB	1	1	2
8.	Foreign body in posterior segment	FB	0	1	1
9.	Subluxated lens in posterior segment	SLPS	1	1	2
10.	Optic nerve thickening	ONT	0	1	1
11.	Mucocele	MU	0	1	1
12.	Extra ocular muscle thickening	EOMT	1	0	1
13.	Ophthalmic artery fistula	OAF	1	0	1

Table 5. Showing Spectrum of Ocular & Extra Ocular Pathologies Detected on High Resolution B-Mode Ultrasonography of Eye

Pathology	Total Cases	Ophthalmic Examination	B-mode Ultrasonography	B-mode Missed	% Accuracy in Ophthalmic Examination	% Accuracy in HRBU
RD	12	4	11	1	33.3	91.6
PVD	10	5	10	0	50	100
VH	7	4	7	0	57	100
CRT	6	4	6	0	66	100
VF	3	1	3	0	33.3	100
CD	3	1	3	0	33.3	100
RB	2	2	2	0	100	100
FB	1	1	1	0	100	100
SLPS	2	2	2	0	100	100
MU	1	1	1	0	100	100
ONT	1	1	1	0	100	100
EOMT	1	0	1	0	0	100
OAF	1	1	1	0	100	100

Table 6. Diagnostic Accuracy of HRUS B-Mode over Ophthalmoscopic Examination

Pathology	Infection/ Inflammation	Neoplastic	Diabetes Millets	Old Age	Post-surgical	Total
RD	3	1	6	1	1	12
PVD	2	1	3	3	1	10
VH	0	0	3	2	2	7
CRT	6	0	0	0	0	6
VF	1	0	0	2	0	3
CD	2	0	1	0	0	3
RB	0	2	0	0	0	2
FB	0	0	0	0	1	1
SLPS	1	1	0	0	0	2
ONT	1	0	0	0	0	1
FM	0	0	0	0	1	1
EOMT	1	0	0	0	0	1
OAF	0	0	0	0	1	1

Table 7. Aetiological Incidence of Pathologies

Location	Number of Cases	Percentage
Ocular	46	92
Extra ocular	4	8

Table 8. Lesions Ocular and Extra Ocular in Location

Figure 1A and 1B. Retinal Detachment (RD)

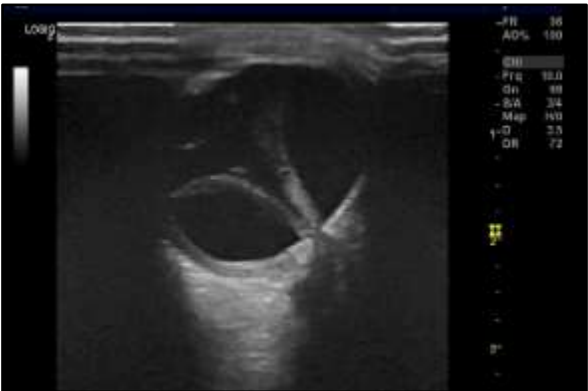


Figure 1a

Figure 1A- High resolution B-scan ultrasonography image showing reflective open funnel (v shaped) membrane attached to optic disc (OD) posteriorly and ora serrata in periphery.



Figure 1b

Figure 1B- High resolution B-scan ultrasonography image showing reflective open funnel type RD with moderately sub retinal echoes suggestive of sub retinal haemorrhages.

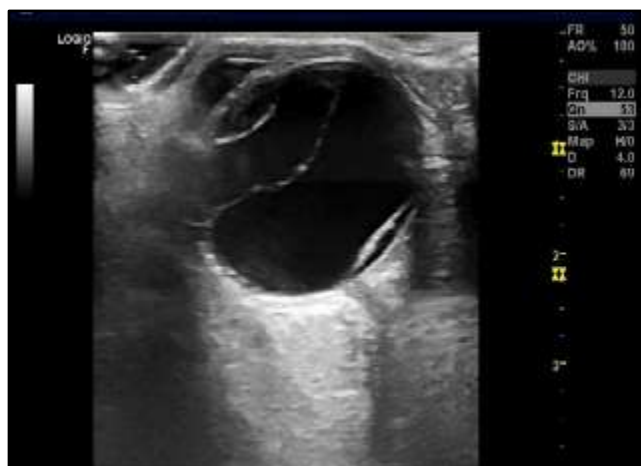


Figure 2. Choroidal Detachment (CD)

High resolution B-scan ultrasonography showing high reflective thick dome shaped membrane.

