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A Study of Roleof B-scan in Evaluating Posterior Segment Pathology of Eye

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Abstract
AIM;*To assess the diagnostic value of B-scan ultrasonography in evaluation of posterior segment disorders of eye in clear and hazy media.* ***Material and Methods****: This Observational Prospective Study of B-scan was conducted in the Ophthalmology department of a tertiary care hospital over a period of one year fromSeptember 2017 to August2018,180 patients with known and suspicious posterior segment pathology were evaluated. Detailed ocular and systemic history, a thorough ocular examination including visual acuity, refraction,ocular movement, and slit lamp and fundus examination with indirect ophthalmoscopy were done. Ultrasonography diagnosis was made by with general purposemachine usinghigh frequency wave.* ***Results****: Out of 180 patients, 123 (68%) were males and 57 (32%) -females. The patients had an age range between 6 months to 70 years. Majority of patients (34.4%) were in the age group ≥61 years. The most common indication of ocular sonography in our study was opaque media due to lenticular opacity (52.5%). Ninty four patients (52.2%) did not demonstrate any posterior segment pathology on B-scan echography. Two most common posterior segment lesions found in our study were vitreous hemorrhage (VH) - 17.7% and retinal detachment (RD) combined with vitreous disorders- 8.9%, respectively. Other B-scan findings were isolated retinal detachment group,retinoblastoma,total choroidal detachment,endophthalmitis,dislocated PCIOL and phthisis bulbi.* ***Conclusion****: B-scan USG stands as an excellent, reliable, and cost-effective noninvasive radiological diagnostic modality for proper evaluation of a variety of ocular disorders in both clear and opaque media.*
KEYWORD:*B scan, posterior segment, opaque ocular media*

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I. Introduction

Eye is affected by spectrum of pathological conditions occurring in allage groups from new born to old age. Many posterior segment lesionsoccurring in the eye can be evaluated accurately by high resolutionsonography since clinical and ophthalmoscopy are less informative[1]. Standardized echography has proved to be highly accurate for thedetection and differentiation of intra ocular disorders [2]. Ophthalmicultrasonography has become the most important accurate diagnosticimaging modality for directly evaluating lesions of posterior segmenthaving opaque ocular media caused by corneal opacities, anteriorchamber opacities, dense cataracts, vitreous hemorrhage,inflammatory opacities which make clinical examination andophthalmoscopic examination difficult and least informative [3]. B-scan is also indicated in the presence of clear ocular media forevaluation and differentiation of intra ocular tumors, ocularinflammatory diseases such as unexplained retinitis and choroiditis[2]. Diagnostic ophthalmic ultrasonography is the first line ofinvestigation in suspected Vitreo retinal diseases with opaque media. Itis possible to identify, evaluate and follow numerous conditions suchas retinal tears, vitreous and retinal detachments, vitreous hemorrhage,sub retinal hemorrhage, eccentric disciform lesions.Ultrasonography is the powerful non- invasive diagnostic tool foraccurate diagnosis, differentiation of intra ocular tumors andinformation regarding the size, location, extension, acousticcharacteristics of the tumors which are critical for the management [3].Ocular trauma is a major cause of vision loss particularly in youngpopulations. In these cases B-scan provides useful informationregarding the presence of ocular foreign body of any kind when otherradiological investigations (X-Ray) become negative [4]. B-scan givesexact location of foreign body in the eye and also the extent of damageto surrounding tissues such as lens, vitreous, retina and guides in thetherapeutic decision related to late effects of ocular trauma [5]. Ocularsonography is painless, non-invasive, safe, rapid, cost-effective, nonionizing real time diagnostic tool that provides valuable diagnosticinformation of various ophthalmic disorders not obtainable by anyother means [6]. B-scan can be repeatedly performed to assess thevarious responses to therapy since ocular sonography has no adverseeffects and is cost effective [7]. Colour Doppler imaging has role inevaluation of

intraocular tumors and also to differentiate vitreoushemorrhage from retinal detachment.Examination of the intraocular contents byophthalmoscopy is dependent upon transparent lightconducting media: the cornea, the aqueous humor,the lens and vitreous gel.Situations that prevent normal examination offundus include:

