RESEARCH

CHARACTERISTICS OF OPEN-GLOBE INJURIES IN ELDERLY PATIENTS

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Abstract

Introduction: This study evaluated the clinical characteristics, outcomes, and prognostic factors of open-globe injuries (OGI) in geriatric patients.

Materials and Method: Hospital records of patients diagnosed with OGI between 2014 and 2018 were retrospectively analyzed. They were divided into two groups: ≥65 years (geriatric) and 20–64 years (adult). Age, gender, nature of trauma, Initial visual acuity (VA), clinical signs, surgical procedures, final VA, and additional complications were reviewed and compared between groups. Correlation analyses were performed using the Spearman/Pearson correlation and the Student's t-test. A multiple linear regression model was used to identify independent predicting factors for final VA.

Results: There were 34 patients each in the geriatric (23 males, 11 females) and the adult (30 males, 4 females) groups with mean ages of 70.5±8.5 and 38.8±10.9 years, respectively ($p<0.001$). The most frequent OGI was globe rupture (25 patients, 73.5%) in the geriatric group and penetrating trauma (23 patients, 67.6%) in the adult group ($p=0.001$). The most frequent cause of trauma was falls (29.4%) in the geriatric group and metal objects (32.3%) in the adult group. Initial VA in the geriatric and adult groups was 0.037±0.10 and 0.29±0.31, respectively ($p<0.001$). The mean ocular trauma score (OTS) in the geriatric and adult groups was 50.3±14.5 and 64.7±16.7, respectively ($p=0.001$). Final VA in the geriatric and adult groups was 0.16±0.24 and 0.55±0.36, respectively ($p<0.001$). Both groups exhibited a correlation among initial VA and final VA ($p1=0.005$, $r1=0.487$; $p2<0.001$, $r2=0.730$). The primary parameters influencing OGI prognosis in the geriatric group were age, initial VA, OTS, and trauma type.

Conclusion: OGI differs between geriatric and adult groups based on demographic, clinical, and prognostic characteristics of the trauma. İncreased age, low initial VA and OTS, and presence of globe rupture were identified as potential risk factors for poor final VA.

Key words: Geriatrics; Eye injuries; Prognostic factors.

ARAŞTIRMA

YAŞLI HASTALARDA AÇIK GLOB YARALANMALARININ ÖZELLİKLERİ

Öz

Giriş: Açık glob yaralanması (AGY) olan geriatrik hasta grubunda klinik özeliklerin, sonuçların ve prognozu etkileyen faktörlerin değerlendirilmesi amaçlandı.

Gereç ve Yöntem: 2014-2018 yılları arasında AGY nedeniyle takip edilen 65 yaş ve üstü (geriatrik grup) ve 20-64 yaş aralığındaki (erişkin grup) hastaların dosyaları geriye dönük olarak incelendi. Hastaların yaş, cinsiyet, travma nedeni, tipi, zonu, başlangıç görme keskinliği, klinik bulguları, cerrahi prosedürleri, son görme keskinliği ve ek bulguları incelendi ve gruplar arasında karşılaştırıldı. Korelasyon analizi için Spearman/Pearson korelasyon ve Student T testi; sonuç görme keskinliğini etkileyen risk faktörlerini belirlemek için çoklu lineer regresyon modeli kullanıldı.

Bulgular: Geriatrik grupta yer alan 23'ü erkek, 11'i kadın 34 hastanın yaş ortalaması 70.5±8.5 iken; erişkin grupta yer alan 30'u erkek, 4'ü kadın 34 hastanın yaş ortalaması 38.8±10.9 idi ($p<0.001$). Geriatrik grupta glob rüptürü (25 hasta, %73.5) daha sıkken; erişkin grupta penetran travma (23 hasta, %67.6) daha sıktı ($p=0.001$). En sık görülen travma nedeni geriatrik grupta düşme (%29.4) iken, erişkin grupta metal objelerdi (%32.3). Geriatrik ve erişkin grupta başlangıç görme keskinliği sırasıyla 0.037±0.10 ve 0.29±0.31 iken ($p<0.001$); ortalama okuler travma skoru (OTS) değeri ise sırasıyla 50.3±14.5 ve 64.7±16.7 idi ($p=0.001$). Sonuç görme keskinliği geriatrik ve erişkin grupta sırasıyla 0.16±0.24 ve 0.55±0.36 olup; geriatrik grupta belirgin olarak daha düşüktü ($p<0.001$). Her iki gruptada başlangıç görme keskinliği ile son görme keskinliği arasında belirgin bir korelasyon mevcuttu ($p1=0.005$, $r1=0.487$; $p2<0.001$, $r2=0.730$). Geriatrik hastalarda prognozu etkileyen faktörler yaş, başlangıç görme keskinliği ve OTS değeri ve travma tipi idi.