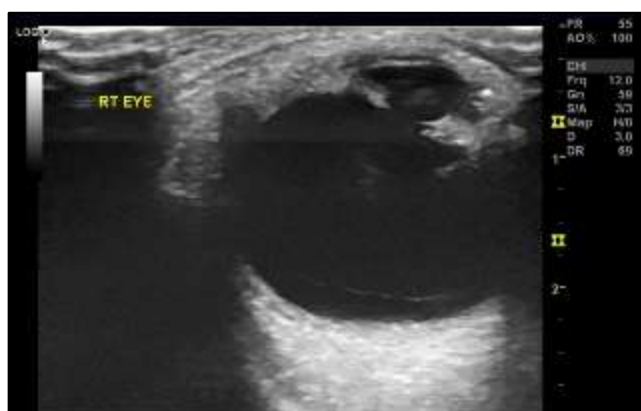


Figure 3. Posterior Vitreous Detachment (PVD)

High resolution B-scan ultrasonography image showing moderately reflective thin undulating membrane.

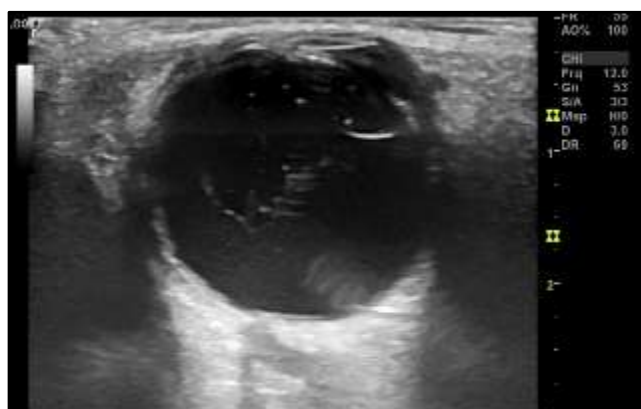


Figure 4. Vitreous Floaters (VF)

High resolution B-scan ultrasonography showing multiple dot like scattered low intensity echoes within vitreous cavity (echoes well appreciated on high gain settings).



Figure 5. Carotid-Cavernous Fistula

High resolution B-scan image showing anechoic lesion in retro orbital region identified as AV fistula.

DISCUSSION

Ultrasound is an imaging test utilizing the high frequency sound waves to visualize internal organs of human body. Initially A scan mode was used in 1956 Mundt and Hughes¹ for evaluating intraocular tumor. Baum and Greenwood in 1958² used B scan for evaluating the intraocular lesions. Both the A scan and B scan ultrasound imaging are used for evaluating the posterior compartment lesions.³ A scan provides the depth information of the lesions whereas the B-scan imaging displays the real time images of the lesions in the posterior orbital compartment and their relationships to normal anatomical structures.⁴ Coleman and colleagues in 1992⁵ described the use of ultrasound for evaluation of anterior compartment lesions using high frequency transducers.

Ultrasound and B scan imaging are particularly important in the opaque lesions of the globe where the ophthalmoscopic has a very limited role in clinical evaluation particularly in presence of the corneal clouding, the anterior and posterior chamber haemorrhages the cataracts and detachments of choroid and vitreous.^{6,7} Ultrasound is also useful in evaluation of evaluation of leucocoria and tumours of the globe and the orbit.

In study done by D. Jackson Coleman, MD et al on 160 patients with retinal detachments of all types. B-scan ultrasonography graphically indicates the location and extent of retinal detachments, and reliably differentiates rhegmatogenous retinal detachments from detachments secondary to solid tumors.^{8,9}

Ultrasound is useful in the evaluation of bleed/hyperaemia in the anterior chamber particularly due to the rupture of conjunctival vessels.

