

Indications for eye removal surgeries

A 15-year experience at a tertiary military hospital

Mehmet T. Koylu, MD, Gokcen Gokce, MD, Yusuf Uysal, MD, Osman M. Ceylan, MD, Dorukcan Akincioglu, MD, Armagan Gunal, MD.

ABSTRACT

الأهداف: لتحليل المؤشرات وأنواع عمليات إزالة العين في مستشفى الرعاية العسكرية من الدرجة الثالثة في تركيا.

الطريقة: تمت مراجعة السجلات الطبية (العمر، الجنس، العين المتضررة ونوع العملية الجراحية، مؤشرات الجراحة) لعدد 123 مريضاً خضعوا لاستئصال وقلع خلال فترة 15 سنة (يناير 2000م إلى ديسمبر 2014م) في أكاديمية جولهان الطبية العسكرية، أنقرة، تركيا تم استعراض بأثر رجعي.

النتائج: كان متوسط العمر 35.61 ± 18.52 (المدى 3-80 سنوات). وكان عدد الذكور في الفئة من المرضى 92 (74.8%)، وعدد الإناث 31 (25.2%). كان المرضى الذين خضعوا لاستئصال 95 (77.2%)، في حين أن 28 (22.8%) منهم خضعوا للقلع. وكان متوسط عمر المرضى اللذين خضعوا لإزالة جزء من العين 30.63 ± 13.08 ، في حين أن متوسط عمر المرضى اللذين خضعوا لإزالة كامل العين كان 52.50 ± 23.92 ($p < 0.001$). وكانت المؤشرات الرائدة لبتز العين بسبب صدمة (n=62، 50.4%)، الورم الخبيث (n=20، 16.3%)، والتهاب العمياء المؤلمة والزرق المطلق (n=20، 16.3%)، التهاب باطن المقلة (n=12، 9.7%)، انضمام العين، وأسباب تجميلية (n=9، 7.3%).

الخاتمة: كانت الصدمة والورم الخبيث من المسببات الأكثر شيوعاً للاستئصال. استخدام النظارات الواقية والكشف المبكر عن الأورام الخبيثة العين والزرق عن طريق فحص روتيني للعيون ضروري لتوفير وسائل العلاج غير مقتحمة للعين بدلاً من إزالتها.

Objectives: To analyze the indications and types of eye removals at a military tertiary care hospital in Turkey.

Methods: The medical records (age, gender, affected eye, type of surgical procedure, indications of surgery) of 123 patients who underwent evisceration and enucleation in the course of a 15-year period (January

2000 to December 2014) at Gulhane Military Medical Academy, Ankara, Turkey were reviewed retrospectively.

Results: The mean age was 35.61 ± 18.52 (range 3-80 years). The number of male in the patient group was 92 (74.8%) and female was 31 (25.2%). Patients who underwent evisceration were 95 (77.2%), whereas 28 (22.8%) of them underwent enucleation. The mean age of the eviscerated patients was 30.63 ± 13.08 , whereas the mean age of the enucleated patients was 52.50 ± 23.92 ($p < 0.001$). The leading indications for eye amputations were trauma (n=62, 50.4%), malignancy (n=20, 16.3%), painful blind eye and absolute glaucoma (n=20, 16.3%), endophthalmitis (n=12, 9.7%), and phthisis bulbi, and cosmetic reasons (n=9, 7.3%).

Conclusion: Trauma was the most common etiology for evisceration, and malignancy was the most common etiology for enucleation. Using protective eyewear and early detection of intraocular malignancy and glaucoma through routine ophthalmic examinations are essential for providing non-invasive treatment modalities instead of eye removal.

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From the Department of Ophthalmology (Koylu), Tatvan Military Hospital, Bitlis, and the Department of Ophthalmology (Gokce), Kayseri Military Hospital, Kayseri, and the Departments of Ophthalmology (Uysal, Akincioglu), Pathology (Gunal), Gulhane Military Medical Academy, the Department of Ophthalmology (Ceylan), Medical Park Hospital, Ankara, Turkey.

