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The role of B-scan ultrasonography in eyes with suspected vitreous haemorrhage

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Abstract
Introduction: *Ophthalmic ultrasonography is a non-invasive, efficient and inexpensive diagnostic tool to detect and differentiate various ocular conditions. It is an indispensable tool in evaluation of posterior segment in presence of media opacities like dense cataract, vitreous hemorrhage etc.*
Aim: *The aim of this study is to document the B-scan findings of the patients with vitreous haemorrhage and to compare the ultrasonographic and clinical findings with final diagnosis.*
Materials and Methods: *It is a prospective study done on the patients attending the ophthalmology department of our institution over last two years, who were diagnosed with vitreous haemorrhage. Ocular ultrasonography was done on all of them by a 10MHz probe and the findings were documented. These findings were compared with the final diagnosis of these patients after treatment.*
Results: *Total 32 patients were included in the study. Clinically 16 had only vitreous haemorrhage (VH), 2 had posterior vitreous detachment, 3 had retinal detachment, 10 had proliferative vitreoretinopathy and 1 patient had intraocular foreign body along with vitreous haemorrhage. Ultrasonography showed only vitreous haemorrhage in 8 cases, VH with posterior vitreous detachment in 6 cases, VH with retinal detachment in 6 cases, VH with vitreous membrane in 10 cases, VH with intraocular foreign body in 1 patient and normal posterior pole in 3 cases. The accuracy rate of ultrasound in diagnosing vitreous haemorrhage was 89%, posterior vitreous detachment 67%, retinal detachment 83%, vitreous membrane 82% and intraocular foreign body 100%.*
Conclusion: *B-scan is a non-invasive, safe and cost-effective real time diagnostic tool to detect posterior segment pathologies in presence of media opacities. B-scan is highly sensitive in finding the associated pathologies like retinal tear, retinal detachment and vitreo-retinal membranes in presence of vitreous haemorrhage obscuring retinal view which helps in deciding the correct treatment plan for the patient.*
Keywords: *Vitreous Haemorrhage, Ultrasonography, B-scan, Posterior Vitreous Detachment, Retinal Detachment.*

Introduction

In the modern era of ophthalmology for correct diagnosis of eye diseases a series of diagnostic tests are required along with the history and clinical examination of the patient. The anterior segment of the eye can be easily examined by slit

lamp biomicroscope, but examination of the eye behind the crystalline lens requires special instruments like direct and indirect ophthalmoscope. But in presence of hazy media due to cataract or vitreous haemorrhage or vitreous opacities, special imaging procedures like ultrasonography, CT scan and MRI are needed. Ophthalmic ultrasonography is a non-invasive, efficient and inexpensive diagnostic tool to detect and differentiate various ocular pathologies[1]. It is an indispensable tool in the evaluation of posterior segment when dense cataract, vitreous hemorrhage or extreme miosis, makes ophthalmoscopic evaluation of the posterior wall difficult[2]. Ultrasonography is based on propagation, reflection and attenuation of sound waves. Those used for diagnostic ophthalmic ultrasound have a frequency of 7.5 to 12 Megahertz[2].Two commonly available modes for ultrasound examination of eye are A-scan and B-scan. A-scan or amplitude modulation scan, is a one dimensional display in which echoes are represented as vertical spikes from a baseline. B-scan or brightness modulation scan provides two dimensional images of a series dots and lines. B-scan provides the topographic information of shape, location, extension, mobility and gross estimation of thickness of the tissue.

Objective

The aim of this study is to document the B-scan findings of the patients with suspected vitreous haemorrhage and to compare the ultrasonographic and clinical findings with final diagnosis.

