Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/11188
DOI URL: http://dx.doi.org/10.21474/IJAR01/11188

RESEARCH ARTICLE

TO EVALUATE THE USEFULNESS OF OPHTHALMIC ULTRASONOGRAPHY IN CASES OF OCULAR TRAUMA AT TERTIARY CARE HOSPITAL OF RURAL INDIA

Ketaki J. Shah[1], Anjali S. Khairnar[1], Kashinath G. Chaudhary[2], Mukaram Khan[3] and Viral Shah[4]

1. Assistant Professor, Department of Ophthalmology, Shri Bhausaheb Hire Government College, Dhule Maharashtra.
2. Professor and Head Dept of Ophthalmology, Shri Bhausaheb Hire Government College, Dhule, Maharashtra.
3. Associate Professor, Department of ophthalmology, Shri Bhausaheb Hire Government College, Dhule Maharashtra.
4. Consultant, Niyakshi Eye Hospital, Nagpur, Maharashtra.

Manuscript Info

Manuscript History
Received: 15 April 2020
Final Accepted: 18 May 2020
Published: June 2020

Key words:-
Ophthalmology ultrasound, Bscan, Ocular Trauma

Abstract

We evaluated utility of Bscan for rapid and accurate diagnosis of ocular pathologies in trauma cases. After due permission from the ethical committee a retrospective cohort analysis was done on 87 patients of ocular trauma presenting between June 2018 to June 2019. Patient's primary history documented and ophthalmic examination with torchlight, Snellen's visual acuity chart, slit lamp biomicroscope and fundus evaluation done. Later B scan was done by closed eye technique with 9MHz probe of Toshiba Aplio 400 ultrasound machine. Young males between 18-40 age group with low socioeconomic strata were more affected. Total traumatic cataract seen in 6 cases. Retinal pathology like vitreous hemorrhage (28 cases), retinal detachment (17cases) seen. Ophthalmic ultrasound is an effective, non- invasive and essential guide for early and accurate diagnosis in ocular injury with hazy media. It helps in further management and can prevent potential blindness.

Introduction:-

Ocular trauma is a major cause of preventable monocular blindness and visual impairment throughout the world. Despite having major socioeconomic impact very less information on magnitude and risk factors is available. A review suggested that at least half a million people are monocularly blind from ocular trauma worldwide.[1,2] Ocular emergencies account for 3% of all emergency department visits.[3]Due to proximity to brain and complexity of ocular tissues eye injuries are difficult to assess. Cruciani et a[l4] said eyes are the third most common site in the body to be affected by blunt trauma.

The International Society for Ocular Trauma's classification distinguishes between closed and open globe trauma. An open globe injury involves a full-thickness laceration of the corneoscleral wall which may result from penetrating or blunt eye trauma. These include penetrating or perforating injuries and intraocular foreign bodies (IOFBs). Closed globe injuries are more commonly due to blunt trauma in which the corneoscleral wall remains intact.[5]

Corresponding Author:- Dr. Viral Shah
Address:- Consultant, Niyakshi Eye Hospital, Nagpur, Maharashtra.

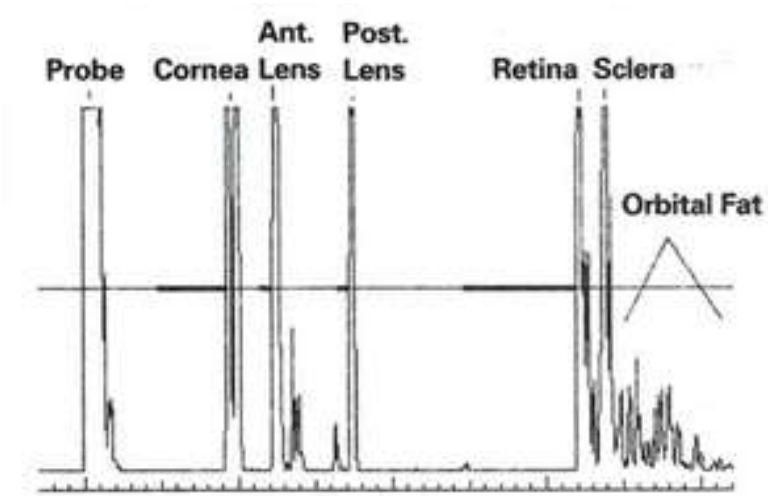
In our study we found accidental trauma was the most common cause of ocular injury. This cause is in contrast to findings in Korea, where traffic accidents [6] while in Nigeria, traffic accidents, assault, and gunshots are the most common causes of ocular injury.[7]

