·Clinical Research·

# Enucleation and evisceration: indications, complications and clinicopathological correlations

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## Abstract

**•AIM: To assess main indications, postoperative complications and clinicopathological correlation of ocular enucleation-evisceration.**

**•METHODS: A total of 107 subjects who underwent enucleation and/or evisceration and received hydroxyapatite implants (Scleral wrap or mesh) were assessed. For each patient clinicopathological data was collected which included demographic information, clinical history, primary clinical diagnosis, main cause of ophthalmic surgery (traumatic, non-traumatic), type of surgical procedure (enucleation, evisceration) and pathological report. Patients´ postoperative clinical visits were checked for procedure-related complications during first year after surgery.**

**•RESULTS: One hundred and seven patients (male: 65.4%; mean age: 26y) underwent enucleation ($n$=100) or evisceration ($n$=7) due to traumatic ($n$=41) and non-traumatic ($n$=66) causes. Disfiguring painful blind eye was the most common indication of surgery (66.4%), followed by leukocoria (19.6%) and endophthalmitis (4.7%). The main types of injury included firecracker, traffic and work accidents, and sharp object perforating injury. In 53 (80.3%) subjects in non-traumatic group the initial clinical diagnosis matched the histopathological results. Malignant tumors (retinoblastoma: 47.5%, malignant melanoma: 27.3%) were the most common pathological diagnoses followed by phthisis bulbi (25.8%). The most common procedure-related complications were major eye discharge (39.6%), and implant exposure and discharge (20.8%).**

**•CONCLUSION: Trauma and malignant tumors are the leading causes of enucleation -evisceration. Despite developing new techniques and materials, enucleation is still associated with considerable postoperative complications.**

**•KEYWORDS:** enucleation; evisceration; retinoblastoma; malignant melanoma; ocular injury
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## INTRODUCTION

Enucleation is an acceptable surgery for end-stage ocular diseases which are not curable with medical treatments, such as inexpiable trauma damage, intraocular malignancies and phthisis bulbi. In enucleation surgeon removes the whole eyeball, whereas in evisceration sclera and extraocular muscle are left intact and is mostly accounted as a cosmetic procedure[1].

Since the description of the first enucleation surgery in 1583 by Bartisch, its indications and implanted materials have been changed through the time in order to obtain the best motility and performance, and to lessen complication rate [2]. The main clinical indications of enucleation or evisceration vary across different countries[3-5]. The most common original causes of enucleation are trauma and malignant tumors[5,6]. In tertiary centers ocular malignancies such as malignant melanoma (MM) and retinoblastoma exceed other causes of enucleation [4,7]. Different materials including cartilage, bone, fat, cork, rubber, gold, silver, and polyethylene and hydroxyapatite (HA) have been used to for orbital implants, and a considerable number of orbital implant configurations are available now[8]. Currently, porous spherical HA implants are the most common implants which was first introduced in

1985 [8]. The rate of post-enucleation or evisceration complications is dependent on many factors like implanted material, surgery techniques, and previous evisceration surgery [9,10]. The most common HA implants-related complications are discharge, implant exposure, migration or infection, conjunctival dehiscence, and pyogenic granuloma formation [11,12].

There are limited reports about indications, complications and the clinicopathological correlation of enucleation/ evisceration. This would provide a primary guide to establish preventive measures for leading causes of enucleation based on the domestic prevalence data. The purpose of this study is to investigate causes and indications, postoperative complications, and clinicopathological correlation of enucleation-evisceration using HA implants.

## SUBJECTS AND METHODS

This retrospective review was conducted on 107 subjects (eyes) who underwent enucleation or evisceration at department of ophthalmology of a tertiary center in Iran, between September 2001 and December 2006. This research study was approved by an Institutional Review Board at the Iran University of Medical Sciences. For each patient clinicopathological data were collected which included demographic information, clinical history, primary clinical diagnosis, main cause of ophthalmic surgery, type of surgical procedure (enucleation, evisceration) and histopathological report. All eye implants were hydroxyapatite (sclera-wrapped or mesh). For each patient, related procedure data of used materials, and techniques were recorded in a prepared datasheet. Patients' postoperative clinical visits were checked for potential procedure-related complications during the first year following surgery. Patients divided into traumatic and non-traumatic groups based on the underlying indication of surgeries. In non-traumatic group, subjects underwent enucleation when the eye was blind, had very poor vision and was painful, had severe endophthalmitis, to prevent sympathetic ophthalmia and/or due to cosmetic issues. In order to measure the clinicopathologic correlation, in non-traumatic group, samples were sent for histopathological study and pathologic diagnoses afterwards were compared to the initial clinical diagnosis.