Materials and methods

This prospective study was done on the patients attending the ophthalmology department of our institution, over the last two years. Patients clinically diagnosed as cases of vitreous haemorrhage were included in the study. The Echovue Contact A & B Scan machine having a 10 MHz probe was used for doing the ultrasound. The procedure was done on an outpatient basis. A water soluble transmission gel was used over the lid as a viscous coupling agent that is necessary for the transmission of sound waves. A detail clinical work-up of all the patients was done which included visual acuity assessment, detail slit lamp examination, dilated fundoscopy, intraocular pressure measurement. The patients were then subjected to an ultrasonographic examination of eye using both A and B scan. The methodology of the procedure was explained to the patients first and their consent was taken. Examination was carried through closed lids. The optic nerve was first identified and horizontal and vertical sections were studied in order to determine the location of the abnormality in relation to the optic nerve head. Transverse scans of the four major quadrants of the eye was performed initially at a high gain setting to assess the vitreous and then gain was lowered to check the retinal status. Longitudinal scans of all meridians at lower gain were then performed in all cases. Careful assessment was made especially looking for signs of Posterior Vitreous Detachment (PVD), abnormal vitreoretinal adhesion, retinal tears and retinal detachment. Wherever indicated, kinetic examination was done especially looking at areas of vitreoretinal adhesion including the vitreous base. Based on A and B scan findings ultrasonic diagnosis was reached. Systemic investigations were done for patients wherever necessary. Depending on the diagnosis, patients were treated conservatively or surgically. The findings were tabulated at the end to compare the results.

Results

Total 32 patients were included in the study. All were clinically diagnosed as cases of vitreous haemorrhage (VH). Among them 21 (66%) were male and 11 (34%) were female patients (Figure-1). Their mean age at presentation was 56 (age range 35 - 74 years). Right eye was affected in 17(53%) patients and left eye in 15(47%) patients. Their visual acuity ranged from hand movement close to face to 6/12 at presentation.

Sixteen patients were clinically diagnosed to have only vitreous haemorrhage (VH) and other 16 patients had other diseases like Posterior Vitreous Detachment (PVD), retinal detachment (RD), proliferative vitreo retinopathy and suspected Intra Ocular Foreign Body(IOFB) along with vitreous haemorrhage. The clinical diagnosis of these patients is depicted in table – 1.

Ultrasound B-scan and A-scan was done for all the 32 patients and the ultrasonographic findings were tabulated in table – 2. Two patients had B-scan features suggestive of vitreous haemorrhage with both retinal detachment and vitreoretinal membranes. Figure-3 shows the B-scan picture of a patient with vitreous haemorrhage and figure-4 shows the B-scan picture of a patient with PVD.

These patients were treated either conservatively or surgically as needed. Uncomplicated cases were managed conservatively for spontaneous clearance of vitreous haemorrhage. Non clearing or recurrent VH was treated by late vitrectomy. Various surgical procedures performed included Intra Vitreal anti-VEGF injection, Pars Plana Vitrectomy, Scleral Buckling, Retinal Endolaser Photocoagulation and removal of foreign body. Table – 3 shows the confirmed diagnosis of these patients after treatment. One patient had fibrovascular vitreoretinal membrane causing tractional retinal detachment.

Only Vitreous haemorrhage was clinically diagnosed in 16 patients at the beginning, but B-scan detected other associated pathologies like presence of PVD, vitreous membrane and retinal detachment in 8 patients along with vitreous haemorrhage. This significant difference is due to the ability of ultrasonography to detect posterior segment abnormalities in presence of hazy media where it is difficult to visualize the retina. Table - 4 shows the clinical misdiagnosis list.

Out of the three patients, who were identified "Normal" as per B-scan process, actually found to have VH in one case and VH with PVD in two cases. This misdiagnosis is due to inability of ultrasound to detect fresh diffuse vitreous haemorrhage. Along with that, one case of retinal detachment and two cases of vitreous membranes were also misdiagnosed as PVD in B-scan. Table - 5 shows the list of ultrasonographically misdiagnosed cases.

Table– 6 denotes the accuracy of ultrasonography, to diagnose various co-existing pathologies in presence of vitreous haemorrhage. Vitreous haemorrhage was detected with 89% accuracy by ultrasonography. Six eyes had PVD at presentation, while ultrasound could detect it accurately only in 67% of such eyes. Retinal detachment was clinically predicted in three patients, whereas ultrasonography confirmed RD in six patients with a whopping accuracy of 83%.