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Address correspondence and reprint request to: Dr. Mehmet T. Koylu, Department of Ophthalmology, Tatvan Military Hospital, Tatvan, Bitlis, Turkey. E-mail: talaykoylu@hotmail.com

Eye removals are performed in cases of severe trauma, eye malignancy, endophthalmitis unresponsive to medical treatment, painful blind eye, and absolute glaucoma, as well as phthisic eyes with severe cosmetic defects.^{1,4} Evisceration is the removal of intraocular structures other than the sclera, whereas enucleation is the removal of the entire eyeball including the sclera leaving behind only the orbital structures.⁵ Evisceration surgery is usually preferred in extremely severe trauma cases, while enucleation is used in advanced cases of intraocular malignancy.^{1,3,6} The aim in such surgeries is to remove the damaged eye, provide sufficient comfort, replace the lost volume, and renew functional and cosmetic appearance.⁷ Removal is a difficult decision for both patients and physicians, and is considered as the last resort. In addition to clinical indications, the potential sight of the eye and patient's psychological aspects should also be taken into consideration.¹ In developed countries, the most common reasons for eye amputations are malignancy³ and trauma,⁶ whereas in developing countries, infections are the dominating factors.^{1,8} In this study, the etiology and surgery methods of 123 eye amputations performed in the Gulhane Military Medical Academy (GATA) between January 2000 and December 2014 were analyzed, and possible public health and preventive programs regarding this matter were evaluated.

Methods. The study protocol was approved by the Local Institutional Review Board and performed according to the principles of the Helsinki Declaration. In this retrospective study, the files of 123 evisceration and enucleation surgeries performed within 15 years (January 2000 to December 2014) in the Ophthalmology Department of GATA, Ankara, Turkey, which is a tertiary military hospital were examined. Information of each patients' age, gender, affected eye, and surgical indications, as well as surgery procedures were examined. The evisceration surgeries were performed by 360 degrees peritomy, keratectomy, anterior and posterior scleral cuts for relief, peeling off intraocular structures and all uveal tissues meticulously, washing the scleral bed with an antibiotic solution, and finally, placing a globe implant of suitable size and suturing the anterior scleral tissues, Tenon's capsule,

and the conjunctiva. The enucleation surgeries were performed by 360 degrees peritomy, separation of the Tenon's capsule from the orbit through blunt dissection, disinsertion of extraocular muscles, cutting the optical nerve, total removal of the globe and bleeding control, placement of a globe implant of suitable size, slinging the implant by suturing the rectus muscles to the implant, and suturing the Tenon's capsule and the conjunctiva.

Inclusion criteria for evisceration were severe trauma, in which early primary repair or globe reconstruction was impossible due to excessive tissue loss, painful blind eye, and absolute glaucoma, phthisis bulbi, cosmetic reasons, and endophthalmitis unresponsive to medical therapies. Inclusion criteria for enucleations were eye malignancy, which was unresponsive to medical therapies or eye malignancy when medical therapies were impossible at the advanced stages during the diagnosis. Exclusion criteria were missing medical information (age, gender, affected eye, or surgical indication) in the files of subjects who underwent eye removal surgery.

Analyses were conducted using the Statistical Package for Social Sciences for Windows software version 16 (SPSS Inc., Chicago, IL, USA). Chi-square test was used for categorical values in the evaluation of intergroup differences. A $p < 0.05$ was considered statistically significant.

Results. A total of 123 eye removal surgeries were performed in the Ophthalmology Department of GATA between 2000 and 2014, 95 (77.2%) of which were evisceration surgeries and 28 (22.8%) were enucleation surgeries. The mean age of all patients who underwent eye removal ($n=123$) was 35.61 ± 18.52 (3-80 years). The mean age of the patients who underwent evisceration ($n=95$) was 30.63 ± 13.08 whereas the mean age of the patients who underwent enucleation ($n=28$) was 52.50 ± 23.92 . The age difference between the patients who underwent evisceration and enucleation was found statistically significant ($p < 0.001$). All patients who underwent enucleation due to retinoblastoma ($n=3$) were below the age of 5. The number of males among all patients who underwent eye removal ($n=123$) was 92 (74.8%), whereas the number of females was 31 (25.2%) (male/female = 2.97). The number of males among the patients who underwent evisceration ($n=95$) was 72 (75.8%) and the number of females was 23 (24.2%) (male/female = 3.1) while the number of males among the patients who underwent enucleation was 20 (71.4%), and the number of females was 8 (28.6%) (male/female = 2.5). There was no statistically significant difference in terms of gender between the patients

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who underwent evisceration or enucleation ($p=0.64$). There were 58 (47.2%) patients who were operated in the right eye, and 65 (52.8%) patients were operated in the left eye. There was no statistically significant difference in terms of the affected eye between patients who underwent evisceration or enucleation ($p=0.17$). An evaluation of the patients who underwent total eye removal ($n=123$) revealed the most common surgical indications as trauma, malignancy, painful blind eye and absolute glaucoma, endophthalmitis, phthisis bulbi, and cosmetic reasons (Table 1).

