



Clinical characteristics, etiologies, co-injuries, and visual outcomes of eyelid lacerations

Emin Serbulent Guclu¹, Omer Ozer² and Pinar Erozu³

¹ Ophthalmology Clinic, Mersin State Hospital, Mersin, Turkey

² Department of Ophthalmology, Nigde Omer Halisdemir University, Nigde, Turkey

³ Ophthalmology Clinic, Tarsus State Hospital, Mersin, Turkey

ABSTRACT

Background: Eyelid trauma may be accompanied by open globe injury, canalicular injury, hyphema, angle recession, or retinal detachment. Therefore, a detailed assessment should be performed during the associated ophthalmological examinations. We assessed the demographic and clinical characteristics, etiologies, co-injuries, and visual outcomes in patients with eyelid lacerations.

Methods: This retrospective, cross-sectional study included individuals 18 years of age and older who underwent repair of an eyelid injury at our tertiary referral center between January 2021 and March 2023. Patients with known structural eyelid disorders or previous ocular surgery were excluded. Demographic and clinical data, including injury site and type, mechanism of injury, and presence of additional ocular injuries, were noted. Best-corrected visual acuity (BCVA) was recorded as the logarithm of the minimum angle of resolution (logMAR) notation at the initial and final follow-up visits.

Results: Of 195 included patients with a mean (standard deviation [SD]) age of 42.5 (5.6) years, 164 (84.1%) were men. The most common etiology was accidental (n = 70, 35.9%) and almost half of these injuries occurred at the workplace (n = 32 out of 70, 45.8%). Nine patients (4.6%) had no co-injury, 47 (24.1%) had imaging evidence of orbital bone fractures, 25 (12.8%) had nasolacrimal system involvement, and 11 (5.6%) had an open globe injury. The right upper eyelid (n = 62, 31.8%) was the most commonly affected site. Tissue loss was observed in 77 (39.5%) patients; however, no grafting was required. Five patients (2.6%) underwent lateral canthotomy to improve tissue apposition. On initial examination, 24 patients (12.3%) had traumatic myogenic ptosis, 13 (6.7%) had traumatic aponeurotic ptosis, and ptosis persisted in 7 of these 37 patients (18.9%) 6 months after laceration repair. We observed significant improvement in BCVA at the final follow-up visit ($P < 0.001$); at the preoperative and final visits, mean (SD) BCVA measurements were 0.21 (0.15) and 0.12 (0.07) logMAR, respectively.

Conclusions: Eyelid injuries are more common in men, and the most common etiology is accidental. These injuries occur most commonly in the workplace. Isolated eyelid lacerations are rare. Early ocular assessment and prompt management ensure better visual outcomes. We recommend preventive safety precautions for workplaces to reduce the incidence of avoidable injuries. Identifying risk factors in further population-based studies could prevent loss of labor in a productive population. Further multicenter, nationwide, longitudinal studies could estimate the actual burden and prognosis of ocular trauma, particularly that of eyelid lacerations.

KEYWORDS


eyelid, physical trauma, eye injury, laceration, ocular surgery, demographic, disease attribute, visual acuities

Correspondence: Omer Ozer, Department of Ophthalmology, Nigde Omer Halisdemir University, Nigde, Turkey. Email: omerozer92@gmail.com. ORCID iD: <https://orcid.org/0000-0003-0329-0931>

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INTRODUCTION

Eyelid injuries are an important subtype of facial trauma. When evaluating eyelid injuries and determining surgical indications, the ophthalmologist must be competent and fully informed [1]. The eyelid anatomy features many connective and muscular tissue elements that serve different functions [1]. Eyelid trauma may be accompanied by open globe injury and various other ocular injuries [2, 3]. Therefore, visual acuity, pupillary reactions, eye movements, intraocular pressure (IOP), and the posterior segment must be examined during the assessment of eyelid injuries [4]. Proper information and education can help individuals avoid eye injuries and their substantial burden [5, 6].

