

FREQUENCY OF VARIOUS OCULAR PATHOLOGIES DETECTED ON B-SCAN ULTRASONOGRAPHY IN PATIENTS OF BLUNT OCULAR TRAUMA

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Abstract: Ultrasound (USG) B-Scan is a readily available, rapid, non-invasive and safe imaging modality to evaluate the clinical findings of traumatic eyes. Ultrasound B Scan is based on the 'Piezoelectric' phenomenon by using a frequency that lies in the range from 5MHz to 20MHz. Ultrasound B Scan can detect, outline and characterize the nature of soft tissue of the eyeball and orbit, regardless of the degree of ocular media transparency. **Objective:** To determine the frequency of various ocular pathologies detected on B-scan ultrasonography in patients of blunt ocular trauma. **Methods:** This cross-sectional study was conducted from 8th November 2022 to 7th May 2023 at Ayub Teaching Hospital Abbottabad. The study enrolled 127 patients with blunt ocular trauma between 15 to 65 years of age. Patients with any known post-segment pathology before ocular trauma and patients with a history of diabetes and hypertension were excluded. Then gentle B scan was performed. The eye was anaesthetized using a topical anaesthetic. Gel was applied to the closed eye. A transverse probe position was used. Each quadrant of the eye was examined using the limbus to fornix approach. The 12- O'clock, 3-O'clock, 6-O'clock, and 9-O'clock positions were examined carefully. Ocular pathologies like vitreous haemorrhage, retinal detachment, intraocular foreign body and endophthalmitis (yes/no) were noted. **Results:** In our study, the frequency of various ocular pathologies detected on B-scan ultrasonography in patients of blunt ocular trauma were as follows; Vitreous haemorrhage was most common and seen in 49 (38.58%) patients followed by Retinal detachment in 28 (22.05%) patients, Intra-ocular foreign bodies were seen in 15 (11.81%) patients and endophthalmitis in 14 (11.02%) patients. **Conclusion:** This study concluded that the vitreous hemorrhage was the most common pathology in ocular trauma followed by retinal detachment and intra-ocular foreign bodies.

Keywords: ocular trauma, ultrasonography, vitreous haemorrhage, retinal Detachment

Introduction

The clinical use of ophthalmic ultrasound has increased dramatically over the past twenty years and has presently reached the point where it is universally regarded as an essential means of soft tissue examination of the eye and orbit (1).

Ultrasound B-scan is a readily available, rapid, non-invasive and safe imaging modality to evaluate the clinical findings of traumatic eye (2). Ultrasound B-scan is based on the Piezoelectric phenomenon by using frequencies that lie in the range from 5MHz to 20MHz. Ultrasound B-Scan detects, outlines and characterizes the nature of soft tissue of the eyeball and orbit, regardless of the degree of ocular media transparency (3). A study showed vitreous haemorrhage to be the most common B-scan finding in ocular trauma (31.5%) while 19.8% of patients had no abnormality detected on the B scan. Retinal detachment was present in 17.9% of patients, intraocular foreign body in 9.9% and endophthalmitis in 7.4% (4).

Although there is no lack of available literature on the utility of B-Scan in the case of cataract and blast injuries its utility in cases of blunt ocular trauma with hazy media has not been adequately investigated. Hence our study aims to perform gentle B-Scan in post-traumatic eyes with hazy ocular media so that timely diagnosis and appropriate management can be done.

Methodology

This cross-sectional study was conducted from 8th November 2022 to 7th May 2023 at Ayub Teaching Hospital Abbottabad. The study participants were selected using non-probability consecutive sampling. Data collection was done after ethical approval from the hospital ethics committee. Informed consent was taken from all the participants. The study enrolled 127 patients of both genders with blunt ocular trauma between 15 to 65 years of age. Patients with any known post-segment pathology before ocular trauma and patients with a history of diabetes and hypertension were excluded. Then gentle B scan was performed. The eye was anaesthetized using a topical anaesthetic. Gel was applied to the closed eye. A transverse probe position was used. Each quadrant of the eye was examined using the limbus to fornix approach. The 12- O'clock, 3-O'clock, 6-O'clock, and 9-O'clock positions were examined carefully. Ocular pathologies like vitreous haemorrhage, retinal detachment, intraocular foreign body and endophthalmitis (yes/no) were noted. **Results:** In our study, the frequency of various ocular pathologies detected on B-scan ultrasonography in patients of blunt ocular trauma were as follows; Vitreous haemorrhage was most common and seen in 49 (38.58%) patients followed by Retinal detachment in 28 (22.05%) patients, Intra-ocular