Indications and their quantity according to surgery type are summarized in Figure 1. The surgical indications of those patients who underwent evisceration surgery ($n=95$) were trauma, painful blind eye and absolute glaucoma, phthisis bulbi, cosmetic reasons, and endophthalmitis (Figure 1). All trauma cases were due to the explosive munitions (improvised explosive devices, grenades, rockets, and land mines), and evisceration was required as a primary surgical intervention in 28% of the eyes (from a total of 340 traumatic severe eye injuries) in the first 48 hours. The surgical indications of those patients who underwent enucleation surgery ($n=28$) were malignancy ($n=20$, 71.4%) and endophthalmitis

($n=8$, 28.6%). According to the pathological assessment of the eyes that underwent enucleation surgery due to malignancy ($n=20$), the diagnoses were uveal malignant melanoma in 13 eyes (65%), retinoblastoma in 3 eyes (15%), conjunctival squamous cell carcinoma in 2 eyes (10%), and infiltrative basal cell carcinoma in 2 eyes (10%).

Microbiologic assessment of all eyes that underwent destructive eye surgery due to endophthalmitis included *Streptococcus pneumoniae* ($n=1$), *Pseudomonas aeruginosa* ($n=1$), *Streptococcus viridians* ($n=1$), *Morganella morganii* ($n=1$), *Staphylococcus epidermidis* ($n=2$), fungal infections ($n=4$), and unisolated culture ($n=2$). Eight cases occurred between the years 2000-2002, 4 cases occurred between 2003-2005, and none occurred after the year 2005. In the eviscerated group, short term postoperative complications included conjunctival and eyelid edema ($n=1$), and long term postoperative complications included implant exposure ($n=2$). In the enucleated group, short term postoperative complications included opening of conjunctival cover ($n=1$), no long term postoperative complications were encountered.

Discussion. In our study, patients who underwent evisceration were younger than the patients who underwent enucleation, according to which a statistically significant difference was found. The mean ages, gender distribution, evisceration/enucleation rates and the most frequent indications according to studies conducted in various countries are summarized in Table 2. In the literature, the reported mean age was 29-53 years, and it was observed that in developing countries, eye removal surgeries occur at younger ages, whereas in developed countries they occur in older ages.^{2,3,5,6,9} In our study,

Table 1 - Surgical indications of patients who underwent total eye removal according to a study in Turkey.

Indication	Number of cases (%)
Trauma	62 (50.4)
Malignancy	20 (16.3)
Painful blind eye/absolute glaucoma	20 (16.3)
Endophthalmitis	12 (9.7)
Phthisis bulbi and cosmetic reasons	9 (7.3)
Total	123 (100)

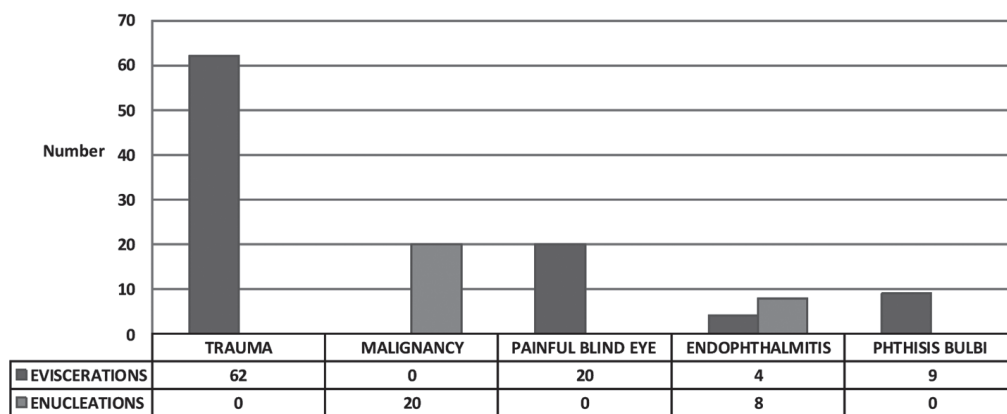


Figure 1 - Indications and type of eye removal surgery of patients included in a study in Turkey.

Table 2 - The mean ages, gender distribution, evisceration/enucleation rates, and the most frequent indications of eye removals according to studies conducted in various countries.