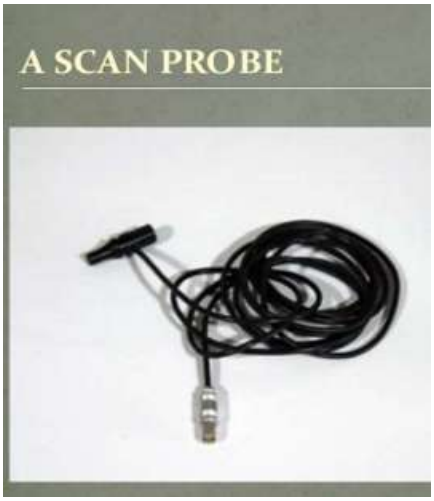
The first use of ultrasound in ophthalmology was by Mundt and Hughes[8] where A-scan mode was used to evaluate an intraocular tumor. Baum and Greenwood [9] were first to introduce B-scan into ophthalmology. Since then bedside ophthalmic ultrasound has become the first investigation of choice in many developing countries. Even though with the advent of new modalities like MRI, CT, UBM (ultrasound biomicroscope) this remains an investigation of choice in cases with ocular injuries.

A scan:
It is also known as amplitude scan. It works on Piezoelectric phenomenon and Acoustic impedance.[10] Procedure-The ultrasound traducer positioned in a way that ultrasonic beam passes through ocular structures. It gives a series of spikes whose height depends on the acoustic density of the tissue. The distance between spikes gives a measure of the distance between ocular tissue and its distance from the transducer.

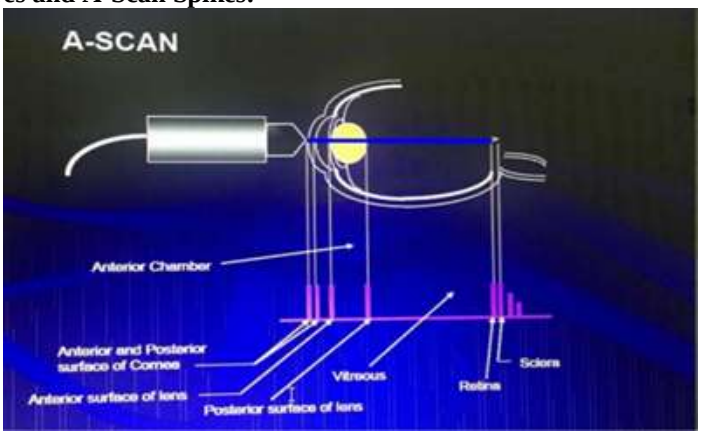
A-scan adds quantitative information like structure (regular or irregular), sound attenuation and the internal reflectivity.

Its one-dimensional scan and useful for:
1. Measurement of Axial length for IOL power calculations.
2. Measurement of Anterior Chamber depth, lens thickness or depth of the lesion.
3. To measure the corneal thickness (pachymetry).





Typical Ocular Structures and A-Scan Spikes:



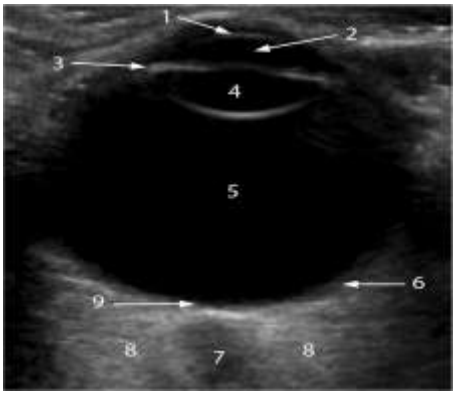
B Scan:
This is the Brightness Scan. Ocular ultrasonography was initially investigated in the clinical setting in the late 1960s and early 1970s. The limitations placed on a resolution by primitive equipment greatly restricted the evaluation of ocular diseases until the 1990s.