Eyelid lacerations can be treated using different techniques depending on their depth, width, injury mechanism, and accompanying injuries [7]. Full-thickness eyelid defects with tissue loss are classified according to the horizontal extent of the defect into small (< 33%), medium (33–50%), and large defects (> 50%) [8]. Depending on the type and size of the injury, defects limited to the anterior lamella can be repaired with primary closure, secondary closure, skin flap, skin graft, or cutaneous-marginal skin graft if the eyelid margin is involved [9]. Small defects limited to the skin of the upper or lower eyelid can be repaired by direct closure. However, an injury affecting both superficial and deep tissues is first converted into a full-thickness defect using a pentagonal excision and then repaired with primary closure. If necessary, lateral canthotomy or superior cantholysis can be performed to advance the lateral wound edge for better placement [10].

Combined anterior and posterior lamellar defects are more complex [11]. Various repair techniques are available for these wounds depending on the extent of injury. Among these are direct closure, direct closure under tension, direct closure with myocutaneous flaps, and closure with composite grafts or tarsoconjunctival flaps. The Cutler–Beard bridge technique, Hughes tarsoconjunctival flap, and Mustarde cheek rotation flap techniques can be used to repair large defects [12, 13]. Local tarsoconjunctival flaps are an option for full-thickness defects that are larger than one-half the eyelid. They are also useful for defects involving the eyelid margin. Substitute tissues are potentially useful when insufficient tissue is available in the contralateral eyelid for tarsoconjunctival grafts [14].

We assessed the demographic and clinical characteristics, etiologies of injury, co-injuries, and visual outcomes in patients with eyelid lacerations presenting to our tertiary referral center. We aim to provide real-world clinical perspectives regarding these potentially blinding yet preventable ocular injuries.

METHODS

This retrospective, cross-sectional study was conducted at our tertiary referral center, Mersin, Turkey, between January 1, 2021, and March 1, 2023. We obtained all necessary permissions from the Toros University Clinical Research Ethics Committee, Mersin, Turkey (Code: 2023-96). We provided the aims and a summary of the study protocol to all potential participants and obtained written informed consent from each.

We consecutively recruited all individuals aged 18 years and older who underwent eyelid laceration repair at Mersin City Hospital, Mersin, Turkey, during the study period. Those with known structural eyelid disorders, previous eye surgery, or unwillingness to participate were excluded.

Demographic patient data at the time of admission were recorded. All patients underwent a detailed slit-lamp examination of the anterior and posterior segments (BM 900 slit lamp; Haag Streit, Koeniz, Switzerland). Best corrected visual acuity (BCVA) was measured using the Snellen chart (Nidek Co. Ltd., Japan), with values converted to the logarithm of the minimum angle of resolution (logMAR) equivalent, at both preoperative (if unavailable, at the immediate postoperative visit) and final postoperative visits. IOP was measured using a non-contact air puff tonometer (NT-530, Nidek) if globe perforation was not suspected. The anatomical location, etiology of injury, presence of co-injuries, and imaging evidence of orbital bone fractures were noted.

The first indication for surgery was defined as deterioration of the shape and function of the eyelid and a laceration length of 2 mm or longer [7]. Because open globe injury is a contraindication to periocular and periorbital manipulation [3, 15], globe repairs were performed first, followed by eyelid repairs. All upper and lower canalicular lacerations were simultaneously repaired using a canalicular stent under the operating microscope [16, 17]. The selection of repair technique was individualized according to the injury characteristics in each case [8, 12, 18, 19].

Postoperatively, topical moxifloxacin eye drops (Moxai® 0.5%; Abdi Ibrahim, Istanbul, Turkey) and oral amoxicillin-clavulanate (Augmentin® 875 mg/125 mg, GlaxoSmithKline, Turkey) were prescribed with the duration and frequency individualized according to the patient's clinical features and nature of the trauma. The frequency and extent of postoperative follow-up examinations were individualized based on the patient's

initial wound characteristics, associated co-injuries, and postoperative outcomes. BCVA was recorded for all individuals at the final postoperative visit.