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foreign bodies were seen in 15 (11.81%) patients and endophthalmitis in 14 (11.02%) patients. This all data (age, gender, duration of trauma, source of trauma (stone/wood/hand/blast/fall), place of living (rural/urban) and ocular pathologies i.e. vitreous haemorrhage, retinal detachment, intraocular foreign body and endophthalmitis (yes/no)) was recorded on a specially designed proforma. The collected information was analyzed by computer software SPSS version 25.0. Mean and standard deviation were calculated for quantitative variables i.e. age and duration of trauma. Frequency and percentage were calculated for qualitative variables i.e. gender, source, trauma (stone/wood/hand/blast/fall), place of living (rural/urban) and ocular pathologies i.e. vitreous haemorrhage, retinal detachment, intraocular foreign body and endophthalmitis (yes/no). Effect modifiers like age, gender, duration of trauma, source of trauma (stone/wood/hand/blast/fall) and place of living (rural/urban) were controlled through stratification. Post-stratification chi-square was applied to see their effects on different ocular pathologies and a p-value ≤ 0.05 was considered significant.

Results

The age range in this study was from 15 to 65 years with a mean age of 35.13 ± 9.93 years. The majority of the patients 62.99% were between 15 to 40 years of age. Out of these 127 patients, 91 (71.65%) were males and 36 (28.35%) were females with male to female ratio of 2.5:1. Mean duration of injury in our study was 6.83 ± 2.41 days. In my study, the frequency of various ocular pathologies detected on B-scan ultrasonography in patients of blunt ocular trauma was as follows; Vitreous haemorrhage was most common and seen in 49 (38.58%) patients followed by Retinal detachment in 28 (22.05%) patients, Intra-ocular foreign bodies were seen in 15 (11.81%) patients and endophthalmitis in 14 (11.02%) patients as shown in Table I.

Stratification of Vitreous Hemorrhage concerning age, gender, and duration of trauma is shown in Table II. Stratification of Retinal detachment concerning age, gender, and duration of trauma is shown in Table III. Stratification of Intra-ocular foreign bodies concerning age, gender, and duration of trauma is shown in Table IV. Stratification of endophthalmitis concerning age, gender, and duration of trauma is shown in Table V.

Table 1: Frequency of various ocular pathologies detected on B-scan ultrasonography in patients of blunt ocular trauma

Ocular pathologies	Frequency (%)	
	Yes	No
Vitreous Hemorrhage	49(38.58%)	78(61.42%)
Retinal Detachment	28(22.05%)	99(77.95%)
Intra-ocular Foreign Bodies	15(11.81%)	112(88.19%)
Endophthalmitis	14(11.02%)	113(88.98%)

Table 2: Stratification of Vitreous Hemorrhage concerning age, gender, and duration of trauma

		Yes	No	P-value
		(n=49)	(n=78)	
Age (years)	15-40	33 (41.25%)	47 (58.75%)	0.421
	41-65	16 (34.04%)	31 (65.96%)	
Gender	Male	34 (37.36%)	57 (62.64%)	0.653
	Female	15 (41.67%)	21 (58.33%)	
Duration of trauma (days)	≤ 7	23 (30.67%)	52 (69.33%)	0.028
	8-13	26 (50.0%)	26 (50.0%)	

Table 3: Stratification of retinal detachment concerning age, gender, and duration of trauma

		Yes	No	P-value
		(n=28)	(n=99)	
Age (years)	15-40	20 (25.0%)	60 (75.0%)	0.295
	41-65	08 (17.02%)	39 (82.98%)	
Gender	Male	16 (17.58%)	75 (82.42%)	0.054
	Female	12 (33.33%)	24 (66.67%)	
Duration of trauma (days)	≤ 7	18 (24.0%)	57 (76.0%)	0.524
	8-13	10 (19.23%)	42 (80.77%)	

Table 4: Stratification of Intra-ocular Foreign Bodies concerning age, gender and duration of trauma

		Yes	No	P-value
		(n=15)	(n=112)	
Age (years)	15-40	11 (13.75%)	69 (86.25%)	0.377
	41-65	04 (8.51%)	43 (91.49%)	
Gender	Male	09 (9.89%)	82 (90.11%)	0.286
	Female	06 (16.67%)	30 (83.33%)	
Duration of trauma (days)	≤ 7	06 (8.0%)	69 (92.0%)	0.110
	8-13	09 (17.31%)	43 (82.69%)	

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Table 5: Stratification of endophthalmitis concerning age, gender and duration of trauma

		Yes (n=14)	No (n=113)	P-value
Age (years)	15-40	08 (10.0%)	72 (90.0%)	0.631
	41-65	06 (12.77%)	41 (87.23%)	
Gender	Male	07 (7.69%)	84 (92.31%)	0.057
	Female	07 (19.44%)	29 (80.56%)	
Duration of trauma (days)	≤7	07 (9.33%)	68 (90.67%)	0.465
	8-13	07 (13.46%)	45 (86.54%)	