The clinical use of ophthalmic ultrasound has increased dramatically over the past twenty years and it has been considered as an essential means of soft tissue examination of the eye and orbit. Ultrasound is an acoustic wave in which compressions and rarefactions occur due to changes in density within a fluid and solid substances. The soft tissue and fluid contents of the globe provide a perfect acoustic window for the identification of ocular anatomy and pathology. It is a system that incorporates a greyscale,and the relative brightness of a displayed echo helps the examiner in identifying the corresponding tissue.

The 8 MHz transducer is a dedicated A-scan probe and the 10-15 MHz transducer is a combined B-mode and A-mode probe. When performing transverse B-scans, the sound is aimed opposite the probe position and the resulting image should be labelled with the clock hour that is centered in the echogram.

The ultrasound frequency of current contact B-scan transducers is around 10 MHz. The new generation, higher-resolution probes have frequencies that range from 20 to 100 MHz. The 20 MHz probe produces an image that is 10-mm wide, 12-mm deep, and provides resolution in the 75micromm range. The eye is a fluid-filled structure, it provides a perfect acoustic window, producing images with excellent detail. The normal eye appears as a circular hypoechoic structure.

The echogenicity of different structures:
The cornea is seen as a thin hypoechoic layer parallel to the eyelid. The anterior chamber is filled with anechoic fluid and is bordered by the cornea, iris and anterior reflection of the lens capsule. The iris and ciliary body are seen as echogenic linear structures extending from the peripheral globe towards the lens. The normal lens is anechoic. The normal vitreous chamber is filled with anechoic fluid. Vitreous is relatively echoed lucent in a young healthy eye. Ultrasonographically, the normal retina cannot be differentiated from the other choroidal layers.
The evaluation of the retrobulbar area includes optic nerve, extraocular muscles and bony orbit. The optic nerve is visible posteriorly as a hypoechoic linear region radiating away from the globe.

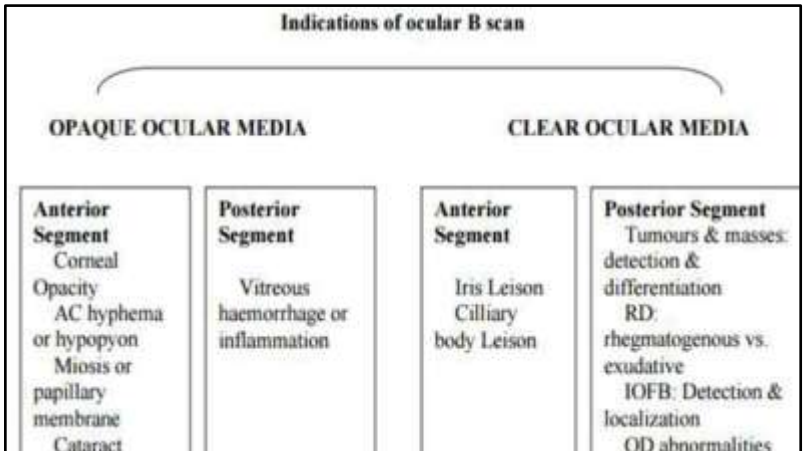


The cornea (1) is visualized as the most superficial echogenic curved line; the anterior chamber (2) is anechoic. The ris (3) appears as a thin echogenic line. The lens (4) is defined by anterior and posterior boundary echoes, but the lens itself is echo-free. The vitreous chamber (5) is filled with a clear gel-like substance that is normally echo-free, although the formation of spots and linear echoes with ageing is considered normal. The RCS complex (6) forms the wall of the posterior ocular segment; it is seen as an echogenic concave line extending from the iris plane to the optic nerve (ON; 7). The ON is seen as a hypoechoic band surrounded by echogenic retrobulbar fat (8). The circular area where the ON connects to the retina is the optic disc or papilla (9).

Sonographic appearance of the structures of the normal eye:
Following ocular trauma, indirect ophthalmoscopy is frequently impossible. Because of the opacified media due to hyphema, cataract formation, vitreous hemorrhage, or edematous eyelids, and often poor patient cooperation ophthalmic USG can supplement clinical findings. It can help in planning further management.

