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ROLE OF B-SCAN ULTRASONOGRAPHY IN EVALUATING DIFFERENT MANIFESTATIONS OF BLUNT OCULAR TRAUMA

Ophthalmology

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ABSTRACT

Purpose: One of the most difficult clinical examinations for an ophthalmologist is that of a traumatised globe. Due to severe pain the patient may be unable to open the eyelids. Also, the trauma may result in opacification of the cornea, anterior chamber or lens and vitreous haemorrhage resulting in poor visualisation. The aim was to study the efficacy of B-scan ultrasonography in diagnosis of various manifestations of blunt ocular trauma. **Methods:** 50 patients with blunt ocular trauma were included in our study group. After all routine ophthalmological examination procedures including X-ray orbit, B-scan ultrasonography was done in all patients irrespective of media opacity. B-scan ultrasonography was done by using the 'Biomedix Echovue' ocular ultrasonography equipment with 10 MHz probe frequency. **Results:** Commonest mode of ocular trauma was road traffic accidents which was followed by assault and domestic work injuries. Most of the cases had involvement of anterior segment either alone or along with associated posterior segment involvement. Conjunctival congestion, subconjunctival hemorrhage and lid injuries were the most common anterior segment injuries, while the most common posterior segment manifestation was vitreous hemorrhage followed by retinal detachment . With the help of B-scan Ultrasonography we diagnosed 16 cases of vitreous hemorrhage, 8 cases of retinal detachment and 2 cases of posterior vitreous detachment, which corresponded to the clinical findings. **Conclusion:** Following trauma, when the cornea, anterior chamber, lens and vitreous are traumatized, it becomes very difficult to diagnose the manifestations beyond these structures, where B-scan USG provides valuable information about structures beyond the haziness. B-scan USG has been found to be sensitive and accurate in diagnosing different manifestations of blunt ocular trauma.

KEYWORDS

B-scan Ultrasonography, blunt ocular trauma, vitreous hemorrhage, retinal detachment.

Ocular trauma, once described as a neglected disorder, has recently been highlighted as one of the major causes of monocular and noncongenital visual impairment and blindness. Globally, approximately 1.6 million people are blind from ocular trauma, 2.3 million have bilateral visual impairment and 1.9 million have unilateral visual loss. Prevalence of ocular trauma has been reported to be 2.4% in a population of urban city of India, 11.4% of which are blind.[1]

A blunt trauma delivered the ocular, periocular or cranial region may produce ocular damage by either one or a combination of mechanisms such as coup, countercoup (rebound injury) or direct ocular compression. Prognosis in a case of blunt ocular trauma remains unpredictable and may range from complete recovery to permanent, complete loss of vision. Maculopathy and consequent loss of vision may be a sequel of direct trauma to eye. A subretinal haemorrhage, choroidal tear and resultant irregularities at the retinal pigment epithelium (RPE) Bruch's membrane may be involved in these cases.

One of the most difficult clinical examinations for an ophthalmologist is that of a traumatised globe. The patient may be in severe pain and unable or unwilling to open the eyelids. Also, the trauma may result in opacification of the cornea, anterior chamber or lens and vitreous haemorrhage resulting in poor visualisation.

Ultrasonography provided the first method for visualization of orbital and ocular diseases (Dallow RL; 1974)[2], and proved to be a major advancement in ophthalmic imaging. The most common and useful mode of ophthalmic imaging technique is B-scan ultrasonography. Ultrasonography has become the most useful method for evaluating an eye with hazy ocular media. It provides an instantaneous view into the interior of the eye. It is a painless and non-invasive procedure that can be performed easily in the clinic, at the patient bedside or in the operating room. This study was performed to study the efficacy of B-scan ultrasonography in diagnosis of various manifestations of blunt ocular trauma.

METHODS:

This observational cross-sectional study was conducted on 50 patients with blunt ocular trauma resulting in closed globe injury during the period of one year from July, 2021 to June, 2022. Cases of open globe injury and penetrating eye injury and known cases of anterior and posterior segment pathology were excluded from the study.

In all patients the routine examination procedures like Visual acuity, torch light examination, slit lamp examination, tonometry, direct ophthalmoscopy, indirect ophthalmoscopy, and X-ray orbit were done. B-scan ultrasonography was done in all patients irrespective of media opacity. Wherever required, other modalities of diagnostic procedures like OCT, FFA, CT-scan orbit and MRI were done to add in clinical diagnosis and for patient's benefit.