Sonuç: Geriatrik hasta grubundaki AGY bazı demografik, klinik ve prognostik özellikleriyle erişkin hastalara göre belirgin farklılıklar göstermektedir. İleri yaş, düşük başlangıç görme keskinliği ve OTS değeri, glob rüptürü varlığı geriatrik grupta düşük sonuç görme keskinliği için risk faktörleridir.

Anahtar Sözcükler: Geriatri; Göz travması; Prognostik faktörler.

INTRODUCTION

Open-globe injuries (OGI) are a critical, albeit preventable, cause of ocular morbidity that typically occur after blunt or penetrating trauma. It is a worldwide public health concern with a global incidence rate of 3.5/100,000 persons per year (1). Low socioeconomic status, male gender, workplace, and road accidents are reported to be the risk factors for OGI (2).

The peak ages of OGI occurrence ranges from 30 to 50 years (3). It frequently occurs in males, and most of them are work-related (4). Nonetheless, a high percentage (20.6%) of OGI occurs in the pediatric age group (3). Therefore, most studies focus on the pediatric and adult patient groups.

Notably, the annual incidence of ocular trauma among the elderly (aged >65 years) is 38/100,000, with 7% of them being OGI (5–7). The characteristics and prognosis of the OGI in the elderly differ from those of the OGI in the younger individuals (6,8). Few studies have detailed regarding the clinical characteristics, outcomes, and prognostic factors of OGI in the elderly.

The present study aimed to evaluate the epidemiological and clinical characteristics and analyze the outcomes and prognostic factors of OGI in elderly patients.

MATERIALS AND METHOD

Medical records of patients with a diagnosis of OGI between 2014 and 2018 at the Sakarya University Medical Education and Research Hospital were retrospectively reviewed. Patient records were obtained from hospital computer database by using International Statistical Classification of Diseases and Related Health Problems (ICD) code for open-globe repair. The patients were divided into two groups: ≥65 years (geriatric group) and 20–64 years (adult group). The study was performed in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board (29.08.2019-E.10869).

The medical records of patients were reviewed and the following data were collected: demographics (age and sex); nature of trauma (cause, type, and zone); Initial examination findings such as visual acuity (VA) measured using Snellen chart, clinical signs, presence of hyphema, lens injury, uveal tissue prolapse, vitreous loss, vitreous hemorrhage, retinal detachment, intraocular foreign body, and relative afferent pupillary defect; surgical procedures (primary/additional); and follow-up examination findings (final VA and ocular complications).

OGI was classified into four categories: rupture, penetrating injury, perforating injury, or intraocular foreign body based on the Birmingham Eye Trauma Terminology (9). The location of the injury was defined as the zone of the injury and classified according to the Ocular Trauma Classification System guidelines (9). Zone I includes injuries to cornea and corneoscleral limbus; zone II includes injuries that are located in the corneoscleral limbus at a point 5 mm posterior to the sclera; and zone III includes injuries that are located in the sclera at a point more than 5 mm to the corneoscleral limbus.

Ocular Trauma Score (OTS), the raw score determined based on the evaluation of rupture, endophthalmitis, perforating injury, retinal detachment, afferent pupillary defect, and Initial VA, was calculated for each patient (10). Based on the severity of the trauma, OTS ranges between 0 and 100. The scores are stratified into five categories, which predict the final VA.

Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA), version 23.0 software, was used for statistical analysis. Analytical methods (Kolmogorov–Smirnov test) were used to determine whether the variables were normally distributed. Descriptive analyses were presented using mean and standard deviations for normally distributed variables. Correlation analyses (between OTS and the final VA and the Initial and

final VA) were performed using the Spearman/Pearson correlation and the Student's t-test. A multiple linear regression model was used to identify independent predicting factors for final VA. p values of <0.05 were considered statistically significant.

RESULTS

This study comprised 34 patients (23 males and 11 females) in the geriatric group and 34 patients (30 males and 4 females) in the adult group with mean ages of 70.5±8.5 (65–91) and 38.8±10.9 (20–64) years, respectively, (p<0.001). OGI occurred in 18 right eyes and 16 left eyes in the geriatric group, and 22 right eyes and 12 left eyes in the adult group with no significant intergroup difference (p=0.324).