Statistical analysis was conducted using IBM SPSS Statistics for Windows, version 29.0 (IBM Corp., Armonk, NY, USA). The Kolmogorov–Smirnov test was used to assess the normality of data distribution. Categorical variables are expressed as numbers (percentages). Continuous variables are expressed as means (standard deviations [SDs]). The means of the two groups were compared using the Student's *t*-test. Comparison of more than two groups was conducted using one-way analysis of variance followed by Tukey's post-hoc test for pairwise comparisons if the *P*-value was less than 0.05. For all variables, a *P*-value less than 0.05 indicated statistically significant differences.

RESULTS

Among the 195 included patients, the mean (SD) age was 42.5 (5.6) years, a higher proportion ($n = 164$, 84.1%) were men, and the men were significantly older than the women ($P = 0.033$) (Table 1). The mean (SD) BCVA at baseline and the final visit was 0.21 (0.15) and 0.12 (0.07) logMAR, respectively, representing a statistically significant improvement at the final visit ($P < 0.001$).

The most common ($n = 70$, 35.9%) etiology was accidental, and almost half of these ($n = 32$ of 70, 45.8%) occurred in the workplace. Table 1 summarizes the demographic characteristics and frequency of each etiology among patients. The mean (SD) age for five etiologies of injury were significantly different in individuals with eyelid lacerations ($P < 0.001$) (Table 1). Pairwise analyses revealed significant differences in the mean (SD) age of etiologies (all $P < 0.001$), except for accidental versus tree branch ($P = 0.086$) and assault versus sports injury ($P = 0.592$).

Table 2 summarizes the anatomical sites of eyelid lacerations and the frequencies of co-injuries observed among the patients. The frequencies of co-injuries observed among the patients differed significantly ($P < 0.001$). Among all patients, 9 (4.6%) had no additional injuries, 25 (12.8%) had nasolacrimal system involvement (upper and/or lower canaliculus), and 11 (5.6%) had open globe injuries. Imaging evidence of orbital bone fractures

Table 1. Demographic data and etiologies of injury in patients with eyelid lacerations

Variable		n (%)	Age (y), Mean \pm SD
Sex	Men	164 (84.1)	43.4 \pm 9.8
	Women	31 (15.9)	38.2 \pm 3.5
Etiology	Accidental	70 (35.9)	39.1 \pm 7.3
	Assault	54 (27.7)	35.4 \pm 7.7
	Falls from height	39 (20.0)	60.7 \pm 6.1
	Tree branch	22 (11.3)	44.6 \pm 5.5
	Sports injury	10 (5.1)	29.3 \pm 4.7

Abbreviations: n, number of participants; %, percentage; y, years; SD, standard deviation.

Table 2. Features of eyelid lacerations in included patients

Variable	Characteristic	Overall	Men	Women
Co-injury, number	None	9	2	7
	Eyelid margin involvement	92	76	16
	Bone fracture	47	43	4
	Eyebrow involvement	46	37	9
	Nasolacrimal system involvement	25	21	4
	Open globe injury	11	10	1
Anatomical position, number	Right upper eyelid	62	48	14
	Left upper eyelid	58	44	14
	Right lower eyelid	49	39	10
	Left lower eyelid	41	30	11

Note: Because some patients had more than one co-injury or more than one eyelid laceration, the sums of the frequencies of co-injuries and the anatomical positions of injuries exceed 195.

was noted in 47 (24.1%) patients. The eyelid margin was involved in 92 (47.2%) patients, and the eyebrow was involved in 46 (23.6%) patients (Table 2). The right upper eyelid was the most commonly affected, followed by the left upper, right lower, and left lower eyelids (Table 2). We observed no significant difference in the frequencies of anatomical positions ($P=0.456$).