Out of the 32 patients with vitreous haemorrhage 15 patients had history of diabetes at presentation. Proliferative Diabetic retinopathy (PDR) was the most common cause of vitreous haemorrhage seen in our series, which was seen in 12 patients (37.5%). History of trauma was present in 7 patients (21.8%), which was the second most common cause for VH. Rhegmatogenous retinal detachment was seen in 3 patients. Other investigations and follow up studies revealed features suggestive of Eales' disease in 4 patients and 2 patients had central retinal vein occlusion (CRVO). The cause of vitreous haemorrhage could not be specified in 4 patients (Figure-2).

Table 1 Clinical diagnosis of patients

Clinical diagnosis	No. of patients	Percentage
Vitreous haemorrhage	16	50%
Vitreous haemorrhage with posterior vitreous detachment	2	6.5%
Vitreous haemorrhage with retinal detachment	3	9.5%
Vitreous haemorrhage with proliferative vitreo- retinopathy	10	31%
Vitreous haemorrhage with suspected intraocular foreign body	1	3%

Table 2 Ultrasonographic diagnosis of patients

Ultrasonographic diagnosis	No. of patients	Percentage
Vitreous haemorrhage	8	25%
Vitreous haemorrhage with posterior vitreous detachment	6	19%
Vitreous haemorrhage with vitreous membrane	10	31%
Vitreous haemorrhage with retinal detachment	6	19%
Vitreous haemorrhage with intraocular foreign body	1	3%
Normal posterior segment	3	9.5%

Table 3 Confirmed diagnosis of patients

Confirmed Diagnosis	No. of patients	Percentage
Vitreous haemorrhage	9	28%
Vitreous Haemorrhage with posterior vitreous detachment	6	19%
Vitreous haemorrhage with vitreo retinal membrane	11	34%
Vitreous haemorrhage with retinal detachment	6	19%
Vitreous haemorrhage with intraocular foreign body	1	3%
Normal posterior segment	0	0%

Table 4 Cases of Clinical misdiagnosis

Clinical diagnosis	confirmed diagnosis	No. of patients
Vitreous haemorrhage	VH with PVD	3
Vitreous haemorrhage	VH with Retinal detachment	3
VH with Retinal detachment	VH with Vitreous membrane	1

Table 5 Cases of ultrasonographic misdiagnosis

Ultrasonographic diagnosis	confirmed diagnosis	No. of patients
Normal	Vitreous haemorrhage	1
Normal	VH with Posterior vitreous detachment	2
VH with Posterior vitreous detachment	VH with Retinal detachment	1
VH with Posterior vitreous detachment	VH with Vitreous membrane	2

Table 6 Comparison of clinical diagnosis, ultrasonographic diagnosis and Confirmed diagnosis

Abnormal vitreo-retinal condition	No. of patients with clinical diagnosis	No. of patients with confirmed diagnosis	ultrasonographic diagnosis correlating with confirmed diagnosis	Percentage accuracy
Vitreous haemorrhage	16	9	8	89%
VH with Posterior vitreous detachment	2	6	4	67%
VH with Vitreous membrane	10	11	9	82%
VH with Retinal detachment	3	6	5	83%
Vitreous haemorrhage with intraocular foreign body	1	1	1	100%

