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Evaluation with A/B Scan Ultrasonography of the Anterior Chamber, Posterior Chamber and Vitreous in Patients with Blunt Eye Trauma

Künt Göz Travmalı Hastalarda Ön Kamara, Arka Kamara ve Vitreusun A/B Scan Ultrasonografi ile Değerlendirilmesi

ABSTRACT

Objective:

To detect common Ultrasonography (USG) findings in patients with blunt ocular trauma and compare them with clinical findings.

Material and Methods:

The anterior chamber depth, lens thickness, axial length and scleral thickness values were measured with USG (Aviso, Quantel Medical, Clermont-Ferrand, France).

Results:

In this study, we included 44 eyes of 44 patients; 77% of blunt ocular trauma patients were male and 31% were in the 20-40 age group. The most common cause of trauma was branch hit (23%). The most common examination findings were eyelid ecchymosis (60%) and hyphema (29%). Intravitreal hemorrhage (15%) and retinal detachment (4%) were the most common USG findings. Initial percentage of best-corrected visual acuity is 0.1 (1 Logarithm of the Minimum Angle of Resolution (logMAR)) and worse was 27%. This value decreased to 6% with medical or surgical treatments at the first month examination. There was no statistically significant difference between the initial, first week, and first month measurements of axial length, anterior chamber depth, lens thickness and scleral thickness ($p = 0.724, 0.724, 0.717, 0.717$, respectively).

Conclusion:

This study emphasizes the importance of USG in blunt ocular trauma and comparing the clinical findings showed that blunt trauma can damage ocular structures in different severities. The final result depends on the severity of the injury and the application of appropriate treatment.

Key Words:

Ocular trauma, Blunt ocular trauma, Ultrasonography

ÖZ

Amaç:

Künt oküler travmalı hastalarda sık görülen Ultrasonografi (USG) bulgularını saptamak ve klinik bulgularla karşılaştırmak.

Gereç ve Yöntemler:

Ön kamara derinliği, lens kalınlığı, aksiyal uzunluk ve sklera kalınlık değerleri USG (Aviso, Quantel Medical, Clermont-Ferrand, France) ile ölçüldü.

Bulgular:

Toplam 44 hastanın 44 gözünün dahil edildiği bu çalışmada, künt oküler travmalı hastaların % 77'si erkekti. Hastaların % 31'i 20-40 yaş arasındaydı. En sık travma nedeni dal çarpmasıydı (% 23). En çok görülen muayene bulgusu ise sırasıyla kapak ekimozu (% 60) ve hifemaydı (% 29). Vitre içi kanama (% 15) ve retina dekolmanı (% 4) en sık görülen USG bulgularını oluşturmaktaydı. Başlangıç en iyi düzeltilmiş görme keskinliği 0,1 (1 Logarithm of the Minimum Angle of Resolution (logMAR)) ve daha kötü olanların oranı % 27 iken, birinci ay kontrollerinde bu oran yapılan medikal veya cerrahi tedaviler ile % 6'ya gerilemiştir. Hastaların USG ile ölçülen aksiyel uzunluk, ön kamara derinliği, lens kalınlığı ve sklera kalınlığında başlangıç, birinci hafta ve birinci ay arasında istatistiksel olarak anlamlı bir farklılık saptanmamıştır (sırasıyla p = 0,724; 0,724; 0,717; 0,717).

Sonuç:

Künt oküler travmada USG' nin öneminin vurgulandığı ve klinik bulguların karşılaştırıldığı bu çalışma künt travmanın oküler yapılara değişik şiddetlerde zarar verebileceğini ve nihai sonucun yaralanmanın şiddetine, yaralanan göz segmentine, uygun tedavi yönteminin uygulanması ve uzun vadeli komplikasyonların takibine bağlı olduğunu göstermiştir.