Ophthalmic ultrasound is inexpensive, fast, and readily available in most radiology departments. Cost-effectiveness is an important consideration in rural areas of low-income countries. Indications for ultrasound assessment in ocular trauma include determination of the extent of the injury, the involvement of the posterior segment, preoperative prognostication of cases, and medico-legal documentation. B Scan is advised whenever opacification of the media prevents adequate clinical examination of either the anterior or posterior segments.

Adaptation of ultrasound technology in emergency ophthalmology department has led to accurate diagnosis and timely intervention of many treatable conditions like lens subluxation, vitreous hemorrhage, retinal detachment, vitreous detachment and intraocular foreign body. Retinal detachment can be difficult to detect on physical examination specially a small one in the periphery in the early weeks of the injury can rapidly escalate causing vision loss.



Aims and Objectives:-

To evaluate usefulness and accuracy of ophthalmic sonography (B Scan) in patients with ocular trauma.

Inclusion criteria:
1. Patients with ocular injuries.
2. Age 5 years to 65 years.
3. Both Sexes.
4. Diminution of vision or total loss of vision due to trauma.
5. A suspected intraocular foreign body or posterior segment trauma.

Exclusion criteria:
1. Patients of intraocular injuries.
2. Unco-operative patients.
3. Refusal for written consent.
4. Severely injured or unconscious patients.

After getting permission from the ethical committee of Shri Bhausaheb Hire government medical college, Dhule, Maharashtra study was conducted in the department of ophthalmology and radiology.

It is a retrospective cohort study which included a total of 87 cases with all types of ocular injuries presenting between June 2018 to June 2019. Out of 87 cases, 69 were male and 18 were females i.e.3: 1 ratio observed. The most common age group,18-35 years and industrial workers and manual laborer were the main victims.

Material and Methods: -

1. The study protocol approved by the institutional review board and permission received.
2. Informed written consent obtained.
3. The collected data were coded, processed, tabulated, and analyzed using the statistical product.

Detailed history regarding nature and cause of injury, the treatment took elsewhere and coexisting medical and ocular conditions noted. Snellen's chart used to record visual acuity. In a few cases with lid swelling and profound facial trauma visual acuity could not be assessed immediately. The anterior and posterior segment evaluated with slit-lamp (Keeler)and direct ophthalmoscope, 90D Volk lens and Indirect Ophthalmoscope respectively. Intraocular pressure (IOP) was measured with a Goldman Applanation Tonometer (GAT) or digitally assessed. After taking written consent patients were sent for ultra-sonographic evaluation.

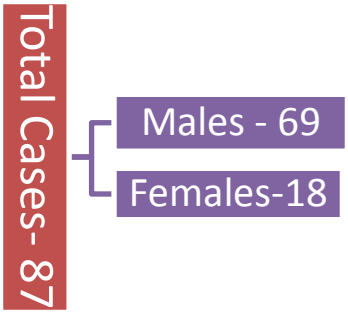
In the radiology department, B scan was done with the help of linear 9MHz probe of Toshiba Aplio 400 machine. A standard water-soluble ultrasound transmission gel should be applied to the patients closed eyelid. Each globe assessed in both sagittal and transverse planes in detail along with retrobulbar area.

Results:-

In this study, 73(83.9%) cases out of 87 had a mechanical injury due to blunt trauma (closed globe injury) while 14 (16.09%) had a penetrating injury. Various ocular pathologies like anterior subluxation of lens seen in 14 patients, total traumatic cataract seen in 6 cases while the posteriorly dislocated lens observed in 3 patients. Retinal pathology like vitreous hemorrhage (17 cases), retinal detachment (28 cases) were seen in our patients. Out of 28 cases of retinal detachment,1 case had a small central serous detachment in the periphery and had a history of trauma with the ball.

In our study male were more affected as they usually involved in outdoor activities and vehicular accidents. 69 patients were male and the most common age group was 18-45 years with low socioeconomic strata. Three pediatric cases had vitreous hemorrhage and cataract due to injury with the ball.

