

*Original Article*

ETIOLOGY OF EYE GLOBE ATROPHY IN UPPER EGYPT: A RETROSPECTIVE ANALYTICAL STUDY

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**Abstract**

**Purpose:** To investigate the different etiologies of eye globe atrophy in Upper Egypt. **Methods:** A retrospective analytical study including 302 eyes of 300 patients with eye globe atrophy. Patients were evaluated in terms of age, gender, laterality, axial length, visual evoked potential (VEP), electroretinogram (ERG) and cause of eye atrophy in addition to the assessment of the condition of their non-atrophic eyes. **Results:** All patients had total blindness in the atrophic globe with no light perception, a mean intraocular pressure (IOP) of  $3.96 \pm 0.23$  mm Hg, a mean axial length of  $15.7 \pm 3.45$  mm and no response of their VEP and ERG. Ocular trauma was the most common cause of eye globe atrophy (53.3%) followed by postoperative atrophy following intraocular surgeries (28.1%), ocular infections or inflammations (13.9%), congenital causes (3%) and tumors (1.7%). Cataract was the most common ocular disease in their non-atrophic eyes (15.7%) followed by open angle glaucoma (12%). VEP and ERG tests were normal in 87.2% and 90.9% of the non-atrophic eyes, respectively. **Conclusion:** Ocular trauma is the commonest cause of eye globe atrophy in Upper Egypt and thus more efforts should be made to raise community and social awareness to reduce the incidence of ocular trauma.

**Keywords:** *Globe atrophy, ocular trauma, eye loss, Upper Egypt*

**1. Introduction**

Eye globe atrophy or atrophica bulbi refers to atrophy of intraocular structures associated with low intraocular pressure while the term phthisis bulbi refers to atrophic globe with shrunken disorganized contents [1]. Eye globe atrophy has different etiologies including trauma, inflammations, ocular surgeries and malignancies [2]. Ocular trauma whether open globe or closed globe injuries accounts for a sign-

ificant percentage of cases of eye globe atrophy as reported by some studies [3,4]. Patients with eye globe atrophy commonly presents with total loss of vision (No light perception) in addition to other clinical features related to the corresponding etiology such as hypotony, neovascularization, thickened choroids, enophthalmos and pseudoptosis [5]. Functional eye loss and anatomical eye globe atrophy are associa-

ted with visual disability as well as psychological and social trauma jeopardizing the well-being of patients [6]. Developments in ocular prosthesis have improved oculo-facial deformities and were associated with acceptable degrees of patient satisfaction [7]. The aim of the current study

## 2. Patients and Methods

### 2.1. Study settings and design

A retrospective analytical study conducted at Assiut University Hospital and Tiba

### 2.2. Ethical approval

This study was reviewed and approved by the Ethical Committee of Faculty of Medicine, Assiut University, Egypt. IRB

### 2.3. Patient selection and assessment

Patients presented with total visual impairment in one or both eyes during the visual impairment program recording in the period between 2021 and 2022 were included in this study. The medical records of patients were evaluated retrospectively. Patients with incomplete medical records or lack of reliable clinical data were excluded from this study. History was taken to evaluate etiology and duration of visual loss. Corrected distance visual acuity (CDVA) was measured for all patients utilizing Snellen's acuity chart converted to decimal notation. Clinical assessment of enrolled patients included slit lamp bio microscopy (Haag-Streit GAT, Köniz, Switzerland) and intraocular

### 2.4. Statistical Analysis

SPSS Ver. 20.0 program (SPSS Chicago, Illinois, USA). Descriptive statistics: Means, standard deviation (SD), medians, range and percentages were calculated. Test of

## 3. Results

### 3.1. Demographics and baseline features of the atrophic eye

The study included 302 eyes of 300 patients presented with eye globe atrophy. All patients had total blindness in the atrophic globe with no light perception

was to investigate the different etiologies of eye globe atrophy in Upper Egypt for patients participating in the visual impairment program at Assiut Univ.Hospital (The largest tertiary care hospital in Upper Egypt).

eye center (private practice), in Assiut, Egypt.

local approval number: 04-2023-300063. The study adhered to the tenets of the Declaration of Helsinki.

pressure (IOP) measurement (Goldman Applanation tonometer, Haag-Streit GAT, Köniz, Switzerland). The investigatory assessment included electroretinogram (ERG), visual evoked potential (VEP) (Metrovision, France) and A-scan ocular ultrasound (Sonomed, New York, USA). All examinations were performed by the same ophthalmologist. Categorization of different etiologies of eye globe atrophy included ocular trauma, postoperative atrophy following intraocular surgery, intraocular infections or inflammations, tumors and congenital eye diseases. Patients were evaluated in terms of age, gender, affected eye, and cause of eye atrophy.

normality "Shapiro-Wilk/Kolmogorov Smirnov" was used to test the normality of continuous variables.

(NLP), a mean IOP of  $3.96 \pm 0.23$  and no response of their VEP and ERG. The demographics of the studied sample is illustrated in tab. (1).