- Lid problems (e.g. Severe edema, partial ortotal tarsorrhaphy)
- Corneal opacities (e.g., scars, severe edema)
- Abnormal contents of anterior chamber(hyphema, hypopyon)
- Abnormalities of pupil- miosis, papillarymembrane
- Dense cataracts, mature cataract
- Vitreous opacities including vitreoushemorrhage, asteroid hyalosis, synchysisscintillans, inflammatory debris,membranes such as seen in retinitisproliferanes and viteroretinal traction,foreign bodies and organized blood.
- Posterior vitreous detachment
- Retinal detachment
- Choroidal effusion, choroidal detachment
- Intraocular tumors especiallyretinoblastoma
- Intraocular foreign bodies

In such cases, diagnostic B-scan ultrasound canaccurately image intraocular structures and givevaluable information on the status of the lens,vitreous, retina, choroid, and sclera.Typically, ultrasonography is more accurate thanany radiographic technique in the assessment ofchoroidal lesions, intravitreal differential diagnosis,retinal detachment, proliferative membranes, andintraocular tumor heights[8]. Studies of ultrasonographicevaluation in eyes with opaque media have shownincidence rates of posterior segment pathology tovary from 19.6% to 66% [9]. Ultrasonography also has the added advantage overfundoscopy in depicting the internal characteristicsof a suspected tumor such as calcific foci inretinoblastoma [10]. The eye can be examined dynamically during eye movements,which is of value in localizing abnormalities [11].

II. Materials And Methods

A prospective observational study was conducted at the M.L.B. Medical College, Jhansi Uttar Pradesh, IndiaDepartment of Ophthalmology of a tertiary care Centre. The study was conducted from September 2017 to August 2018. The patients attending ophthalmology outpatient department (OPD) during the study period and fulfilling the selection criteria mentioned below were included in the study.

Inclusion criteria:

(1) The patients with suspected posterior segment pathology having an opaque ocular media.
(2) The patients with clear ocular media in whom the extent of posterior segment pathology needed to be assessed.
(3) Hazy media
(4) Unexplained visual loss

Exclusion criteria:

(1)The patients with badly ruptured globe and having active bleeding were excluded.
(2) Unstable / poor general health

Approval was taken from Institutional Ethical Committee of our institute for conducting this study. An informed consentwas taken from all patients. After detailed ocular and systemichistory, a thorough ocular examination including visual acuity, refraction, keratometry, ocular movement, and slit lamp and fundus examination with indirect ophthalmoscopy were done. B scan was done usingNidekEchoscan Model US-3300 Ophthalmic Ultrasound Scanner. The patients were examined in supine position. The transducer after application of the thick layer of commercially available sonographic gel. Gel used was water soluble viscous gel. Scanning was done with contact B-scan probe coated with coupling gel.

B-scan Probe Orientation

1. Transverse scan – The Probe is kept at the limbus with the axis of marker circumferential at limbus. The area of the marker is displayed in the upper part of screen. This can be horizontal, vertical and/or oblique transverse scans.
2. Longitudinal scan – The marker is perpendicular to the limbus.
3. Axial Scan - Is done with the patient fixing in primary gaze and probe centred in the cornea. It displays lens and optic nerve in the centre of the echogram. This is useful for evaluation of macula.

During basic screening, the entire globe was examined,from the posterior pole out to the far periphery. Using a limbus-tofornix approach, each quadrant is evaluated carefully. The 4 major quadrants include the 12-o'clock, 3-

o'clock, 6-o'clock, and 9-o'clock positions, each centred on the right side of the echogram in transverse approaches. Because approximately 6 clock hours are imaged at once, by examining each quadrant, the areas examined overlap, thereby reassuring the examiner that the entire periphery of the globe is visualized. Next, document the posterior pole with a horizontal axial scan, which incorporates both the optic nerve and the macula in one echogram. If no additional pathology is detected, these 5 echograms complete the examination. The study was conduct from high sensitive setting of 80db to 40db to differentiate various tissue densities. Necessary care was taken to avoid artefacts. The required images were frozen and a thermal print out was taken. Then patient's eyes were cleaned by cotton pads. Then analysis of the images was done in real-time and after freezing the images. Data was entered in Microsoft excel and Chi Square test was used for statistical analysis.