In patients with clear media, B-scan USG was done to find out any ocular pathology which is beyond the reach of clinical evaluation. In patients with media opacity, B-scan USG is the only safe diagnostic modality which can be used to evaluate the ocular manifestations following ocular trauma as posterior segment cannot be visualized with routine clinical procedures. B-scan ultrasonography was done by using the 'Biomedix Echovue' ocular ultrasonography equipment with 10 MHz probe frequency. 'Biomedix Echovue' is a new generation multipurpose personal computer based ultrasonic system for ophthalmic applications, intended for visualizing the interior of eye and making measurements inside the eye, including axial length.

Optic nerve was used as an anatomical reference for the posterior fundus, that served as a reference point for the three primary B-scan probe positions viz, transverse, longitudinal and axial. In both transverse and longitudinal scans, the patient's gaze is directed away from the probe, towards the meridian being examined. In the axial scan, the patient fixes in primary gaze and the probe is placed on the centre of the cornea, thereby displaying the lens and optic nerve in the centre of the echogram.

With the patient's gaze directed towards 12 O'clock meridian, the superior portion of the orbit is scanned first. The probe is then oriented horizontally, with its face placed next to the inferior limbus with marker directed nasally. This gives the horizontal transverse scan of the 12 O'clock meridian. Then, the probe is shifted downwards towards the lower fornix thereby examining progressively more anterior aspects of the superior orbit. Similar manoeuvres are followed to scan the nasal orbit by instructing the patient to look medially. The probe is then shifted from limbus to the fornix and thereby entire nasal half of orbit is monitored. The inferior and the temporal aspects of the orbit are then similarly scanned. For axial scans, the patient is asked to fixate in primary gaze and the probe is centred on the cornea.

RESULTS:

In the study the patients included were between the age of 8 years and 61 years. Most of the ocular trauma occurred in the age group of 21 – 30 years. The relative higher incidence in this age group may be due to

more activities and increased exposure to occupational and non-occupational injuries. It was evident that males are more vulnerable to the ocular trauma than females (70% as compared to 30%). The reason might be due to more outdoor activities and more exposure to occupational injuries.

Amongst the different modes of trauma, road traffic accidents (RTA) accounts for most of the cases of ocular trauma (28%) in the present study. It is followed by assault (20%) and domestic injuries (18%). Accidental fall, sports injury and other causes constitute the other modes of trauma to the eye.

In the present study, following blunt ocular trauma 26 (52%) patients presented with clear media, while 24 (48%) had opaque or hazy media, where the posterior segment was not visualized. Most of the cases have multiple injuries of different structures of the eye.

Anterior Segment Morbidities:

The anterior segment of the eye was affected by the trauma alone or in association with many of the posterior segment injuries. conjunctival congestion and subconjunctival hemorrhage was the most common anterior segment injury (48%), followed by lid injuries (46%). The other forms of injuries involving anterior segment were corneal edema, hyphaema, iris injury and lens injury (dislocation and traumatic cataract).

Table1: Anterior Segment Morbidity

Morbidity	No. of cases	Percentage (%)
Lid injury	23	46
Conjunctival congestion & SCH	24	48
Corneal edema	4	8
Hyphema	8	16
Iris injury	1	2
Lens injury (dislocation & cataract)	11	22

*Several cases have multiple involvements

Posterior Segment Morbidity:

Most common posterior segment manifestation following trauma was vitreous haemorrhage (32%) followed by retinal detachment (16%). The other posterior segment morbidities were posterior vitreous detachment, choroidal injury and subhyaloid hemorrhage.

Table2: Posterior Segment Morbidity

Morbidity	No. of cases	Percentage (%)
Vitreous haemorrhage	16	32
Posterior vitreous detachment	2	4
Choroidal injury	1	2
Retinal detachment	8	16
Subhyaloid Haemorrhage	1	2

B-scan Ultrasonographic Findings:

The following table shows the various B-scan ultrasonographic findings.

Table3: B-scan Findings

B-scan findings	Number of cases	Percentage (%)
Cornea & Anterior segment involvement	5	10
Traumatic cataract	3	6
Dislocation/subluxation of lens	3	6
Vitreous hemorrhage	16	32
Posterior vitreous detachment	2	4
Retinal detachment	8	16
Choroidal injury	1	2
Subhyaloid hemorrhage	1	2
Within normal limits	15	30

DISCUSSION:

Study on ocular trauma merits special emphasis because the resultant morbidity may be responsible for serious handicap leading to personal as well as national socio-economic upset. At times detection of different manifestations of the ocular trauma cannot be done clinically when the cornea, lens and the media become opaque due to the injury. In such circumstances, the diagnosis relies largely upon special diagnostic studies like ultrasonography and computerised tomography. In the present study, B-scan ultrasonography was selected for the evaluation of ocular trauma because it provides two-dimensional approach, facilitating orientation and permitting recognition of normal and pathological ultrasonic tissue pattern.