**Statistical Analysis** Results were reported as mean ± standard deviation (SD) for quantitative variables and number and percentage for categorical variables. The groups were compared using the Student's $t$-test for continuous variables and the Chi-square test (or Fisher's exact test if required) for categorical variables. Statistical significance was based on two-sided design-based tests evaluated at the 0.05 level of significance. All the statistical analysis were performed using SPSS version 18.0 (SPSS Inc, Chicago, IL, USA) for Windows.

## RESULTS

A total of 107 patients (eyes) (male: 65.4%), with the mean age of 26±22y (range: 2.5mo to 78y) were recruited. One hundred eyes were enucleated and seven others underwent evisceration. Sclera-wrapped HA was the most common implant used for enucleated patients (94.0%). In six patients HA mesh was applied as implant. Ocular injury was the most common cause of the surgery and patients were classified based on the underlying indication of surgeries into traumatic ($n$=41) and non-traumatic ($n$=66) groups. Table 1 lists indications of enucleation/evisceration stratified by traumatic and non-traumatic groups. Disfiguring painful blind eye was the most common indication of surgery (66.4%), followed by leukocoria (19.6%) and endophthalmitis (4.7%).

Table 2 summarizes the causes of ocular injuries in patients who received enucleation/evisceration. In traumatic group, the main types of injury included firecracker, traffic and work accidents, and sharp object perforating injury. Among 41 patients with ocular traumas, 14 enucleations were performed primarily (including 4 eviscerations). Five patients underwent pars planavitrectomy prior to secondary enucleation. Primary enucleation was performed when the repair of globe was not possible due to unrecognizable eye contents or in case of avulsed optic nerve. Twenty seven eyes were repaired primarily, but underwent secondary enucleation (including 3 eviscerations). Among them, 24 patients had no light perception and were enucleated due to painful blind eye ($n$=9),

**Table 1 Indications of enucleation/evisceration stratified by traumatic and non-traumatic groups.**

| Indications | *n* (%) |
|---|---|
| Traumatic | 41 (38.3) |
| Disfiguring blind eye | 22 (20.6) |
| Painful blind eye | 9 (8.4) |
| Endophthalmitis | 5 (4.7) |
| Painful eye | 3 (2.8) |
| Prevention of sympathetic ophthalmia | 2 (1.9) |
| Non-traumatic | 66 (61.7) |
| Blind eye | 27 (25.2) |
| Leukocoria | 21 (19.6) |
| Painful blind eye | 10 (9.3) |
| Painful eye | 8 (7.5) |

**Table 2 Causes of ocular injury in 41 patients with enucleation/evisceration.**

| Causes | *n* (%) |
|---|---|
| Firecracker | 11 (26.8) |
| Traffic accident | 10 (24.3) |
| Work related | 8 (19.5) |
| Knife | 5 (12.2) |
| Scissor | 4 (9.8) |
| Fist | 2 (4.9) |
| Explosion | 1 (2.4) |

**Table 3 Histopathological results of enucleation/evisceration (*n*=66)**

| Histopathological diagnosis | *n* (%) |
|---|---|
| Retinoblastoma | 30 (45.5) |
| Malignant melanoma | 18 (27.3) |
| Phthisis bulbi | 17 (25.8) |
| PHPV | 1 (1.4) |

PHPV: Persistent hyperplastic primary vitreous

**Table 4 Postoperative complications in enucleated patients during one year follow up (*n*=107).**

| Complications | *n* (%) |
|---|---|
| Major discharge | 19 (39.6) |
| Exposure and discharge | 10 (20.8) |
| Implant exposure | 6 (12.5) |
| Cellulitis | 5 (10.5) |
| Lid edema | 3 (6.2) |
| Pyogenic granuloma formation | 3 (6.2) |
| Conjunctivitis | 2 (4.2) |
| Total | 48 (100) |

disfigured blind eye ($n$=8), endophthalmitis ($n$=5), and prevention of sympathetic ophthalmia($n$=2). An additional 3 eyes with light perception were enucleated for pain. All 7 cases who underwent evisceration had phtisisbulbi due to ocular injuries (3 car accident, 2 work related, and 1 gun injuries). Four patients were blind at presentation, and three patients had painful eye. Table 3 shows the pathological diagnosis in 66 enucleated eyes in non-traumatic group. In 53 (80.3%) subjects in non-traumatic group the initial clinical diagnosis matched the histopathological study results. Malignant tumors (74.8%) were the most common pathological diagnoses followed by phthisis bulbi. Among 48 subjects with final diagnose retinoblastoma, 24 (50%) cases presented with leukocoria. Blind eye (69.0%) was the most common cause of refer in patients who were finally diagnosed as MM ($n$=29). In 13 (19.7%) the clinical diagnosis was different from the pathological results which includes phtisisbulbi ($n$=8), retinoblastoma ($n$=2), multiple myeloma ($n$=2), and PHPV ($n$=1).

