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ORIGINAL RESEARCH

Sonographic features of patients with ocular trauma at the University of Benin Teaching Hospital, Benin-City

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Abstract

Background: The human eye is vulnerable to various external injuries. This is in spite of the seemingly adequate protection offered by the bony orbit. Ultrasound, as a non-invasive and safe imaging modality, is very useful in evaluating the orbit as the globe provides a perfect acoustic window. There is a need for an update on the sonographic patterns of ocular trauma in Nigeria.

Objective: To sonographically assess the features of ocular trauma at the University of Benin Teaching Hospital.

Methods: Eighty patients with ocular injuries were studied over an 8-month period. After detailed history taking, using a closed eye technique, each patient was scanned with a 5-12MHz linear array probe of a SONOACE X4 Machine.

Results: The 18-35 years age group was most affected and the right eye was more frequently involved. The most common sources of injury were intraocular foreign bodies (26; 32.5%), assault (20; 25%) and road traffic accidents (18; 22.50%). Mechanical injuries were more common, comprising 44 (56.4%) cases of blunt trauma and 34 (43.6%) cases of penetrating trauma. The most common sonographic findings included vitreous haemorrhage, intraocular foreign bodies and retinal detachment.

Conclusion: Posterior chamber findings (vitreous haemorrhage and retinal detachment) were more frequent than anterior chamber findings in ocular trauma.

Keywords: Assault, Intra-ocular foreign body, Ocular trauma, Retinal detachment, Ultrasound, Vitreous haemorrhage.

Introduction

Worldwide there are approximately 1.6 million people who are blind from eye injuries, and trauma is the most common cause of unilateral blindness. [1] Young males are more affected by eye injuries with attendant socioeconomic implications from the loss in productivity. [2, 3]

The injuries can be mechanical or non-mechanical. Mechanical injuries can be blunt or penetrating, caused by sharp objects and high-velocity foreign bodies, for example, due to blasts. Non-mechanical injuries can be physical

or chemical, commonly from workplace activities, household implements, combat sports and road traffic accidents. [4, 5]

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 intra-ocular foreign bodies (IOFBs). Conversely, closed globe injuries are more commonly due to blunt trauma in which the corneoscleral wall remains intact [6] The clinical picture varies, depending on the mechanism and severity of trauma. Mild manifestations include conjunctival haemorrhage and corneal surface abrasions. Moderate manifestations include eyelid, canalicular or conjunctival lacerations and superficial corneal foreign bodies, while severe injuries include a wide range of eyelid avulsion and defects, penetrating eye injuries, intra-ocular foreign bodies, contusions, haemorrhage and orbital fractures. The anterior segment structure (cornea, conjunctiva, trabecular meshwork, iris and crystalline lens) are more vulnerable to direct trauma, with a worse outcome in combined anterior and posterior segment (retina, choroid and optic nerve) injuries. [7,8]

Ultrasound evaluation of the eye provides a quick and non-invasive method for evaluating both the globe and orbit for many conditions, including trauma. Indications for ultrasound assessment in ocular trauma include determination of the extent of the injury, the involvement of the posterior segment, pre-operative prognostication of cases, and medico-legal documentation. The soft tissue and fluid contents of the globe provide a perfect acoustic window for the identification of ocular anatomy and pathology. When used in conjunction with clinical examination, more lesions may be identified, especially in the posterior eye segment.

The aim of this study was to identify, by means of ultrasound, the pattern of eye injuries in Benin-City, Nigeria.

Methods

This was a descriptive, cross-sectional study of 80 patients who presented with ocular trauma at the Accident and Emergency Unit of the University of Benin Teaching Hospital (UBTH). The UBTH is a tertiary care centre, with a large Accident and Emergency Unit which also handles cases of ocular trauma, and receives referrals on ocular trauma from neighbouring Delta, Ondo and Kogi states. The study was conducted over an eight-month period [September 2013 to April 2014]. Ethical approval for the study was obtained from the Ethics and Research Committee of UBTH.

Informed consent was obtained from patients where possible or from the relatives. Patients who did not give consent and those that presented with globe rupture were excluded. Classification into open (penetrating) and closed injuries was based on the integrity of the corneoscleral wall.

Following brief history and examination, ocular sonography using the closed eye technique was performed for the consecutively recruited patients by one of the authors (SNO), under the supervision of AAA. Each patient was scanned in the supine position after the water-soluble gel was applied to the closed eyelid. Each patient was asked to look straight ahead without clenching the eyelids.

Ocular scanning was done with a linear array probe with a transducer frequency of 7.5 to 10MH_2 (SONOACE X 4 machine; Medison Co: Korea). Each globe was carefully assessed in both sagittal and transverse planes. The chambers of the eyes were studied in detail, as

well as the retrobulbar structures. The demographic data and the relevant clinical information were recorded for each patient.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 17. The entries were double checked for accuracy. Parametric data were summarized using means and standard deviation. Dichotomous variables were presented as frequency counts and charts. The statistical test of significance of the hypothesis between blunt and penetrating trauma, anterior and posterior chamber involvement was done using Chi-Square test and Pearson's correlation.
The level of significance was set at $p < 0.05$ (95% confidence interval).