The reported incidence of ocular trauma in relation to age is varied. Most of the authors reported highest incidence of ocular trauma within the first three decades of life. In the present study, 46% cases of ocular trauma were observed in first three decades of life, highest (28%) being in the third decade. Similar findings were reported by Doshi (1968)[3], Olurin (1979)[4], and Ilsar et al (1982)[5]. They found highest incidence of ocular trauma in third decade of life with an incidence of 21%, 32% and 35% respectively. Shukla and Verma (1979)[6] reported the incidence in third decade to be the highest (29.5%).

In the present study, incidence of ocular trauma was found to be extremely high in males (70%) in comparison to females (30%). This may be due to relatively higher exposure to outdoor activities and occupational injuries. The male: female ratio has been found to be 7:3. Other workers have also reported similar findings.[7-9]

In the present study, the commonest mode of ocular trauma was road traffic accidents which contributed to 28% of the cases. It was followed by assault (20%) and domestic work injuries (18%). A study by Raju KV et al reported the common circumstances of ocular trauma to be at play (29.09%) and at home (27.27%), followed by workplace[10]. Badrinath[11] and Banshi krishna et al[12] reported domestic accidents to be responsible for majority of the injuries.

Conjunctival congestion and subconjunctival hemorrhage were the most common anterior segment injuries (48%), followed by lid injuries (46%). Hyphema was found in 16% cases while corneal edema was noted in 8% cases. Lens injury including dislocation and traumatic cataract was found in 22% cases. In a study by Arushi Kakkar et al (2022)[13] found incidence of lid edema and lid ecchymosis in 62.6% and 61.8% cases respectively. They were followed by subconjunctival hemorrhage which was found in 60.6% cases. The study by Raju KV et al[14] reported that 34.55% patients had corneal abrasions and 54.55% had hyphaema. In the same study incidence of traumatic cataract was 12.73%. A study by Henry[15] showed the incidence of traumatic cataract as 11%, while the study by Britten reported it to be 15%.

The most common posterior segment manifestation was vitreous hemorrhage (32%), followed by retinal detachment (16%). Posterior vitreous detachment was seen in 4% patients, while choroidal injury and subhyaloid hemorrhage were seen in 2% each. The study by Henry MM[15] noted incidence of vitreous hemorrhage in 10% cases, while Britten[16] noted it to be 15%. In the same study by Henry, the incidence of chorioretinal injuries was 14%, while Britten reported it to be 18%. The study by Raju KV et al[10] reported 21.82% incidence of vitreous hemorrhage, while 3.64% had retinal detachment and 9.09% had choroidal tear. Krishnan and Sreenivasan (1988)[17] reported incidence of vitreous hemorrhage to be 20.7%.

In the present study, with the help of B-scan Ultrasonography we diagnosed 16 cases of vitreous hemorrhage, 8 cases of retinal detachment and 2 cases of posterior vitreous detachment, which were similar to the clinical findings. Thus, the sensitivity of B-scan was 100% in diagnosing these manifestations of blunt ocular trauma. In a study by Atta HR[18], a total of 66 cases of vitreous hemorrhage were clinically diagnosed, which were correctly identified on B-scan subsequently. They found no incorrect diagnosis. Thus, B-scan ultrasonography is an accurate method of diagnosing vitreous hemorrhage. Taraprasad Das and P. Namperumalsamy (1987)[19] analyzed and described 175 recent and old traumatized eyes in the presence of opaque ocular media. Out of them Ultrasonography detected 34 cases of vitreous haemorrhage, 33 cases of cataract, 12 cases of intraocular foreign body and 22 cases of retinal detachment.

Not only the nature of the lesion but also the exact dimension of the globe can be known precisely by B-scan USG. Again, the procedure is repeatable and without any hazards whatsoever. Its ability to differentiate between fresh and old vitreous haemorrhage, helps in predicting the possible prognosis, in addition to proper planning and execution of surgery.

CONCLUSION:

clinical examination along with routine investigations like X-rays may

not be adequate for the diagnosis and management of a case of blunt ocular trauma, particularly those with hazy optical media and with posterior segment involvement. B-scan USG has been found to be sensitive and accurate in diagnosis of the different manifestations of blunt ocular trauma. Not only the nature of lesions but also the exact dimension of the globe can be precisely known. It is a rapid and non-invasive diagnostic tool that supplements the general clinical approach by detecting, locating and finding the extent and nature of the lesion.

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