III. Results

In the present study, Out of 180 patients, 123 (68%) were males and 57 (32%) females [Figure1]. The patients had an age range between 6 months to 70 years. The maximum number of patients - 62 (34.4%) were in the age group ≥61 years [Table 1]. The most common indication of ocular sonography in our study was opaque media due to lenticular opacity (52.5%) [Table2]. Ninty four patients (52.2%) did not demonstrate any posterior segment pathology on B-scan echography [Table3].The two most common posterior segment disorders found in our study were vitreous disorders -48patients (26.7%) and retinal detachment in conjunction with vitreous disorders - 16 patients (8.9%) [Table3]. Among the vitreous disorders, vitreous hemorrhage which was seen in 28 (58.3%) patients topped the list [Figure2]. Out of 28 patients of vitreous hemorrhage, 18 had history of trauma, 4 patients had diabetic eye disease, 1were having history of cataract surgery , 2 was hypertensive ,2 for both diabetic & hypertension and 1 of idiopathic [Figure3].Retinal detachment (including patients of RD combined with vitreous disorders) was seen in 30 (15%) cases.. Out of 14 patients with isolated retinal detachment[Table3], 9(64.30%) had history of trauma; 2 (14.28%) were myopic; 2(14.28%) had history of cataract extraction and in 1 (7.1%) patient the cause was not known. Of 12 patients with retinal detachment combined with vitreous hemorrhage, 6 (50%) patients had history of trauma, 5 (41.67%) had diabetes mellitus, and 1(8.33%) had history of surgery for cataract [Table 3]. The third group of posterior segment disorder diagnosed in our series was intraocular tumours(1.1%) [Table3]. Bilateral retinoblastoma with microphthalmos was seen in one patient. In rest onepatients with unilateral retinoblastoma.The last group of posterior segment disorder diagnosed in the present study included heterogeneous conditions and all were placed under the heading of miscellaneous disorder[Table4]. It included 2 cases of total choroidal detachment, 2 cases of endophthalmities and 1case of dislocated PCIOL in vitreous and 1 case of phthisis bulbi. Two cases of total choroidal detachment were diagnosed in the study .Endophthalmitis was diagnosed in two patients; one of these was postoperative eye and one had traumatic endophthalmitis.

IV. Discussion

Over the last 30 years, ultrasonography has greatlyadvanced and this has enabled us to study posteriorsegment of eye even in the presence of opaquemedia. Although, it can be used to detect thepathology in the anterior segment and in the orbit,but its most common use is to study theabnormalities in the posterior segment [12]. In the present study, the maximum number ofpatients - 62 (34.4%) were in the age group ≥61 years [Table1] .In a study by Qureshiand Laghari maximumnumber of patients was also present in the age groupof 60-69 years [14]. The two most common posterior segment disordersfound in our study were vitreous disorders -48patients (26.7%) and retinal detachment inconjunction with vitreous disorders - 16 patients (8.9%) [Table3]. Among the vitreous disorders, vitreous haemorrhagewhich was seen in 28 (58.3%) patients topped thelist [Figure2]. Vitreous hemorrhage was seen as dot likeechoes and membranes, predominantly in thedependant portion of vitreous cavity [Figure 6]. Out of 28patients of vitreous hemorrhage, 18 had history oftrauma, 4 patients had diabetic eye disease, 1werehaving history of cataract surgery and 1 washypertensive. Dawood et al found 98 (44.95%)vitreous disorders and 58 (26.60%) retinaldetachments among the total of 218 ultrasonogramsperformed [13]. In their series, vitreous haemorrhage(35 patients) was the commonest vitreous problemfollowed by posterior vitreous detachment (19patients) and the most common cause of vitreoushemorrhage was trauma (12 out of 35 patients)followed by diabetic eye disease (9 out of 35patients). Rabinowitz et al study showed thatproliferative diabetic retinopathy (35%) and ocular trauma (33%) were the most common causes of vitreous hemorrhage [15].Retinal detachment (including patients of RDcombined with vitreous disorders) was seen in 30(15%) cases. Sen et al showed an incidence of 21.34%(34 out of 164 cases examined) due to traumatic and non-traumatic causes [16] .Study by Sharmademonstrated 26 cases (21.31%) of retinaldetachment diagnosed out of 122 cases scanned [17] .Javed et al reported that out of 463 patients, thepatients of retinal detachment were 68 (14.70%) [18] .Out of 14 patients with isolated retinal detachment,9(64.30%) had history of trauma; 2 (14.28%) weremyopic; 2(14.28%) had history of cataract extraction and in 1 (7.1%) patient the cause was notknown. Of 12 patients with retinal detachmentcombined with vitreous hemorrhage, 6 (50%)patients had history of trauma, 5 (41.67%) haddiabetes mellitus, and