Nonetheless, significant differences were observed based on gender and trauma type between groups. The male to female ratio was 7.5:1 in the adult group and 2.1:1 in the geriatric group. The adult group had a significantly higher number of males than geriatric group (p=0.041). The geriatric group was noted to have a male preponderance; however, it was not statistically significant. Regarding the trauma type, the most common type of OGI was globe rupture in the geriatric group (25 patients, 73.5%) and penetrating trauma in the adult group (23 patients, 67.6%) (p=0.001). The most frequent cause of trauma in the geriatric group was falls (29.4%), closely followed by wooden objects (26.4%). In the adult group, the most common cause of trauma was metal objects (32.3%), followed by sharp objects (17.6%) and wooden objects (17.6%) (Table 1).

Table 1. General characteristics of patients.

Variable	Geriatric n	%	Adult n	%	p
Age (years)	70.5±8.5		38.8±10.9		0.001
Gender					
Male	23	67.6	30	88.2	0.041
Female	11	32.3	4	11.7	
Laterality					
Right	18	52.9	22	64.7	0.324
Left	16	47.1	12	35.2	
Trauma type					
Rupture	25	73.5	11	32.3	0.001
Penetrating	9	26.4	23	67.6	
Cause of trauma					
Sharp objects	2	5.8	6	17.6	
Stone	2	5.8	1	2.9	
Metal	3	8.8	11	32.3	
Wood	9	26.4	6	17.6	
Glass	3	8.8	3	8.8	
Traffic accident	2	5.8	3	8.8	
Falls	10	29.4	2	5.8	
Other	3	8.8	2	5.8	

Zones I (13 patients, 38.2%) and II (13 patients, 38.2%) were the most common sites of trauma in the geriatric group, whereas zone I (17 patients, 50%) was the most common in the adult group. No statistical significance was observed regarding the zone of trauma (p=0.279).

Upon examination of clinical signs, hyphema was observed in 22 patients (64.7%) in the geriatric group and 8 patients (23.5%) in the adult group, and it was significantly higher in the geriatric group (p=0.001). The presence of lens injury (38.2%), iris prolapse (61.7%), vitreous loss (32.3%), and vitreous hemorrhage (47%) were more common in the geriatric group than that in the adult group; however, the difference was not statistically significant. Moreover, both groups were similar regarding the presence of retinal detachment and foreign body (Table 2). Subconjunctival lens dislocation after blunt trauma was seen in 4 patients in the geriatric group.

Initial VA was 0.037±0.10 and 0.29±0.31 in the geriatric and adult groups, respectively (p<0.001). Notably, 41.1% of the elderly patients and 14.7% of the adult patients had light perception or worse VA preoperatively. The mean OTS was 50.3±14.5 and 64.7±16.7 in the geriatric and adult groups, respectively, being significantly worse in the geriatric group (p=0.001). Mean OTS category was 1.9±0.7 and 2.6±0.8 in the geriatric and adult groups, respectively (p=0.003).

Both groups had a similar frequency of primary and multiple surgeries (p=0.564). Notably, 11 (32.3%) patients in the geriatric group and 13 (38.2%) patients in the adult group underwent additional surgical procedures. Among the

Table 2. Initial parameters of OGI in patients.

Variable	Geriatric n	%	Adult n	%	p
Zone of trauma					
Zone I	13	38.2	17	50	
Zone II	13	38.2	7	20.5	0.279
Zone III	8	23.5	10	29.4	
OTS category					
1	10	29.4	3	8.8	
2	16	47.1	13	38.2	0.003
3	7	20.5	12	35.2	
4	1	2.9	6	17.6	
Involved clinical signs					
Hyphema	22	64.7	8	23.5	
Lens injury	13	38.2	10	29.4	0.001
Iris prolapse	21	61.7	14	41.1	0.442
Vitreous loss	11	32.3	9	26.4	0.089
Vitrous hemorrhage	16	47.1	9	26.4	0.595
Retinal detachment	3	8.8	3	8.8	0.078
Foreign body	3	8.8	7	20.5	0.532
Subconjunctival lens dislocation	4	11.7		0	0.171
Surgery					0.564
Primary	25	73.5	22	64.7	
Multiple	11	32.3	13	38.2	

geriatric group patients, 5 had vitreoretinal surgery, 3 had phacoemulsification and intraocular lens implantation, 2 had anterior chamber lavage, and 1 had evisceration. Among the adult group patients, 7 had phacoemulsification and intraocular lens implantation and 6 had vitreoretinal surgery. Secondary glaucoma controlled with antiglaucoma drugs was observed in 8 (23.5%) and 3 (8.8%) patients in the geriatric and adult groups, respectively. No patient in either group had post-traumatic endophthalmitis.