Anahtar Kelimeler:

Oküler travma, Künt oküler travma, Ultrasonografi

INTRODUCTION

Eye injuries are one of the most common causes of vision loss or decrease and affect the quality of life. Even the simplest ocular traumas cause pain and discomfort, leading to loss of workforce, care and treatment costs. Despite the advances in diagnosis and treatment methods, eye traumas continue to be socially and economically serious (1). Blunt ocular trauma can occur during industrial work as an occupational accident, as a sports accident, in-home accidents, or as part of in-vehicle accidents. Depending on these, temporary or permanent vision loss may develope (2).

The patient may not be able to open their lids due to severe pain or swelling, and this may make direct examination impossible. Since the 1950s, Ultrasonography (USG) has been used as a painless and noninvasive evaluation method of the traumatized globe. Today, with the advent of high-frequency probes and color Doppler USG has become a vital imaging modality in the evaluation of the traumatized globe and provides valuable information that is often not available by other means (3). USG has revolutionized the diagnosis and treatment of the traumatized eye, especially in opaque ocular media. Clinical examination of the posterior segment may be limited in anterior segment injuries that cause opacity such as hyphema and corneal edema. Traumatic posterior segment pathologies such as vitreous hemorrhage or vitritis may also limit the diagnostic information obtained from clinical examination. In these cases, control of the eye with USG can show pathological changes and guide us to the necessary treatment, so it is considered an important diagnostic and prognostic tool (4, 5).

The study aims to detect common USG findings in patients with blunt ocular trauma and compare them with clinical findings.

MATERIAL and METHODS

Forty-four consecutive patients with blunt ocular trauma admitted to Akdeniz University Hospital between 2015 and 2017 were included in this prospective study. The study protocol was approved by the Akdeniz University Hospital Clinical Research Ethics Committee. The study was carried out by the Declaration of Helsinki. Written informed consent was obtained from each patient. The study was conducted in accordance with research and publication ethics (Date: 23.07.2014, Number: 337).

All patients underwent comprehensive ophthalmic examination with a history of blunt trauma. Visual acuity was measured with a Snellen chart and converted to Logarithm of the Minimum Angle of Resolution (logMAR) and slit lamp and non contact lenses were used for the anterior segment and fundus examination. Intraocular pressures of the patients were recorded with a noncontact tonometer (Nidek NT-2000 NCT, Nidek CO, LTD., Hiroishi Gamagori, Aichi, Japan).

Patients with a history of penetrating ocular trauma or chemical burns and patients who did not have pathological findings after slit-lamp examination and USG were excluded from the study. All patients underwent B-scan USG to evaluate the posterior segment of the eye with AVISO A/B scan USG (Aviso, Quantel Medical, Clermont-Ferrand, France).

Patients' gender, age, cause of trauma (stone hit, metal object hit, bottle hit, branch hit, ball hit and after falling), examination findings (ecchymosis, corneal edema, hyphema, cataract, iridodialysis, zonular dialysis, commotio retina, vitreous hemorrhage, retinal detachment), USG data (axial length, anterior chamber depth, lens thickness, scleral thickness) at the first examination, first week, and first month were recorded and compared.

Statistical Analysis

Statistical analysis was performed using SPSS version 18.0 software (SPSS Inc. Chicago IL USA). Fisher's exact test, t-test, and Pearson chi-square test were used to compare groups. A p value below 0.05 was considered statistically significant.

RESULTS

A total of 44 eyes of 44 patients were included in the study. 34 (77.3 %) of all patients were male, 10 (22.7 %) were female, 24 (54.5%) patients had left eye trauma, and 20 (45.5 %) patients had right eye trauma. The mean age of the patients was 40.93 ±

20.97 (6-82) years. The most common causes of blunt ocular injuries were branch fragments (23%) and metal object injuries (21%). Afterward, blunt ocular trauma was caused by beating (14%), other (11%), stone (11%), ball (9%), falling (7%), and bottle hit (4%) injuries, respectively. Other causes included plastic foreign body injury in 2 patients, in-vehicle traffic accident in 1 patient, out of vehicle traffic accident in 1 patient, and injury after heel strike in 1 patient (Table I).