Results

Eighty patients had emergency ocular scans during the study period; they comprised 67 males (83 .8%) and 13 females (16.2%). The sex distribution was not statistically significantly different ($p = 0.27$). A quarter of the study subjects (19; 24.4%) were engaged in manual occupations as shown in Table I.

Foreign bodies from blasts, (26; 32.5%), blows (20; 25%), and road traffic accidents (RTA) (18; 22.5%) were the common causes of eye injuries. The right eye was more frequently involved (45; 53%) than the left (34; 42.5%); bilateral involvement was seen in only 1 case (1.2%).
Two - thirds of the patients (152; 65.8%) gave a history of visual impairment. Injuries from blows and gunshots frequently resulted in choroidal detachment than those from RTA and falls (25; 31.3% vs. 21; 26.3%, $p = 0.000$), while foreign bodies were seen more frequently in non-intentional injuries compared with intentional injuries from blows (26; 32.5% vs. 20; 25%, $\chi^2 = 3.41$, $p = 0.041$), as shown in Table II.

The most common sonographic finding was vitreous haemorrhage (36; 45.0%), followed by retinal detachment (13; 16.3%) and foreign bodies (16; 20.0%). Other findings were aqueous haemorrhage (11; 13.8%) and lens subluxation (11; 13.8%)—as shown in Table III. Left eye involvement, vitreous haemorrhage and visual impairment occurred more frequently with intentional injuries, though the findings were not statistically significant ($p = 0.065$, $p = 0.095$, and $p = 0.080$ respectively). For both eyes, the posterior chamber was significantly more involved (38; 47.5%) compared to the anterior chamber (23; 28.8%); ($\chi^2 = 5.96$; $p = 0.015$).

Figures 1 and 2 are sonograms depicting choroidal detachment and vitreous haemorrhage respectively.

Discussion

Sonography has emerged as a well-tolerated, non-invasive tool for evaluating the eye in traumatic and potentially vision-threatening conditions. It compliments clinical examination in the identification of presence and extent of lesions, posterior segment involvement and pre-surgical profiling of patients. The modal age group for patients with ocular injury in the present study was 18 to 35 years, while males outnumbered females in the ratio of 5.1:1. This age and gender distribution are consistent with those of published reports on ocular trauma by Cao *et al*. [9], and Nzeh *et al*.[10] in China and Nigeria respectively. Similar age and gender distribution were reported by Jahangir *et al* [11] in Pakistan and Soliman *et al* [12] in Egypt. This predominant involvement of males and the age group 18 to 35 years is a reflection of the increased level of activity generally associated with youths, especially males. This study also found the right eye to be more involved than the left. This was probably a chance finding; especially since there are no reports in the

literature that support predominant involvement of either eye.

Table I: Socio-demographic characteristics of subjects with ocular trauma

Parameters	Frequency (n = 80)	Percentage
Age group (years)		
0-12	17	21.3
13-17	1	1.2
18-35	34	42.5
36-59	23	28.8
> 60	5	6.2
Sex		
Male	67	83.8
Female	13	16.2
Educational Level		
No formal education	2	2.5
Primary	32	40
Secondary	24	30
Tertiary	22	27.5
Marital Status		
Single	39	50
Married	37	47.4
Widowed	2	2.6
Occupation		
Students/Pupils	19	23.8
Manual Occupations	19	23.7
Trader/Private Business	12	15
Other non-specific occupations	30	37.5

Table II: Causes of eye injuries among 80 subjects

Causes	Frequency	Percentage
Blows	20	25.0
Gunshot	5	6.3
Foreign Bodies, from blasts/shrapnel.	26	32.5
RTA	18	22.5
Falls	3	3.8
Chemical injury	2	2.5
Football	2	2.5
Instrument	2	2.5
Knife	1	1.3
Birth trauma	1	1.3

RTA – Road Traffic Accidents

Table III: Sonographic findings of eye injuries among subjects

Variables	Frequency (N=80)	Percentage
Affected Eye		
Right	44	56.4
Left	33	42.3
Both	1	1.3
Sonographic findings		
Vitreous haemorrhage	36	45.0
Foreign bodies	16	20.0
Retinal detachment	13	16.3
Aqueous haemorrhage	11	13.8
Lens subluxation	11	13.8
Lens dislocation	11	13.8
Incidental cataract findings	6	7.5
Choroidal detachment	5	6.3

Figure 1: Transverse ultrasound image showing choroidal detachment (Arrow).