1(8.33%) had history ofsurgery for cataract.Funnel shaped membrane attached to optic disc posteriorly and oraserrataanteriorly inexudative retinal detachment [Figure 5].The third group of posterior segment disorderdiagnosed in our series was intraocular tumours(1.1%). Bilateral retinoblastoma withmicrophthalmos was seen in one patient. In rest onepatients with unilateral retinoblastoma, echogenicmass was seen arising from retina and projectinginto vitreous cavity [Figure 9]. Highly echogenic areas ofsuspected calcifications were also found in the massin both of these patients. Antero-posterior diameterof the globe was reduced (13-14mm) in one patientwith unilateral retinoblastoma. We could notdemonstrate any retinal detachment associated withthe tumor. Similar results were shown by Sen et al study where retinoblastoma formed 3% of various ocular abnormalities[16] . The last group of posterior segment disorderdiagnosed in the present study includedheterogeneous conditions and all were placed underthe heading of miscellaneous disorder. It included 2cases of total choroidal detachment, 2 cases ofendophthalmities and 1case of dislocated PCIOL in vitreousand 1 case of phthisis bulbi.Two cases of total choroidal detachment werediagnosed in the study and both of them appeared astwo echogenic convex membranes into the vitreouscavity approaching the midline but not involving theoptic nerve head [Figure 8,10]. Endophthalmitis was diagnosed in two patients;one of these was postoperative eye and one hadtraumatic endophthalmitis. There was diffusevitreous opacification with vitreous echoes andmembranes and thickened and ill definedretinochoroido-scleral complex on B-scan. Inendophthalmitis, opacities are similar to opacities ofdispersed vitreous hemorrhage. Follow up wasnecessary as organization and membrane formationis faster than seen in vitreous hemorrhage.Ultrasound is useful to determine the severity andextent of inflammation in clinically suspected casesof endophthalmitis. Similar findings were reportedby Maresova et al, who conducted a retrospectivestudy in 7 eyes of 7 patients to evaluate theultrasound findings in eyes with endophthalmitisfollowing penetrating injury and found thatmembranes were present in the vitreous in 5 eyes [19]. The thickening of the choroid was present at theultrasound examination in all seven eyes. Thedetachment of the choroid was not found in any eye.

Table 1. Demographic Profile of Patient[n=180]

Age distribution	
Less than 20 years 38	
21-40 years20	
41-60 years60	
More than 60 years	62
Gender distribution	
Males	123
Females	57

Figure 1. Showing sex distribution of patients

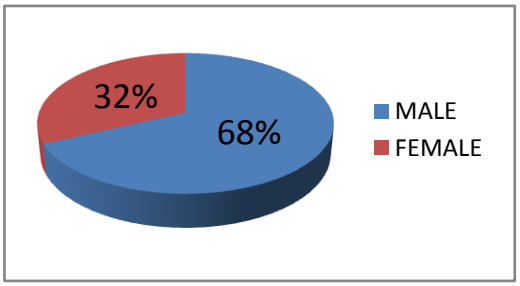


Table 2. Showing Indication of Ultrasonography (B-Scan)

Indication	**Percentage**	**No. of patients**
Suspected vitreo-retinal pathology (including leukocoria) on clinical examination	17.78	32
Opaque media due to trauma	30	54
Opaque media (excluding trauma cases) • Lens opacity (cataract) • Corneal opacity	52.2 50.5 1.7	94 91 3
Total **100**	**180**	

Table 3. Showing distribution of B-scan results

Group	No. of patients	Percentage (%)
Normal	94	52.2
Vitreous disorders	48	26.7
Vitreous disorders combined with retinal detachment	16	8.9
Retinal detachment	14	7.8
Intraocular tumours	2	1.1
Miscellaneous	6	3.3
Total	**180**	**100**

Table 4showingfrequency of various conditionplaced under miscellaneous group

Diagnosis	No. of patients	Percentage (%)
Choroidal detachment	2	33.3
Endophthalmities	2	33.3
Dislocated PCIOL in vitreous	1	16.7
Phthisis bulbi	1	16.7
Total	**6**	**100**