Table I : Frequency and Percentage of Causal Factors

Frequency and Percentage of Causal Factors	Number (%)
Branch	10 (23)
Metal object	9 (21)
Beat	6 (14)
Other	5 (11)
Stone	5 (11)
Ball	4 (9)
Falling	3 (7)
Bottle	2 (4)

The most common anterior segment findings after trauma were found to be lid ecchymosis (60%), hyphema (29%), corneal edema (27%), traumatic cataract (11%), zonular dialysis (11%), iridodialysis (9%). On the other hand, commotio retinal detachment was seen in 11% of the patients, vitreous hemorrhage in 15%, and retinal detachment in only 2 patients (4%). USG was used to detect structural changes that could not be detected by clinical examination, especially in an opaque environment; vitreous hemorrhage and retinal detachment were the most common USG findings (Table II).

Table II : Frequency and Percentage of Findings by Total Cases

Findings	Number (%)
Lid ecchymosis	27 (60)
Hyphema	13 (29)
Corneal Edema	12 (27)
Traumatic Cataract	5 (11)
Zonular Dialysis	5 (11)
İridodialysis	4 (9)
Commotio Retina	5 (11)
İntravitreal Hemorrhage	7 (15)
Retinal Detachment	2 (4)

Visual acuity was 0.6 (0.22 logMar) or better in 16 patients (36%), but visual acuity was 0.1 (1 logMar) or worse in 12 patients (27%) and perception was positive. At the first month follow-up, the number of patients, having visual acuity 0.6 (0.22 logMar) and better, increased to 30 (69%), the number of patients having visual acuity 0.1 (1 logMar) and worse, decreased to 3 (6%). One of these patients had retinal detachment and vitreous hemorrhage accompanying choroidal detachment, another patient had optic nerve avulsion, and 3 patients having corneal edema that did not regress after traumatic cataract surgery. It was observed that there was a statistically significant increase in the first examination's mean visual acuity if it's compared to the first week and first month ($p = 0.01$).
There was no statistically significant difference between the patients' axial length, anterior chamber depth, lens thickness, and scleral thickness measured by USG between the first examination, first week, and first month follow up (Table III).

Table III: Comparison of USG measurements

	First Examination	First Week	First Month	p Values
Axial length	23.29 mm	23.26 mm	23.24 mm	0.724
Anterior chamber depth	3.39 mm	3.23 mm	3.23 mm	0.724
Lens thickness	4.00 mm	3.9 mm	3.9 mm	0.717
Sclera thickness	1.03 mm	1.03 mm	1.01 mm	0.717

mm= milimeters

DISCUSSION and CONCLUSION

Causes such as inability to open the eyelids after blunt ocular trauma, hyphema, traumatic cataract development, or vitreous hemorrhage may make the evaluation of the posterior segment difficult or impossible. Although clinical findings suggest a complication such as retinal detachment, orbital USG is required for a comprehensive posterior segment evaluation.
In our study, the incidence of eye injury was almost three times more common in men (77.3%) than in female patients (22.7%). Especially in the young age group, male patients 20 to 40 years of age (31%) constituted the group in which blunt ocular traumas were encountered most frequently. As in our study, Elshafie et al.(6) and Pai et al.(7) also reported that blunt ocular trauma was seen more intensely in males . They reported that, unlike our data, it was mostly encountered between the ages of 10-20 (31% and 28%, respectively). When we look at the causes, Pai et al.(7) stated that the most common cause was motor vehicle accidents (28%), but similar to the results of Elshafie et al. 6 (27%), in our study, it was seen that the most common cause was branch hit (23%). According to these results, a higher rate of ocular scarring in younger men compared to older individuals or women, was probably due to more risky jobs and the different categories of sports they do. It has been seen that the probability of scaling is higher and it is often caused by branches, metal objects or stones. In another study, it was observed that blunt eye traumas were more common especially in children and young adult males (8). In that study 38% of the traumas were caused by falling, 32% during play, 14% due to work accident, 9% to beating, 6% to traffic accident. It is stated that these accidents are preventable.