**Table 1:** Demographics and baseline features of the atrophic eyes

Parameter	Value
<b>No. of Eyes</b>	302
<b>No. of Patients</b>	300
<b>Age (years) †</b>	46.06±1.9/ 47.5 / 7-90
▪ Children (0-14)	17 (5.7%)
▪ Youth (15-24)	28 (9.3%)
▪ Adults (25-59)	157 (52.3%)
▪ Older adults (60 and older)	98 (32.7%)
<b>Gender</b>	
▪ Male	233 (77.6%)
▪ Female	67 (22.4%)
<b>Laterality</b>	
Unilateral / Bilateral	298 / 2
<b>Right eye</b>	202 (67.8%)
<b>Left eye</b>	96 (32.2%)
<b>VA</b>	NLP (302 / 100%)
<b>IOP (mm Hg) †</b>	3.96±0.23/ 4 / 0-8
<b>VEP</b>	NR (302 / 100%)
<b>ERG</b>	NR (302 / 100%)
<b>Axial length (mm) †</b>	15.7±3.45 /15 / 14.6-17.9

† Data expressed as Mean ± SE, Median, Range; SE: Standard error; VA: Visual acuity; IOP: Intraocular pressure; NLP: No light perception; VEP: Visual evoked potential; NR: No response; ERG: Electroretinogram.

### 3.2. Etiologies of eye globe atrophy

Ocular trauma was the most common cause of eye globe atrophy in this analytical study (53.3%). Most ocular trauma cases were due to open globe injuries (143 eyes out of 161 representing 88.8% of trauma cases of whom 23 eyes had retained intraocular foreign body). Postoperative ocular globe atrophy following intraocular surgery was the next most common cause and was reported in 85 patients (28.1%) of the enrolled sample (23 patients had cataract surgery complicated by endophthalmitis or persistent uveitis, 47 patients had vitrectomy surgery for longstanding retinal detachment and 15 patients had trabeculectomy filtration surgery complicated by endophthalmitis). Out of those 85 patients,

30 patients underwent their surgical interventions in general hospitals (35%), 21 patients in private hospitals (25%) and the rest were unknown (40%). Ocular infections and inflammations represent 13.9% of the studied sample and were associated with perforated infectious keratitis, endogenous endophthalmitis and long-standing uveitis. Two patients had bilateral, and 5 patients had unilateral eye globe atrophy due to a congenital cause (persistent hyperplastic primary vitreous PHPV) and five patients had eye globe atrophy after irradiation for choroidal melanomas. The etiologies of eye globe atrophy are shown in tab. (2).

**Table 2:** Etiologies of eye globe atrophy of the studied sample

Parameter	Value (n = 302 eyes )
<b>Trauma</b>	161 (53.3%)
<b>Postoperative complication</b>	85 (28.1%)
<b>Infections / Inflammations</b>	42 (13.9%)
<b>Congenital causes</b>	9 (3%)
<b>Tumors</b>	5 (1.7%)

Data expressed as number and percentage.

### 3.3. The condition of the other eye (non-atrophic globe)

The mean CDVA of the other non-atrophic eye of the enrolled patients was  $0.37 \pm 0.06$  (decimal notation) with a mean IOP of  $14.86 \pm 0.29$  mm Hg and a mean axial length of  $22.7 \pm 2.65$  mm. VEP and ERG test were normal in 260 (87.2%) and 271 (90.9%) eyes, respectively. VEP testing was abnormal in 38 eyes (12.8%) as follows: mild delay of VEP latency in 9 eyes (23.7%), moderate VEP delay in

8 eyes (21%) and severe VEP delay in 21 eyes (55.3%). Cataract was the most common ocular disease in the other non-atrophic eye of included patients (15.7%) followed by open angle glaucoma (12%) with nearly 7% of the non-atrophic eyes suffering from low vision (CDVA less than 0.05). Table (3) summarizes the parameters reporting the condition of the other non-atrophic eye.

**Table 3:** The condition of the other eye (non-atrophic globe)

Parameter	Value (n = 298)
No. of Eyes	298
CDVA †	$0.37 \pm 0.06$ / 0.4 / 0.01-1
IOP (mm Hg) †	$14.86 \pm 0.29$ / 15 / 9-25
VEP (Normal / Abnormal)	260 / 38
ERG (Normal / Abnormal)	271 / 27
Axial length (mm) †	$22.7 \pm 2.65$ / 23 / 20.8-31.9
Ocular diseases	
▪ Cataract	47 (15.7%)
▪ Glaucoma	36 (12%)
▪ Corneal opacity	15 (5%)
▪ Retinal disease	18 (6%)

† Data expressed as Mean  $\pm$  SE, Median, Range; SE: Standard error; CDVA: Corrected distance visual acuity; IOP: Intraocular pressure; VEP: Visual evoked potential; ERG: Electroretinogram.