Discussion

Estimates on global data suggest that each year around 1.6 million people become blind due to ocular trauma, while an additional 2.3 and 19 million suffer from bilateral low vision and unilateral blindness/low vision respectively (5). Early diagnosis and intervention are of utmost importance in preventing blindness in such cases. In developing countries like Pakistan, the burden on the healthcare system due to ocular trauma is overwhelming with around 7% of admissions to Ophthalmology wards related to ocular trauma (6). Such injuries can readily be investigated by ultrasound, which is of particular value when the light-conducting media is opacified by haemorrhage or another injury (7). B-Scan is the most important routine investigation to be done in cases of blunt ocular trauma, especially in the presence of media opacities like Hyphaema, Corneal oedema, and Traumatic cataracts which are very commonly seen findings of ocular trauma (8).

Ultrasonography can function to diagnose intraocular pathology immediately following ocular trauma when no additional imaging is possible (9). The seminal study in penetrating ocular trauma by Rubsamen et al (10). Demonstrated 100% sensitivity and specificity for preoperative ultrasound diagnosis of retinal detachments and intraocular foreign bodies (IOFBs) in 46 patients. More recently, ultrasound has had comparable results to CT scans in assessing ocular blast injuries in a military setting (10,11).

The age range in this study was from 15 to 65 years with a mean age of 35.13 ± 9.93 years. The majority of the patients 62.99% were between 15 to 40 years of age. Out of these 127 patients, 91 (71.65%) were males and 36 (28.35%) were females with male to female ratio of 2.5:1. Frequency of vitreous hemorrhage was 49 (38.58%) followed by Retinal detachment in 28 (22.05%) patients, Intraocular foreign bodies were seen in 15 (11.81%) patients and endophthalmitis in 14 (11.02%) patients. A study showed vitreous haemorrhage to be the most common B-scan finding in ocular trauma (31.5%) while 19.8% of patients had no abnormality detected on the B-scan. Retinal detachment was present in 17.9% of patients, intraocular foreign body in 9.9% and endophthalmitis in 7.4%. (4).

In another study, total number of patients was 79, including 78 males (98.73%) and 1 female (1.26%). Age ranged from 5 to 60 years with a mean of 23.43 ± 10.67 years. The interval between the time of injury and presentation to an ophthalmologist ranged from 1 to 10 days in 44 patients (60 eyes) and was more than 10 days in 35 patients (48 eyes). The most common type of injury was corneal/scleral perforation (48.14%) followed by vitreous haemorrhage (38.88%) and traumatic cataract (30.55%) (12).

In one study, ultrasonography detected one or the other pathology in 21% of ocular trauma cases. The vitreous membrane was seen in 7%, RD in 6%, vitreous haemorrhage in 4% & IOFB in 4% of cases (13). In another study, ultrasonography revealed RD in 17 (13%), vitreous haemorrhage in 14 (10.7%), macular oedema in 14 (10.7%), endophthalmitis in 12 (9.2%), PVD in 7 (5.4%) and Panophthalmitis in 1 (0.7%) eyes (14). Djosevska ED, in his study, detected vitreous haemorrhage in 20.9% of eyes, RD in 4.4%, endophthalmitis in 3.3%, PVD in 3.8%, IOFB in 6.6% and choroidal detachment in 1.1% eyes on ultrasonography (15).

Traumatic vitreous haemorrhage from all sorts of traumatic insults (blunt, penetrating, surgical trauma, birth trauma, abusive head trauma, etc.), despite being uncommon, accounts for the majority of vitreous haemorrhages (VH) in children and adolescents, ranging from 54.3 to 82.5% of all causes of VH (16,17).

In a study (18). on 72 traumatic eyes, the traumatic ocular findings seen on B-scan were cataract alone 11 cases (15.3%), IOFB 10 cases (13.8%), retinal detachment alone 6 cases (8.3%), vitreous haemorrhage alone 5 cases (6.9%), hyphema alone 5 cases (6.9%), and combined lenticular-vitreoretinal abnormalities 35 cases (48.6%) (18).

Conclusion

This study concluded that vitreous haemorrhage was the most common pathology on B-scan ultrasonography in ocular trauma followed by retinal detachment and intraocular foreign bodies. So, we recommend that the B-scan ultrasonography should be done carefully in ocular trauma patients for proper evaluation of posterior segment pathologies so that timely diagnosis and appropriate management can be done.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-TCHMMC-0243/22)

Consent for publication

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The authors declared the absence of a conflict of interest.

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Conception of Study, Final approval of manuscript.

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