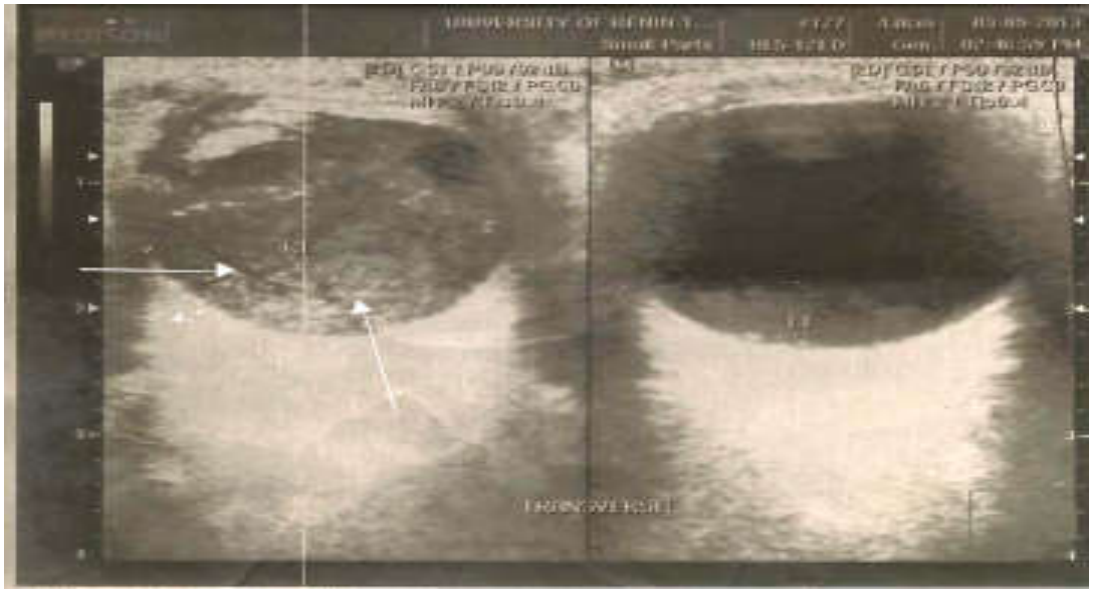

Figure 2: Ultrasound image showing bright echoes in the posterior chamber (arrow) demonstrating vitreous haemorrhage

In this study, mechanical causes of injury due to blunt trauma (closed globe injury), from blows, RTA, falls were responsible for 53.8% cases, while penetrating trauma (stab wounds, gunshots, instrumentation) caused the injuries in 37.5% of cases. Previous reports on ocular trauma in Nigeria, [10, 13] made similar observations. On the contrary, Solimar *et al*, [12] in Egypt reported that penetrating (open globe) injuries were more common, from gunshots, missile and blast injuries. The difference between the Egyptian study and the reports from Nigeria is probably due to the increase in violence in the Arab country during the study period. Another reason for the difference could be in the types of study subjects, as the patients in the index study were recruited from the Emergency Department.

Occupational ocular trauma was more common than domestic ocular injuries (47.5% vs. 33.8%) in this study. This may be attributed to poor awareness of health and safety practices in the workplace as reported by Okojie *et al*, [14] and Okeigbemen *et al* [15] in their studies on the health status of sawmill workers and safety practices among welders respectively, both in Benin City. The subjects studied in this report also included some welders. Voon *et al* [16] and Cao *et al* [9] in Singapore and China respectively also published similar findings.

Foreign bodies from blasts and shrapnel constituted the most common sources of eye injury in the present study (32.5%) followed by blows (25%). Therefore, penetrating and blunt injuries were more common than non-mechanical injuries. These findings are consistent with reports of other studies by Voon *et al* [16] and Jahangir *et al*. [11] This is because a sizeable number of subjects in this study were artisans like motor mechanics, carpenters and welders and are, therefore, more prone to injuries from chips, shrapnel among others. The fact that only patients that had ultrasound were studied could also be contributory. In addition, these workers are not aware of safety practices like the use of protective devices such as goggles as similarly reported by Okeigbemen *et al* [15], in their study on ocular trauma and use of protective eye devices among welders.

The posterior eye chamber involvement, in the form of findings including vitreous haemorrhage, choroidal and retinal detachment and haemorrhage, were more commonly encountered than anterior chamber lesions (aqueous haemorrhage contract, lens subluxation and dislocation) Previous studies on sonography of ocular trauma by Blaivas *et al* [17] in the USA, Kwang *et al* [18] in South Korea and Sadaf *et al* [19] in Pakistan reported similar patterns. On the contrary, Nzeh *et al* [10] and Ukponmwan *et al*, [20] in their studies on ocular trauma among Nigerians reported retinal detachment as the most common finding. The possible explanation for the differences in these reports may be that in some cases, late presentation, characteristic of our environment, could have resulted in insidious haemorrhage becoming organized and leading to more cases of retinal detachment.

This report has documented the sonographic patterns in ocular trauma in our environment. Therefore, early intervention, including treatment planning and preventive measures can be instituted, as may be applicable.

Conclusion

The study found vitreous haemorrhage as the most common sonographic finding following ocular trauma. It has further highlighted the complementary role of ultrasound to clinical assessment in ocular trauma. Under-reporting of cases, late presentation of cases to the hospital and operator dependence in ultrasonography could have influenced the findings in this study.

Authors' Contributions: OSN and AAA conceived and designed the study and interpreted the data; OSN did a literature search, EOJ participated in data collection while EAE did the data analysis. OSN drafted the manuscript while AAA, EOJ and EAE revised the manuscript. All the authors approved the manuscript.

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