During one year follow up, 48 patients (44.8%) developed procedure-related complications. Discharge was the most common complications after surgery. Table 4 lists postoperative complications of the patients during follow-up period.

## DISCUSSION

Ocular enucleation is accounted as the last resort for end stages of many ocular diseases like ocular malignancies or other clinical causes leading to a painful blind eye [1]. Evisceration is another alternative which is mainly a cosmetic procedure and is used when a malignancy does not exist[1]. In this study ocular injuries and malignancies were two main causes of enucleation which were matched with initial indication of surgery. Disfiguring painful blind eye was the most common indication of surgery, followed by leukocoria and endophthalmitis. The postoperative complication rate was high in enucleated eyes who received HA implants.

In present study in consistence with previous reports, ocular injury was the leading indication of enucleation in referred subjects [6,13]. In traumatic group, the main types of injury included firecracker, traffic and work accidents, and sharp object perforating injury. A report from the United Kingdom during the period of 1994 to 2003 also confirmed eye trauma as the leading cause enucleation [3]. However, invasive ocular malignancies and their consequences were reported as the most common indication of enucleation/evisceration in tertiary centers [4,7]. Our department is a tertiary center, but ocular trauma was ranked as the most common indication of enucleation/evisceration among our patients. This might be attributed to the specific conditions in our country which are associated with more injuries like firework-related injuries during Persian New Year Festival (Chaharshanbe Soori), which is associated with severe and several injuries of hand, eye, leg and face [14]. However new surgical procedures have substantially reduced the number of cases with mechanical eye injuries who finally need enucleation, these ocular injuries, especially in severe cases are not associated with promising outcomes and still lead to a grim visual outcome or enucleation [15]. This implies the importance of political and educational strategies as a primary prevention for these types of eye injuries which are mostly preventable.

In this study, malignant tumors, including retinoblastoma and MM were the most common final diagnoses in histological studies. A retrospective review of 646 eyes in 644 American patients who underwent enucleation also revealed malignancies as the leading diagnosis in histological study[1]. The suggested underlying explanation for the predomination of tumors over trauma might be the high percentage of referred patients with malignant ocular tumors to the tertiary care centers. This is in agreement with the result of some similar studies[4,16]. Leukocoria and decreased VA are the most common signs of retinoblastoma and MM, respectively [17-19]. These signs were found in a considerable proportion of our studied patients as well which is compatible with the final confirmed histological diagnosis. Phthisis bulbi was the second order histological diagnosis in this study. Saeed *et al* [3] and Kitzmann *et al* [1] also reported phthisis bulbi as the second histological diagnosis in enucleated patients.

In our study procedure-related complications were recorded in 48 patients (44%), relatively compatible with previous reported rates (22%-48%)[9,19]. Major eye discharge was the most common complication occurred in 39.1% of our patients. Lin *et al* [20] also reported discharge as the most common complication. Higher temperature of subtropical climates and the difficulties in postoperative wound care might result in increased discharge in some cases. Exposure

and discharge (20.8%) was the next common complication followed by implant exposure (12.5%). Implant exposure rate reported to range from 10% to 22% of patients [20]. Implant exposure rate depends on several factors including age(seen more in children), type of implant (seen more in HA implants), and surgery techniques (higher after evisceration vs. enucleation)[21,22]. In this study, rate of cellulitis (10.5%) was greater than previous studies. Ashworth *et al*[23] reported cellulitis in 4% of their cases. The higher ate of cellulitis in our study might be associated with the considerable rate of eye discharge and implant exposure. Intraoperative manipulation of extraocular muscle and motility of the implant may cause edema[24]. Lid edema was detected in three patients in this study. Granuloma formation occurred in three enucleated eye in this study. Material of implant and conjunctiva-implant interface (and there with microtrauma) may affect the rate of granuloma. Due to the aggressive nature of procedure conjunctiva is also prone to damage and infection. In our study conjunctivitis occurred in two (4.2%) patients. Edelstein *et al* [25] reported three cases with conjunctivitis after enucleation.

The retrospective nature of our study limits our findings. Among our patient there were only 7 cases of evisceration while 100 patients underwent enucleation. Both enucleation and evisceration are major ophthalmic operations, and the clinical indications might not be the same, however both procedures are considered the last resort. The prevalence rate and unfavorable outcome of severe eye injuries due to mechanical trauma especially during national festivals in developing countries like Iran emerge the necessity of nationally-wide targeted program on primary prevention. Further prospective studies are encouraged to evaluate the impact of political and educational intervention on reducing the rate of severe eye injuries, and subsequent enucleation.

In conclusion, trauma and malignant tumors are the leading causes of enucleation-evisceration. Despite developing new techniques and materials, enucleation is still associated with considerable postoperative complications.

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