For all patients, surgery was performed within the first 24 hours after the injury. All patients with isolated skin lacerations ($n=9$, 4.6%) were treated with primary closure. Suturing was performed according to the correct anatomical orientation. None of the 77 (39.5%) patients who had tissue loss at baseline examination required tissue grafting. Primary closure under tension was performed in all patients with tissue loss. Five (2.6%) patients underwent lateral canthotomy for improved tissue apposition. In the initial ophthalmological examination, 24 (12.3%) patients had traumatic myogenic ptosis and 13 (6.7%) had traumatic aponeurotic ptosis. At the 6-month postoperative follow-up visit, ptosis persisted in 7 of these 37 (18.9%) patients. No patient developed serious intraoperative and/or postoperative complications such as lagophthalmos, entropion, ectropion, infection, epiphora, or slit canaliculus.

DISCUSSION

In this study, we aimed to highlight traumatic eyelid injuries, which are frequently encountered in emergency departments. According to our results, eyelid injuries were more common in men (84%). The most common etiology of injury was accidental, and most of these occurred at the workplace. Isolated eyelid lacerations were rare. We noted a significant BCVA improvement at the final visit.

Traumatic eyelid lacerations require a thoughtful, well-planned approach to provide the best outcome and reduce the chances of postoperative complications [20]. In the initial evaluation of traumatic eyelid injury, any abrasion, ecchymosis, or laceration should be noted [2, 21]. Most often, swelling will limit the mobility of the globe and eyelid [21]. A previous study found globe injury in 25% of patients, with most (83.3%) of these having upper canalicular involvement [22]. Therefore, if canalicular injury is present, globe injury should be suspected [21, 22]. Of the patients included in our study, 11 (5.6%) had open globe injuries.

Lacerations involving the eyelid margin, canalicular system, or levator muscle should be evaluated and repaired by an ophthalmologist [7]. Monocanicular lacerations may not require immediate surgical repair, and delays of up to 48 hours are acceptable [23]. However, this is not always possible, as patients may have concurrent injuries, such as a traumatic brain injury. In the case of lacrimal system injury, stents may be used during repair to prevent stenosis and ensure proper alignment of the anastomosis [24]. In the current study, 25 (12.8%) patients had nasolacrimal system involvement (upper and/or lower canaliculus) and surgery was performed within the first 24 hours after the onset of injury. We did not encounter epiphora or slit canaliculus at the final visit.

In our study, the most common ($n=70$, 35.9%) etiology of injury was accidental, and nearly half of these occurred at the workplace, mostly in men. According to a recent report [25], the incidence of eyelid injuries in the United States decreased by 7.1 per million from 2006 to 2014. Object-related (42.2%) and fall-related (28.8%) mechanisms were the most commonly reported. Most eyelid injuries occurred in men, representing 69% of all cases [25]. In the current study, among the 195 included patients, a higher proportion were men, and the men were significantly older than the women.

Huang et al. [26] evaluated 165 pediatric patients, and 136 were followed up for at least 1 week. The most common mechanisms of injury were dog bites ($n=62$, 38%), falls ($n=33$, 20%), and being struck by an object ($n=22$, 13%). Eyelid margin involvement was present in 108 (65%) patients and canalicular involvement in 77 (47%). Risk factors for canalicular involvement were hook injury, eyelid margin involvement, and lower eyelid injury [26]. In our study of adults, 25 (12.8%) patients had upper and/or lower canalicular involvement. All upper and lower canalicular lacerations were simultaneously repaired using a canalicular stent under the operating microscope.

In a Chilean study, 37 425 patients with eye and orbital injuries were analyzed. Approximately 82% of the patients were men, and most were middle aged [27]. Chiang et al. found that 92 (64.3%) of 143 patients with eyelid lacerations were men [28]. According to our findings, eyelid lacerations were particularly prevalent in men (84.1%). In nearly all studies on this subject, ocular trauma mostly affected men [25, 27, 28]. This may be because most workers in factories and workplaces in our country are men, and individuals who perform heavy labor are generally male [29].