As well as the young population, blunt trauma after falls is frequently encountered in the elderly population. In a study, open globe injuries in the population over 70 years of age were examined and blunt trauma was found to play an important role (9). It's found that it is mostly related to falls, with a female predominance (in contrast to the male predominance in the young group) and a poor visual prognosis. It's concluded that to

prevent this condition, care should be taken to educate elderly patients and their caregivers on how to prevent falls.

A blunt eye injury can affect any structure of the eye. The most common finding in our study was valve ecchymosis with a rate of 60%. Pai et al.(7) also found that 62.5% of patients injured by blunt ocular trauma, similar to our study, showed signs of ecchymosis and edema on the eyelids. However, Elshafie et al.(6) showed that lid ecchymosis only represents 14% of cases, unlike this current study. Hyphema was found to be a common complication occurring in 29 % of patients with blunt injuries, whereas in some other studies this rate was found to be approximately 50 % (2, 6, 10). We consider that the difference in results can be explained by exposure to objects larger than the globe volume in most cases.

The most common findings detected in USG were intravital hemorrhage (15%) and retinal detachment (4%). Although trauma is the most common cause of vitreous hemorrhage in young patients, most causes of vitreous hemorrhage in the general population are non-traumatic (diabetic retinopathy, retinal vein occlusion, posterior vitreous detachment) (11, 12).

Commotio retinal, also known as Berlin edema, may also occur after recent blunt eye trauma. Studies have shown that this injury is present in 9% to 14% of orbital blowout fractures (13). In our study, 11% of patients had commotio retina. Retinal edema in these cases were resolved completely without the need for treatment. Trauma is the most common cause of retinal detachment in children and is responsible for approximately 10% of detachments in the general population (14). While retinal detachment was observed at the rate of 4% in our study, this rate was 21% in the studies of Elshafie et al.(6).

USG is a device that is frequently used after trauma because it is available in many clinics and is easily accessible. Nowadays, optical coherence tomography can be used as an effective method to show retinal damage in addition to USG. However, in order to obtain good quality optical coherence tomography images, there should be no opaque media, which is encountered in most blunt traumas. In such cases, ultrasound gains importance in providing us with information about the damage. In a recent study, optic coherence tomography and optical coherence tomography angiography images were compared between traumatized eyes and contralateral eyes of the patients with blunt ocular trauma (15). Although there were no evident findings on fundus examination or structural spectral domain-optical coherence tomography changes, optical coherence tomography angiography demonstrated a significant decrease in retinal deep capillary plexus vessel density of the eyes effected by blunt ocular trauma. These findings show that microvascular changes can be observed after blunt trauma that cannot be detected on examination and optical coherence tomography. In conclusion blunt trauma can cause significant abrupt deterioration of the eyeball, causing more serious damage than appears clinically. As long as there is no penetration or globe rupture, even if there are pathological eye findings due to trauma, no difference was observed in the USG measurements of the anatomical structures of the eye, such as anterior chamber depth, lens thickness, axial length, scleral thickness and in serial follow-ups up to 1 month. Despite blunt eye trauma, good visual acuity can be achieved in the majority of patients after 1 month of follow-up or appropriate surgical intervention (69%). USG guides us in the treatment by allowing us to look at the posterior segment of the eye even in an opaque environment such as corneal edema, traumatic hyphema, opaque lens and vitreous hemorrhage, which prevents the diagnosis of eye pathology in the injured eye. This study showed that blunt trauma can damage ocular structures with varying degrees of severity, and the final outcome depends on the severity of the injury, the injured eye segment, the appropriate treatment modality, and the follow-up for long-term complications.