## 4. Discussion

The facial disfigurement associated with eye globe atrophy is a major cause of physical and psychological stress experienced by patients. It decreases the patient's capability to perform normal activity and represents an obstacle impeding progress and achievement in life. Replacing the atrophic globe with an ocular prosthesis helps to promote physical and psychological rehabilitation and improve social tolerance. This study aimed to evaluate the different etiologies of atrophic globes in Upper Egypt, correlate between age, gender, and different causes of eye loss and to raise community awareness about the preventable causes. Regarding the etiology of eye loss, findings of our study showed that ocular trauma was the most common cause of eye globe atrophy in 53.3% of patients. These findings were consistent with other studies in the lit-

erature. Modugno et al [8] evaluated 8018 patients with ocular prosthesis and found that the ocular trauma was the main cause in 54% of their studied sample. Erie et al. [9] reported that trauma constituted 35% of different etiologies of 101 enucleated eyes. Côas et al. [4] found that ocular trauma was the main etiology behind 57.1% of patients suffering from ocular globe atrophy in their study. Haile et al. [10] studied the causes of eye removal in 282 patients in Ethiopia and found that traumatic globe rupture represented 33% of causes of globe atrophy. Other studies in developing countries documented that nearly 50% of eye loss were due to traumatic eye injuries [11,12]. A higher percentage was reported in a study of eye loss in Turkey by Fazil [13] who noted that 71.9% of included cases were due to eye trauma. On the other

hand, some studies reported lower percentages of eye loss due to trauma. Gunalp et al. [14] included 3506 enucleated eyes and showed that tumors were the most common etiology with a percentage of 33.8%, whereas the percentage of traumatic etiology for enucleation was only 6%. Antonio Fea et al. [15] found that the percentage of traumatic eyes loss in their study was 14.26% only. The dissimilarity of the percentages of the most common causes of eye globe atrophy between studies could be attributed to the varied environmental and socioeconomic risk factors associated with eye loss in different study populations. In our study, the second most common cause of globe atrophy was postoperative ocular complications representing 28.1% of the studied sample. Our results are in line with Fazil [13] who reported the percentage of postoperative complication as a cause of globe atrophy in the adulthood group to be 17%. Other causes of globe atrophy such as ocular tumors, ocular infections and inflammations and congenital abnormalities constituted about 26 % of the total number of eyes enrolled in the current study. Also, these percentages were similar to what was observed in previous studies [8,13]. Regarding the age distribution of the studied sample, the highest number of eye loss cases in our study was recorded in the early and middle adulthood (25-60 years). These results are in agreement with what was instituted by Modugno et al. [8]. However, it is worthy to mention that this age distribution might not be accurate because of the retrospective nature of our study. Many patients with an ocular traumatic etiology of globe atrophy might have been exposed to trauma at younger ages. Fazil [13] found that ocular globe loss was more prevalent in ages less than 8 years as the level of children awareness of eye trauma at that

age is expected to be deficient and most of them can't protect themselves or wear protective measures. Many studies investigating traumatic eye injuries in Egypt attributed reasons for the predominance of these injuries among pediatric population to family negligence, lack of adult supervision and low socioeconomic conditions associated with poverty and ignorance [16-18]. Concerning gender distribution in this study, males (77%) were affected by globe atrophy more than females (23%). A possible explanation of this observation is the higher incidence of ocular trauma at work, especially with careers that are male dominated especially in Upper Egypt. Similar results of higher male affection with globe atrophy compared with females were suggested by other studies [8,13]. In the current study, most of enrolled cases had right eye loss in 67.8% and left eye loss in 32.2% of included eyes. Right eye predominance in traumatic eye injuries might be attributed to the predominance of right hand use among persons over the left hand and so the same side eye might be more prone to trauma. However, the predominance of eye loss in the left side over the right side was observed by Mattos et al. [19]. All cases in the current study have unilateral atrophic globe except two patients who were presented with bilateral atrophic globes. Cataracts and glaucoma were the most common ocular morbidities of the contralateral non-atrophic eyes. Similarly, Adewara et al. [20] investigated the status of the fellow eye of 79 patients with unilateral phthisis bulbi in Nigeria and documented that glaucoma and cataracts were the commonest morbidities in the fellow non-atrophic eye of those patients. Zhang et al. [21] showed that 5.58% of contralateral non-atrophic eyes of 573 patients with removed eyes had low vision which is comparable to our results. Ana-

lyzing the morbidities of the fellow-eye in studies investigating atrophic globes, phthisis bulbi or eye-loss would improve

the quality of vision and raise the psychosocial status of one-eyed patients.

## 5. Limitations

Our study has some limitations such as the lack of detailed information about the different circumstances related to the cause of eyeball loss in addition to the relatively small sample size.

## 6. Conclusion

*Ocular trauma is a leading cause of severe anatomical and functional impairment of the visual system. The data from our study may be beneficial for long-term prevention strategies which may participate in reducing the socioeconomic and personal burden of eye loss. Special attention should be paid to the condition of the fellow non-atrophic eye of patients with unilateral atrophic globes.*

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