Year	Country	Study group	Mean age	Male to female ratio	Evisceration number	Enucleation number	Evisceration/Enucleation ratio	Common indications
2010	Denmark	Rasmussen et al ³	53	1.1	174	154	1.13	Malignancy Trauma Surgery complications
2012	USA	Yousuf et al ⁶	49.9	1.1	54	31	1.74	Trauma Painful blind eye and glaucoma Retinal ischemia
2014	Cameroon	Kagmeni et al ⁹	29	1.4	181	69	2.6	Infections Trauma Painful blind eye and glaucoma
2011	Palestine	Keenan et al ²	39	1.5	21	11	1.75	Trauma Infections Painful blind eye and glaucoma
2013	Nigeria	Etebu et al ⁵	36	2.6	63	15	4.2	Trauma Endophthalmitis Malignancy
2014	Turkey	Our study	35.6	2.9	95	28	3.4	Trauma Malignancy Endophthalmitis

the most frequent indication in evisceration surgeries was trauma, whereas it was malignancy in enucleation surgeries, which explains the younger age of evisceration patients, and the older age of enucleation patients.

Among all patients who underwent eye amputation in our study, there was a male predominance (male/female = 2.97). Likewise, the ratio was similar in patients who underwent evisceration (male/female = 3.1) and enucleation (male/female = 2.5). In the literature,⁵ the higher rate of male patients is due to the fact that men are more frequently subject to occupational accidents, as well as injuries in the military field.⁵

The most commonly used eye removal method in our study was evisceration (evisceration/enucleation = 3.4). Evisceration operations take a shorter time, and are simpler and more predictable compared to enucleation operations.^{4,6} In addition, as the sclera is not surgically removed in evisceration operations, there is a more suitable bed support for implants.^{3,4} If the lesion (tumor, infection, and so forth) involves the sclera, then enucleation should be preferred. In our series, we applied enucleation as the single eye removal method in advanced malignancy cases. Various studies have shown that in the last decade the number of eye removals due to endophthalmitis, painful blind eye, and absolute glaucoma decreased. However, surgery due to trauma increased, therefore, an increase was experienced in the rate of evisceration/enucleation.^{6,10,11} Our clinical approach is to prefer evisceration surgery as an eye removal surgical method except for eye malignancy cases.

In our study, the most common indications of eye removal surgery were trauma, followed by malignancy, painful blind eye and absolute glaucoma, endophthalmitis, phthisis bulbi, and cosmetic reasons. Trauma has become the most common indication in evisceration surgery because our hospital is a referral center to which severe injury cases are transferred. Traumas that occur in military operations are more severe than injuries that occur in civilian areas due to the fact that they are caused by high energy explosives, lead to more serious eye injuries,¹² worse initial visual acuity, and occur with injuries in multiple systems.^{13,14} The improvised explosive devices (road bombs) and land mines are frequently used by terrorist groups worldwide and responsible for almost all terror related eye injuries in Turkey.¹⁵ Many of these injuries happened during vehicle convoy operations. Because of the higher impact of these explosives at the roadside, and the lack of protection combined with the high velocity impact and fragmentary nature of these weapons such as rocks, metal, or glass fragments has led to significant mortality and morbidity in our study. We believe that the use of protective eyewear will decrease the number of severe eye traumas and evisceration surgeries. It was also reported in various studies that the use of protective eyewear in military operations result in fewer and minor injuries and better final visual acuity.^{14,16}

In eye malignancy in general, there is an opportunity for local ophthalmic intervention treatment methods at the early stages such as cryotherapy, laser photocoagulation, thermotherapy, chemotherapy,

radiotherapy, and surgical resection.¹⁷ Enucleation can be applied as the last resort in the treatment of intraocular malignancy at the advanced stages when effects on the entire eye are detected.¹⁸ Early discovery of intraocular malignancy (especially retinoblastoma and malignant melanoma) may reduce the need for enucleation.¹⁹ Infectious reasons make the most common eye removal indications in countries or regions of low socioeconomic conditions.^{8,9} The developments in the diagnosis and treatment of endophthalmitis in recent years, the existence of effective antimicrobials and their intravitreal applications enable medical therapy for endophthalmitis.⁵ In our study, no eye removal surgery was performed after 2005 for the indication of endophthalmitis.

Study limitations. Our results cannot be generalized for the community as our hospital is a tertiary military hospital, and most traumatic cases in military areas were caused by high energy explosions. Second, male predominance may be affected not only from trauma, but also the natural dominance of males in military areas.

In conclusion, trauma was the most common etiology for evisceration, and malignancy was the most common etiology for enucleation. Using protective eyewear and early detection of intraocular malignancy and glaucoma through routine ophthalmic examinations are essential for providing non-invasive treatment modalities instead of eye removal.

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