Figure-1 Distribution of Male & Female Patients

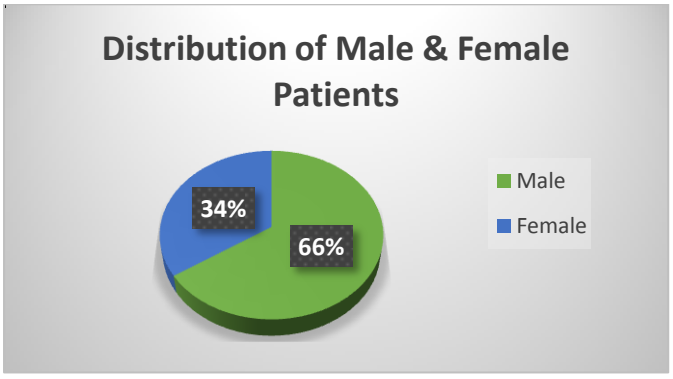


Figure-2 Image of B-scan showing vitreous haemorrhage

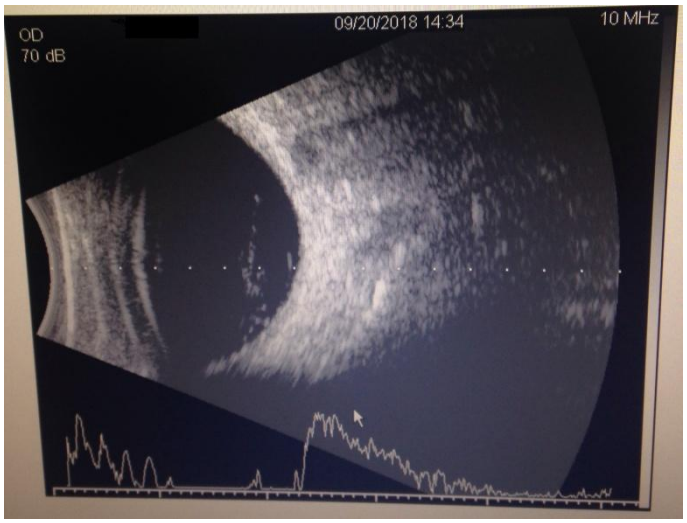


Figure-3 Image of B-scan showing Posterior Vitreous Detachment

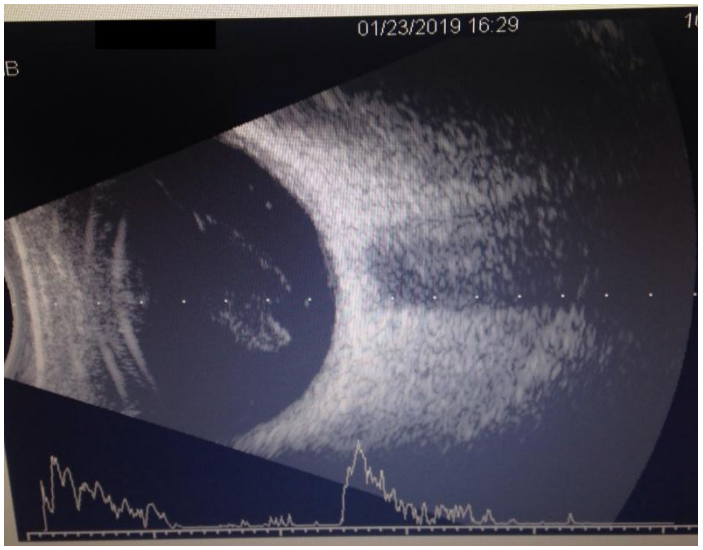
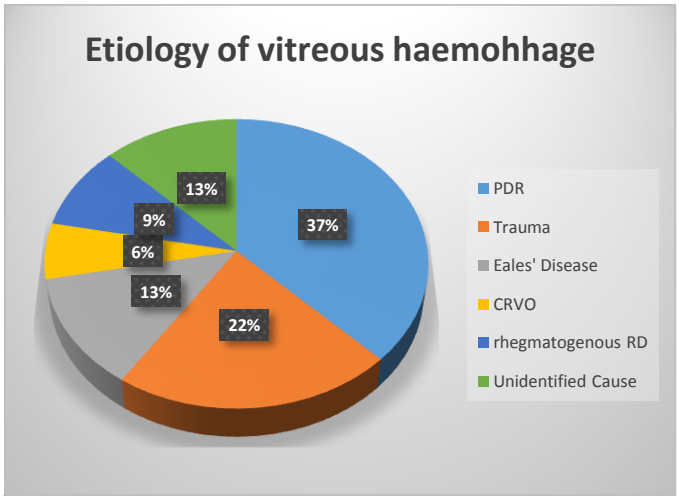


Figure-4 Etiology of vitreous haemorrhage



Discussion

The main indication for echography in vitreous haemorrhage is to exclude an underlying retinal tear and retinal detachment. Kinetic and quantitative echography is sometimes required to differentiate between retinal detachment and thick, detached posterior vitreous face. Sometimes open funnel retinal detachment and thick PVD attached to optic nerve can look very similar in B-scan[4]. This leads to erroneous reports. Out of 32 patients, one patient with retinal detachment and two patients with vitreous membranes were reported as PVD in B-scan in our cohort.