Figure 2. Showing frequency of distribution of vitreous disorders

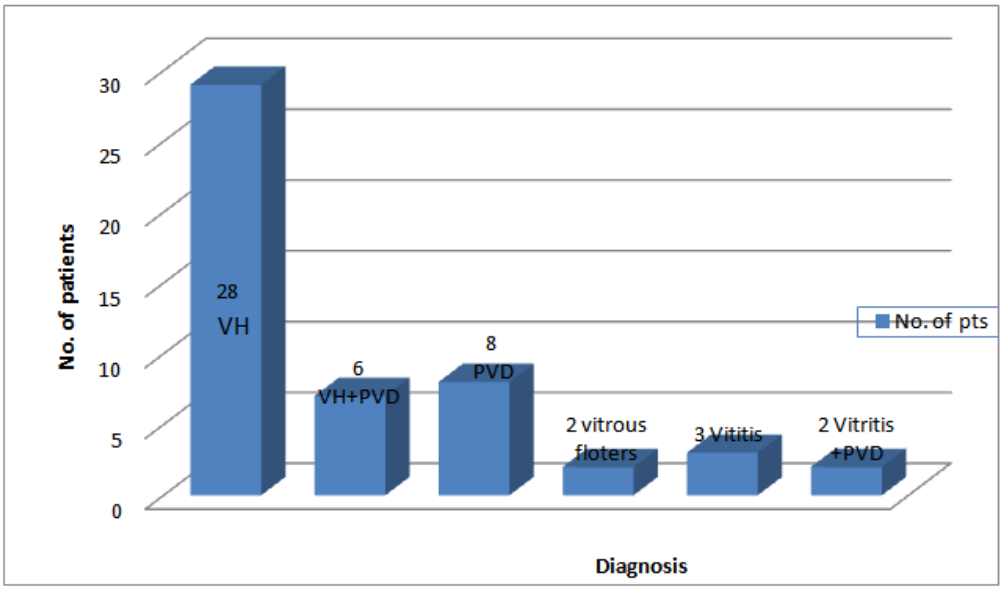


Figure 3. Showing causes of vitreous haemorrhage

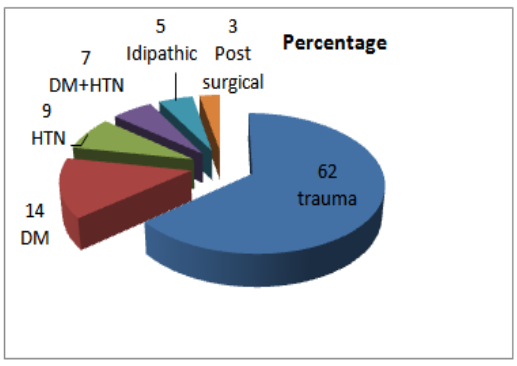
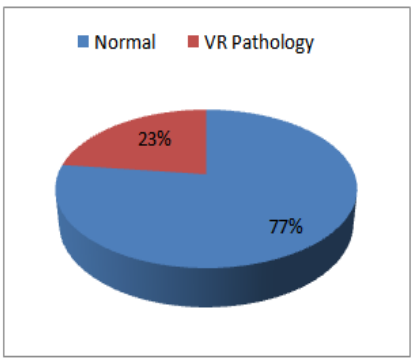


Figure 4.showing distribution of B-scan results among patients of ocular trauma



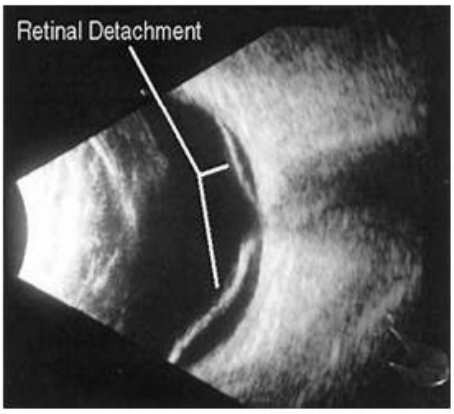


Figure5. [Retinal detachment] funnel shaped total RD with anterior attachment at ora serrate & posteriorly optic disc