In a study conducted in the United States, falls were the most common cause of eye trauma. The most commonly affected group was aged 21–64 years. Patients aged more than 65 years were 16.75 times more likely to be injured in falls [30]. In our study, sports injuries generally affected the younger age group (mean [SD]

age: 29.3 [4.7] years), whereas falls more often affected the older population (mean [SD]: 60.7 [6.1] years). In addition, the mean age of men was significantly higher than that of women. Loss of balance and strength, gait difficulties, and visual problems in older patients may render them more vulnerable to falls [31]. We observed that men outnumbered women in those who sustained eyelid lacerations. This may be because women reduce outdoor activities as they age and are therefore less exposed to trauma. Further studies are necessary to support this reasoning.

In a study conducted in Thailand [32], 144 (63.4%) of 227 men with a history of ocular trauma were injured at work, followed by those injured at home (n = 35, 15.4%) and on the street (n = 32, 14.1%). In contrast, women were most often injured on the street (n = 8, 36.4%), followed by the home (n = 6, 27.3%) and the workplace (n = 5, 27.3%). The proportion of patients with visual acuity of 20/40 or better increased from 9.8% at the initial examination to 32.9% at the final visit. Those with eyelid/adnexal injury had significantly better initial visual acuity than those with open and closed globe injury [32]. In our study, the most common etiology was accidental (n = 70, 35.9%), and nearly half of these lacerations occurred in the workplace (n = 32 of 70, 45.8%). All patients experienced a significant improvement in the final BCVA. Given the higher rate of lacerations caused by workplace accidents, appropriate eye protection at work will reduce the rate of accidental eyelid injuries [33, 34]. This preventive approach could reduce the frequency and severity of ocular injuries [35].

In a study by Tabatabaei et al., the most commonly affected sites of laceration were the right (n = 21, 21.6%) and left (n = 20, 20.6%) upper eyelids. The least affected area was the left lower eyelid (n = 11, 11.3%) [36], as observed in our study. The most commonly affected site in our study was the right upper eyelid (n = 62, 31.8%). Most individuals are right handed and right-eye dominant [37]. For this reason, they use the right hand and foot more often in their personal and professional life. This may explain the high number of right eyelid injuries.

The annual cost of work-related eye injuries is estimated at 1 to 3 billion dollars [38]. Most affected individuals are male and younger in age [39]. The incidence and financial burden of eye injuries can be reduced with preventive measures [40]. Moreover, eyelid shape and facial expressions are important for social communication [41, 42]. Therefore, avoidance of eyelid trauma can prevent a lack of self-confidence and promote social well-being. Further studies are needed to analyze the outcomes of early and proper eyelid laceration repair from this perspective.

This study reported the demographic and clinical characteristics, etiologies of injury, co-injuries, and optimistic visual outcomes in individuals with promptly managed eyelid lacerations. However, limitations of our study include its small sample size and restriction to a single tertiary care center. In addition, the short follow-up period precluded an assessment of long-term outcomes and complications. Further studies are needed to address these limitations and to provide robust evidence to establish proper preventive policies in our community.

CONCLUSIONS

Eyelid injuries are more common in men, and the most common etiology is accidental. These injuries occur most commonly in the workplace. Isolated eyelid lacerations are rare. Early ocular assessment and prompt management ensure better visual outcomes. We recommend preventive safety precautions for workplaces to reduce the incidence of avoidable injuries. Identifying risk factors in further population-based studies could prevent loss of labor in a productive population. Further multicenter, nationwide, longitudinal studies could estimate the actual burden and prognosis of ocular trauma, particularly that of eyelid lacerations. The proposal of preventive recommendations and safety precautions is required in our workplaces to lower the incidence of avoidable injuries in our society.

ETHICAL DECLARATIONS

Ethical approval: We obtained all necessary permissions from the Toros University Clinical Research Ethics Committee, Mersin, Turkey (Code: 2023-96). We provided the aims and a summary of the study protocol to all potential participants and obtained written informed consent from each.

Conflict of interests: None.

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