Ethics Committee Approval:

This research complies with all the relevant national regulations, institutional policies and is in in accordance with the tenets of the Helsinki Declaration, and has been approved by the Akdeniz University Faculty of Medicine Ethical Committee, Akdeniz University (Approval number: 2014 /337).

Informed Consent:

All the participants' rights were protected and written informed consents were obtained before the procedures according to the Helsinki Declaration.

Author Contributions:

Concept –K.C.A, H.D.İ., E.B.T.; Design - K.C.A., H.D.İ., E.B.T. Supervision – K.C.İ. Resources –K.C.A. , M.E.D., Ç.E.P.; Materials - K.C.A. , M.E.D., Ç.E.P.; Data Collection and/or Processing – M.E.D., Ç.E.P. Analysis and/ or Interpretation - M.E.D., Ç.E.P.; Literature Search - M.E.D., Ç.E.P.; Writing Manuscript M.E.D., Ç.E.P.; Critical Review - K.C.A., H.D.İ., E.B.T., M.E.D., Ç.E.P.

Conflict of interest:

The authors declare that they have no confict of interest.

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REFERENCES

1. Sternberg PJ, Aaberg TM. The persisten challenge of ocular trauma. Am J Ophthalmol. 1989;107(4):421-4.

2. Ozdal MPC, Mansour M, Deschênes J. Ultrasound biomicroscopic evaluation of the traumatized eyes. Eye (Lond). 2003;17(4):467-72.

3. Takhar P, Constantine S, Tew K, Brown R, Chatterton B, Sparnon M. Ocular trauma The role of ultrasound. 2009:5-6.

4. Wang A, Zhao Z, Xu Q, Wang Y, Liao H. Risk Factors for Residual Vitreous Cortex at the Fovea after Posterior Vitreous Detachment during Vitrectomy in Ocular Trauma. J Ophthalmol. 2019; 2019:4312958.

5. Chugh J. Verma M. Role of ultrasonography in ocular trauma. Indian J Radiol Imaging. 2001;11(2):75-9.

6. Elshafie MA, Abouelkheir HY, Othman MM, Elhefny EM. Ultrasonic evaluation of eyes with blunt trauma. J Egypt Ophthalmol Soc 2018;111:20-4.

7. Pai SG, Kamath SJ, D'Souza S, Dudeja LA. Clinical Study of Blunt Ocular Trauma in a Tertiary Care Centre. Online J Health Allied Scs. 2013;12(2):10.

8. Duman M, Akkan F, Umurhan JC, Eltutar K. Künt göz travmaların klinik değerlendirilmesi. İstanbul Tıp Derg, 2004; 1: 22-6.

9. Vidne-Hay O, Fogel Levin M, Luski S, Moisseiev J, Moisseiev E. Blunt ocular trauma in patients over 70: Clinical characteristics and prognosis. European Journal of Ophthalmology. 2021;31(5):2705-9.

10. Ghafari AB, Siamian H, Aligolbandi K, Mohammad V. Hyphema caused by trauma. Med Arh. 2013;67(5):354-6.

11. Williamson TH, ed. Vitreous Haemorrhage BT - Vitreoretinal Surgery. In: Berlin, Heidelberg: Springer Berlin Heidelberg; 2008:49-52.

12. Pieramici DJ. Vitreoretinal trauma. Ophthalmol Clin North Am. 2002;15(2):225-234, vii.

13. Zagelbaum BM, Tostanoski JR, Kerner DJ, Hersh PS. Urban eye trauma-one year prospective study. Ophthalmology. 1993; 100: 851–6.

14. Liu X, Wang L, Wang C, Sun G, Liu S, Fan Y. Mechanism of traumatic retinal detachment in blunt impact: a finite element study. J Biomech. 2013;46(7):1321-7.

15. Yalinbas Yeter D, Kucukevcilioglu M, Yesiltas YS, Gedik Oguz Y, Durukan AH. Effect of blunt ocular trauma on retinal microvasculature: An optical coherence tomography angiography study. Photodiagnosis Photodyn Ther. 2021;33:102147.