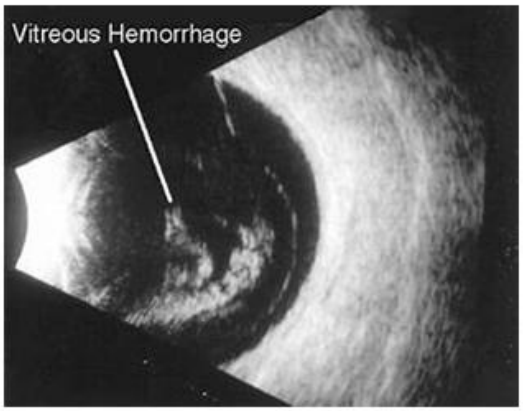


Figure6. [VitreousHemorrage] dot like opacities &membrane like

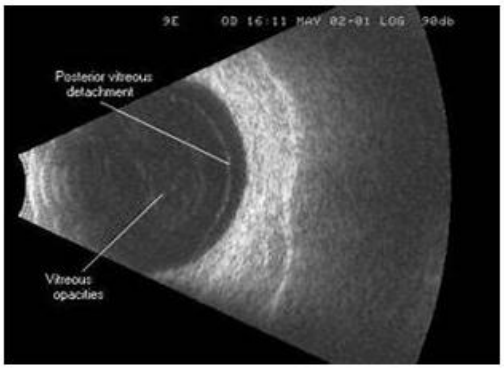


Figure 7.Membranous echo moderate after movements. This is PVD beneath this vitreous hemorrage

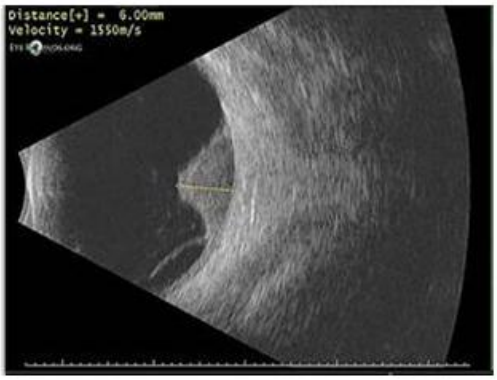


Figure 8.Choroidal detachment with hemangioma

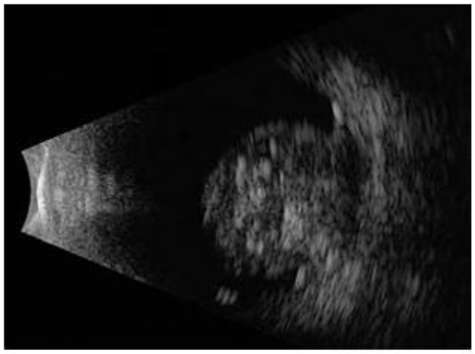


Figure 9.[Retinoblastoma] echogenic mass was seen arising from retina and projecting into vitreous cavity.

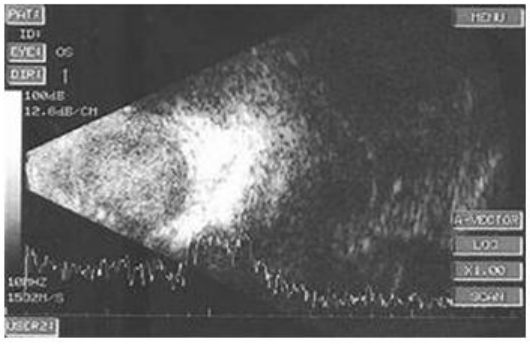


Figure 10.Endophtalmitis vitreous echos&membrane thickened and ill definedretinocho -roidal-scleral complex

V. Conclusion

B scan ultrasonography can be extensively used in evaluation of vitreo-retinal disorders, in patients with opaque ocular media, where a preoperative fundoscopic evaluation is virtually impossible, for assessment of posterior segment. Dynamic B-Scan ultrasonography is specialfeature which can be useful in detecting retinal detachment in setting of vitreous hemorrhage.Despite the increased use of cross-sectional imaging like CT and

MRI for orbitaldiseases,. B scan ultrasonography still has a valuable role because of its ease, portability,and economic feasibility,cost effective and non-invasive technique which can be performed safely as an outpatient procedure, even in children without any use of anesthetics or sedatives.

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