Ultrasound is particularly useful in evaluation of Persistent hyperplastic primary vitreous, endophthalmitis, coats disease and dislocation of lens particularly in patients with homocystinuria and the Marfan's syndrome.¹⁰

Ultrasound imaging is particularly used in the evaluation of vitreous haemorrhage.¹¹ In a normal eye the vitreous is very clear without any movement noted within whereas in

the vitreous haemorrhage uniform internal echoes may be seen showing movement within the vitreous. Ultrasound imaging is particularly useful in differentiation of cases of vitreous haemorrhage from the asteroid hyalosis or the calcium granules/soaps.¹² The vitreous haemorrhage on gaze shift show a prolonged after movements as compared to the former.

Ultrasound imaging is helpful in demonstration of the normal anatomy and pathology of the lesions of lacrimal gland. Ultrasound demonstrates both the orbital and palpebral part of the gland. Many lacrimal gland lesions from inflammatory aetiology including sarcoidosis, histiocytosis, infections and neoplastic lesions including lacrimal gland adenomas, adenocarcinomas, lymphomas, leukaemias etc. can be demonstrated using both grey scale and colour doppler imaging.

Ultrasound imaging is particularly useful in orbital trauma particularly in the evaluation of the radiolucent foreign bodies, orbital contusions, perforating injuries of the eyeball and in the evaluation of the dislocation of lens, vitreous haemorrhage, retinal detachments associated with the orbital trauma.¹³

Study done by Dr. Hemang D. Chaudhari et al on graves ophthalmopathy, all of our 3 cases of grave's ophthalmopathy were asymmetrical with inferior rectus being the most common extra ocular muscle involvement.¹⁴ A study done by Dr. Netan SBS, thyroid orbitopathy was found in 3 patients as bilateral eye involvement. There was asymmetrical involvement with medial rectus being most commonly involved muscle. All patients have raised thyroid status.¹⁵ Similar findings were described by McQuown,¹⁶ Dubey et al¹⁷ and OP Sharma.⁵

CONCLUSION

- High resolution B-scan ultrasonography is noninvasive, painless, cost effective, nonionizing, and is an outdoor investigation without the need for anaesthesia.
- For a radiologist high resolution B-scan ultrasonography is very handy and has high predictive value.
- In cases where surgery is not considered, High resolution B-scan ultrasonography aids in follow up of lesions.
- Compared to CT & MRI imaging, ultrasound has an added advantage of real time scanning of the lesions.

Real-time high-resolution B scan ultrasound imaging is considered most accurate for the diagnosis and management of both ocular and extraocular lesions of the orbit.

Study of 50 cases with suspected ocular and extra ocular pathologies was done with real time high frequency transducer in B-mode and colour doppler ultrasonography.

Grey scale sonographic parameters including echotexture, lesion morphology, location of lesion, patient's age and colour Doppler characteristics, were studied for the diagnosis of various ocular and extra ocular pathologies.

Post-surgical correlation was done and confirmation of diagnosis were done for all possible pathologies in the study.

Most common diagnoses included retinal detachment, vitreous detachment, vitreous haemorrhage, chorioretinal thickening, vitreous floaters, choroidal detachments, retinoblastoma, subluxated lens, foreign body, and ophthalmic artery occlusion, optic artery occlusion, extra ocular muscle atrophy, carotid-cavernous fistula.

Of the 50 patients studied, intra ocular pathologies were 46 and extra ocular 4.

Diagnostic Accuracy of High-Resolution B-Scan Ultrasonography-

- Retinal Detachment 91%
- Vitreous Detachment 100%
- Vitreous Haemorrhage 100%
- Chorioretinal Thickening 100%
- Vitreous Floaters 100%
- Choroidal Detachments 100%
- Retinoblastoma 100%
- Subluxated Lens 100%
- Foreign Body 100%
- Ophthalmic Artery Occlusion 100%
- Optic Artery Occlusion 100%
- Extra Ocular Muscle Atrophy 100%
- Carotid-Cavernous Fistula 100%.

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