Final VA was 0.16±0.24 and 0.55±0.36 in the geriatric and adult groups, respectively, being significantly worse in the geriatric group ($p<0.001$). Both groups revealed a correlation between initial and final VA ($p1=0.005$, $r1=0.487$; $p2<0.001$, $r2=0.730$, Pearson's test). Poor initial VA resulted in poor final VA. Moreover, both groups showed a similar correlation between OTS and final VA ($p1=0.001$, $r1=0.543$; $p2<0.001$, $r2=0.713$, Pearson's test).

Linear regression analysis was performed to determine the factors affecting the final VA, which was divided into 2 categories: ≤20/200 and >20/200. Age; trauma type; initial VA; OTS; and the presence of hyphema, lens injury, iris prolapse, vitreous loss, vitreous hemorrhage, retinal detachment, and foreign body were determined as potential factors affecting final VA. Notably, age (Odds ratio: 0.832), type of the trauma (Odds ratio: 0.188), initial visual acuity (Odds ratio: 1.962), and OTS (Odds ratio: 1.107) were determined to be the potential risk factors for poor final VA (Table 3).

DISCUSSION

The present study showed that some clinical characteristics and outcomes and the epidemiology of OGI differ between elderly and adult individuals. In this study, the male to female ratio was 2.1:1 in the geriatric group and 7.5:1 in the adult group. The geriatric group exhibited a male preponderance; however, it was not statistically significant. The predominance of

Table 1. Regression analysis on preoperative parameters affecting final VA in geriatric patients.

Variable	Odds ratio	p	95% CI for Cv	
Age	0.832	0.048	0.693	0.999
Trauma type	0.188	0.023	0.044	0.794
Initial VA	1.962	0.043	0.384	2.285
OTS	1.107	0.009	1.025	1.195
Lens injury	0.380	0.428	0.035	4.152
Hyphema	4.854	0.316	0.221	16.693
Iris prolapse	0.355	0.447	0.025	5.116
Vitreous loss	9.352	0.256	0.198	42.536
Vitreous hemorrhage	3.377	0.504	0.095	19.599
Retinal detachment	12.659	0.949	1.414	23.222

VA: Visual acuity, OTS: Ocular trauma score

males observed in the adult group was consistent with previously published data. Primary reasons for this male preponderance in the adult group are higher risk from work-related and dangerous outdoor activities (2, 3). Previous studies have reported that the gap between genders decreases with increasing age owing to lifestyle changes (6, 11). Some studies have reported a high incidence of OGI in elderly women because of the high risk of falls (6, 7). By contrast, our study showed a male predominance probably because of increased daily activities of older men.

The most common OGI type was globe rupture in the geriatric group (73.5%) and penetrating trauma in the adult group (67.6%) in the present study. Similarly, Andreoli et al. (6) (88%), Sheng et al. (12) (83.3%), and Tok et al. (8) (56.7%) reported that ruptured globe was the most common type of OGI in the geriatric population. They suggested that previous ophthalmic surgeries weaken the globe, which can be a precipitating factor for ruptures after blunt trauma. Sheng et al. (12), Andreoli et al. (6), and Tok et al. (8) reported that 51.1%, 49%, and 16.6% patients, respectively, had previous ocular surgeries and dehiscence of the surgical wound. In all these studies, the most common previous surgery was cataract surgery. In our study, only 3 (8.8%) patients had cataract surgery previously, and subconjunctival intraocular lens dislocation was observed in 2 of 3 patients after blunt trauma in the geriatric group. Furthermore, our results showed a correlation between the type of injury and final VA. Globe rupture was associated with poor final VA, which is consistent with previous studies (13, 14). This result could be owing to globe rupture causing significant damage to ocular tissues through the coup–contrecoup mechanism.

It was reported that, wound localization tends to be more posterior, and zones II and III traumas were more common in the geriatric group after globe rupture (6, 8). By contrast, trauma zones showed a relatively uniform distribution in our geriatric group. Sheng et al. (12) reported that the distribution of trauma related to zones was partially equal in the elderly, which is consistent with our results.