Sex Ratio:



Causative Agents for Injuries:

Causative Factor/ Agent	No. Of Cases
RTA leading to fall	64
Industrial Machine Sharp parts	16
Toys/Ball	03
Stick/Stone	4

Age Distribution of Injuries:

Age Group	No. of Patients
2-12	03
13- 40	48
41- 65	27
65 and above	09

Types of Injuries:

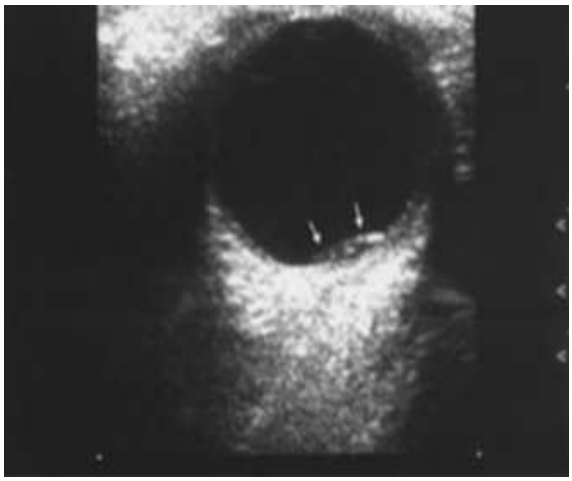
USG B scan Findings	No. of Cases (N= 87)
Anterior Lens Dislocation	14
Posterior Lens Dislocation	05
Mature Cataract	07
Hyphema	09
Vitreous Haemorrhage	32
Retinal Detachment	18
IOFB	02

B Scan of ocular diseases:

Vitreous Hemorrhage

Retinal Detachment

Intraocular Foreign Body (IOFB)



Serous Detachment

Anterior Lens dislocation

Review of Literature:-

A study done by Brambhatt et al[12] found that ultrasound scan is a useful imaging modality for diagnosis of various ocular conditions due to trauma especially in rural areas of India.

Mateer et al[13]described an article regarding emergency ultrasound training in 1994. They have explained 6 applications of ultrasonography but currently with newer sophisticated instruments and improved technology wide applications of ocular ultrasound are seen.

In our study males outnumbered females in the ratio of 3:1. This age and gender distribution are consistent with those of published reports by Cao et al[1] and Nzeh et al[14]in China and Nigeria respectively.

Road traffic accidents the most common cause for ocular injuries in the study done by Pai Et al[15]while Elshafie Et al[16] reported stick/stone related trauma. Solimar et al[17]said that penetrating injuries from gunshots, missiles and blast injuries were common.

Vehicular accidents and industrial work are common culprits in our study for various ocular injuries. These workers are unaware of safety practices like the use of protective devices similarly reported by Okeigbemen et al [17] In Korea[6] road traffic accidents and Nigeria[7] RTA, gunshot and assaults reported causes of ocular trauma.

Eze et al[7] found abnormal B scan findings were retinal detachment (26.87%) and vitreous hemorrhage (25.37%). A study done by Yusuf &Ahmad et al [18] in Sudan showed that traumatic cataract is the most common pathology. A study done by Ghafari et al [19] showed that nearly 50-60% cases had hyphema due to blunt trauma and 3 cases had total hyphema.

A study by Elshafie Et al[16]had 2 cases with total traumatic cataract with posterior capsular rupture, it was diagnosed only on USG. Research done by Ozougwu NS et al[20] found that vitreous hemorrhage followed by retinal detachment as a major US finding.

A study published in 2004 by Scott IU et al [21]stated that USG can provide about 95% accuracy in diagnosing posterior segment pathologies.

Blaivas et al[11] said that ultrasound can noninvasively evaluate for lens dislocation, globe rupture, and retrobulbar hemorrhage. The same study also stated usefulness of USG for evaluation of diseases like tumors, anterior chamber disease, extraocular muscle and retinal pathologies.

Okeigbemen et al[17] concluded that though B scan is a useful tool in an emergency, under-reporting of cases, late presentation to the hospital and operator dependence can influence the outcome.

Conclusion:-

Eye injury is the most common cause of visual loss in children and industrial workers which can be prevented by safety measures. Ultrasound scan is a useful imaging modality for examination of the globe in patients with ocular trauma. It aids in planning medical or surgical treatment.

In a developing country like India, ophthalmic ultrasound B scan is an affordable, non-invasive and easily accessible diagnostic facility for ocular injury patients. Though with the advent of CT scan and Ultrasound biomicroscope (UBM) more detailed evaluation of ocular structures can be done whereas in rural setup and developing countries ultrasound B scan modality has proven as the first line of diagnosis in cases of ocular trauma.