It is important to identify an underlying retinal tear or rhegmatogenous retinal detachment (RRD) urgently in vitreous haemorrhage cases, as this significantly changes the management plan. Conversely, it is also important to avoid potentially unnecessary surgery in other less urgent conditions, in which it is safe to wait and see if spontaneous hemorrhage clearance occurs. Sandinha et al[5] reported a series of 58 cases of fundus obscuring vitreous haemorrhage, who underwent ocular ultrasonography and they found underlying rhegmatogenous retinal detachment (RRD) and retinal tears without RRD in nine and fourteen patients, respectively. An additional six patients with suspected retinal tears underwent vitrectomy, during which tears were confirmed in three, two had retinal vessel avulsions, and one had retinal new vessels. Their ultrasound report was 100% accurate in finding underlying retinal tear or rhegmatogenous retinal detachment. So they concluded that B-scan Ultrasonography is highly sensitive in identifying the pathology in acute fundus obscuring vitreous haemorrhage. In our series of 32 patients, the accuracy rate of B-scan in diagnosing retinal detachment was 83%.

The ultrasonographie picture of vitreous haemorrhage depends on the density, location, extent and membraneous changes associated with it. A recent haemorrhage that is diffused and light, may be acoustically clear, although it completely obscures a view of the fundus[6]. This was the reason for three cases of VH to be reported as normal, on ultrasound examination in our series.

Atta[7] assessed the value of ultrasonography in VH by determining its diagnostic accuracy, its ability to identify the cause of VH and consequently influence the course of management. A total of 66 cases of VH were clinically diagnosed and correctly identified on ultrasound with no incorrect diagnosis of VH. They concluded that ultrasound is a useful modality in accurately diagnosing vitreous haemorrhage and in identifying an underlying cause in many cases. In our series vitreous haemorrhage was diagnosed correctly in 89% cases.

Marry N Abraham[6] reported the ultrasonographic findings in 76 eyes with vitreous haemorhage. In her series ultrasonographic findings aided in selecting cases for surgery and planning the surgical procedure. She had a diagnostic accuracy rate of 80% in her series which is comparable to our findings of 82 – 89% accuracy rate. The most common cause of vitreous haemorrhage was diabetic retinopathy accounting for 44 eyes in her study. We also found Proliferative Diabetic retinopathy as the most common cause of VH seen in 37.5% of our patients, followed by trauma (21.8%).

Spraul et al[8] noted that incidence of spontaneous vitreous haemorrhage is approximately 7 cases per 1,00,000 population. Proliferative diabetic retinopathy (32%), retinal tear (30%), retinal vein occlusion (11%) are the most common causes in their series. Vitreous hemorrhage in the setting of acute PVD has been estimated to be associated with retinal tear in 70%–95% cases.

Sarrafizadeh et al[9] showed that acute, spontaneous, non traumatic posterior vitreous separation with dense fundus –obscuring VH is associated with a high incidence of retinal tear and detachment. Even in our series one patient with fundus obscuring vitreous haemorrhage was misdiagnosed to have PVD, whereas he had retinal detachment.

Our study has coupe of limitations. We have collected data for only two years and our sample

size is also small. A larger study will provide a more accurate finding.

Conclusion

Since the first application in ophthalmology by Mundt and Huges[10], ultrasonography little over five decades has emerged as an indispensable tool in diagnosis and management of various ocular abnormalities. It is a painless, non-invasive, safe and cost-effective real time diagnostic tool to detect posterior segment pathologies where optical means of evaluation fail due to media opacity. B-scan is highly sensitive in finding the associated pathologies like retinal tear, retinal detachment and vitreo-retinal membranes in presence of vitreous haemorrhage obscuring retinal view. This helps the surgeon to decide the treatment plan correctly.

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