In our study, the most frequent causes of OGI in elderly were falls (29.4%), followed by wooden (26.4%), glass (8.8%), and metal objects (8.8%). In contrast, metal (32.3%), sharp (17.6%), and wooden (17.6%) objects were more likely to cause OGI in adults. Andreoli et al. (6) (65%), Sheng et al. (12) (64.4%), Desai et al. (15) (44%), Sahraravand et al. (7) (22%), and Tok et al. (8) (13.4%) reported that falls are the most common cause of eye injuries in elderly patients, which is consistent with our results. The varying rates of results in these studies may be related to the differences in the lifestyle of the elderly based on their sociocultural differences. Onakpoya et al. (11) reported that OGI in elderly typically occurs during farming activities in developing countries, whereas it happens at home owing to falls in developed countries. Increasing age, cognitive and visual impairment, poor depth perception, balance disorders, and systemic diseases increase the risk of fall-related eye injuries in the elderly (7,11,16). Notably, even a mild trauma owing to fall can cause globe rupture in elderly individuals because of the decreased globe rigidity and may lead to significant ocular damage.

In our study, hyphema (64.7%), iris prolapse (61.7%), vitreous hemorrhage (47%), lens injury (38.2%), and vitreous loss (32.3%) were more common in the geriatric group than in the adult group. However, the difference was significant only for hyphema. Sheng et al. (12) reported that rates of iris prolapse, hyphema, and vitreous hemorrhage were 70%, 66.7%, and 51.1%, respectively, which is concordant with our results. Agrawal et al. (13) reported that lens injury, hyphema, vitreous loss, and vitreous hemorrhage were significant predictive parameters affecting the final VA. In our study, none of these parameters were found to be potential risk factors for poor final VA.

Initial VA was worse in the geriatric group, and

41.1% of these patients had light perception or worse initial VA preoperatively. Consistent with our results, previous studies showed that initial VA was significantly worse in the geriatric group (6, 8, 12). Our study found a correlation between initial and final VAs in both groups, and initial VA was a crucial prognostic factor-consistent with previously published data (13, 14, 17). Poor initial VA indicates more severe ocular tissue damage, particularly in the retina and optic nerve. Accordingly, the final VA was significantly worse in the geriatric group of our study ($p<0.001$). Moreover, poor final VA may be related to the limited recovery process and accompanying ocular diseases, such as age-related macular degeneration, glaucoma, and vascular occlusive diseases in elderly patients.

Most studies have found OTS to be an important predictive factor in OGI (9, 15, 18). In our study, the mean raw OTS was 50.3 and 64.7 in the geriatric and adult groups, respectively. Furthermore, it correlated with final VA in both groups. Andreoli et al. (6) reported that the mean OTS was 47 and 70 for the geriatric and young groups, respectively. Lower OTS indicates more severe ocular injury, which may be accompanied by a retinal detachment, optic nerve injury, and endophthalmitis.

Both groups had a similar frequency of primary and multiple surgeries. Most frequent additional surgeries were vitreoretinal surgery in the geriatric group and phacoemulsification and intraocular lens implantation in the adult group. Only 1 patient had evisceration in the geriatric group. The literature revealed a low evisceration rate in the elderly because of their low aesthetic expectations, increased risk of additional surgery owing to comorbidities, and decreased risk of sympathetic ophthalmia owing to reduced life span (6, 8).

Several studies have been designed to determine the factors affecting the final VA after OGI. Age; type and zone of the OGI; extent of the wound; initial VA; and the presence of hyphema, vitreous loss, vitreous hemorrhage, retinal detachment, and lens injury were found to be the parameters that significantly correlated with the final VA (15–20). In this study, the primary parameters influencing the final VA and prognosis of the OGI in the geriatric group were age, initial visual acuity, OTS, and trauma type.

Nevertheless, the limitations of our study were its retrospective nature, a small sample size, and short follow-up time.

Open-globe injury is a significant cause of visual impairment in the elderly. Results of this retrospective study showed that OGI in the geriatric group differs from that in the adult group in terms of some demographic and clinical characteristics of the trauma. Notably, globe rupture was the primary trauma type, and falls were the most frequent cause. Furthermore, increased age, poor initial VA, low OTS, and presence of globe rupture were the primary risk factors for poor final VA in the geriatric group.

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CONFLICT OF INTEREST

There is no conflict of interest.

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