References:-

1. Cao H, Li L, Zhang M, Li H. Epidemiology of Pediatric Ocular Trauma in the Chaoshan Region, China, 2001–2010. PLoS ONE. 2013;8(4)
2. Al-Mahdi HS, Bener A, Hashim SP. Clinical pattern of pediatric ocular trauma in fast developing country. Int EmergNurs. 2011;19(4):186–91.
3. Rosen P (ed). Emergency Medicine Concepts and Clinical Practice, ed 4. St. Louis: Mosby, 1997, pp 2243–5.
4. Cruciani F, Lucchetta F, Regine F, Salandri AG, Abdolrahimzadeh B, BalaccoGabrieli C. Work-related accidents of ophthalmologic interest in Italy during 1986–1991. Ophthalmologica 2001; 211:251–255.
5. Kuhn F, Morris R, Witherspoon CD, Heimann K, Jeffers JB, Treister GA. A standard classification of ocular trauma. Graefes Arch Clin Exp. Ophthalmol 1996; 6: 399-403.
6. Chang NS, Kim JH, Kim JC, Park CH, Cho JS, Rhee BC, et al. Ultrasonography of ocular trauma patients. J Korean Radiol Soc 1990; 26:1138-43.
7. Eze KC, Enock ME, Eluehike SU. Ultrasonic evaluation of orbito-ocular trauma in Benin-city, Nigeria. Niger Postgrad Med J 2009; 16:198-202.
8. Mundt GH, Hughes WF. Ultrasonics in ocular diagnosis. Am J Ophthalmol. 1956; 41: 488-498.
9. Baum G, Greenwood I. The application of ultrasonic locating techniques to ophthalmology-part 2. Ultrasonic visualization of soft tissues. Arch Ophthalmol. 1958; 60: 263–279.
10. The Essentials of Ophthalmology by Dr. SamarBasak 6th edition; page no 545.
11. Blaivas M. Bedside emergency department ultrasonography in the evaluation of ocular pathology. AcadEmerg Med. 2000; 7:947–50.
12. Jyotindra N Brambhatt, Akshay V Sahayata, Mansi V Sahayata, Himani V Chavda: NJMR, Volume 6, Issue 3, July – Sep 2016.

13. Mateer J, Plummer D, Heller M, et al. Model curriculum for physician training in emergency ultrasonography. Ann Emerg Med. 1994; 23:95–102.
14. Nzeh DA, Owoeye JF, Ademola-Popoola DS, Uyanne I. Sonographic evaluation of ocular trauma in Ilorin, Nigeria. Eur J Ophthalmol 2006; 16:453-7.
15. Pai SG, Kamath SJ, D'Souza S, Dudeja L. A clinical study of blunt ocular trauma in a tertiary care centre. Online J Health Allied Sci 2013; 12:10.
16. Mohamed A. Elshafie, Hossam Y. Abouelkheirb, Maha M. Othmanb, Eman M. Elhefnyb. Ultrasonic evaluation of eyes with blunt trauma. Journal of the Egyptian Ophthalmological Society 2018, 111:20–24.
17. Okeigbemen VW, Omoti AE, OvienriaW.Pattern of ocular injuries and use of protective eye devices among welders. J Med Biomed Res 2012; 11: 5–13.
18. Yusuf AY, Ahmad HA. B-scan ultrasonography in ocular trauma in Al-Obeid, Sudan. Sudanese J Ophthalmol 2017; 9:55-6.
19. Ghafari AB, Siamian H, Aligolbandi K, Vahedi M. Hyphema caused by trauma. Med Arch 2013; 67:354–356.
20. Ozougwu NS1, Adeyekun AA*1, Ese-Onakewhor NJ2, Efe-Aluta EE1 Sonographic features of patients with ocular trauma at the University of Benin Teaching Hospital, Benin-City, Annals of Health Research Volume 4, Issue No 2: 174-181, July-December 2018.
21. Scott IU, Smiddy WE, Feuer WJ, Ehlies FJ. The impact of echography on evaluation and management of posterior segment disorders. Am J Ophthalmol. 2004; 137(1): 24-29.