Shiraz E-Med J. 2014 August; 15(3): e21867. DOI: 10.17795/semj21867

Published online 2014 August 30. **Research Article**

Methods of Globe Removal and Orbital Implants

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Received: November 10, 2013; **Revised:** December 21, 2013; **Accepted:** January 10, 2014

Background: This report describes surgical techniques used for patients who had underwent eye removal surgery with orbital implant replacement in Shahid Sadoughi hospital, Yazd, Iran.
Objectives: The aim of eye removal approaches is to achieve a normal appearance and satisfactory motility with low complication rate. In this study, we analyzed different eye removal methods in Yazd Shahid Sadoughi hospital, taking into consideration the patient's age, gender, implant type and surgical complications.
Patients and Methods: Medical records of patients who underwent eye removal surgery including enucleation, evisceration and exenteration were reviewed, retrospectively. Demographic data, ocular diagnosis, surgical techniques, implant type and postoperative complications were gathered and documented. Data was analyzed by SPSS-16 based using descriptive statistics and the chi-square test.
Results: We studied 102 cases, 70 males (68.6%) and 32 females (31.4%). Surgery was more common for 20 to 50 years old patients (53.9%). Enucleation was performed on 90.2% of cases and the more frequently used implant was hydroxyapatite (88.2%). Frequent causes of enucleation, evisceration and exenteration were trauma (61.4%), endophthalmitis (100%) and tumor (83.3%), respectively. The most common complication was discharge (15.7%).
Conclusions: Enucleation with replacement of hydroxyapatite implant was the most common type of surgery as it was safe with low rate of complications.

Keywords: Eye Enucleation; Eye Evisceration; Orbital Implants

1. Background

Removal of an eye for treatment of some ocular disease was first described by Bartisch in 1583 (1). The modern form of this operation was introduced in 1841 by Farrell and Bonnet and in 1885, Mules placed the first orbital implant after evisceration (2). Enucleation, evisceration and exenteration are three techniques of eye removal surgery (3, 4). Evisceration and enucleation were developed during the two recent centuries but there is controversy regarding advantages and disadvantages of each method. In the past, enucleation was the preferred technique for prevention of sympathetic ophthalmia (SO) after evisceration. However, some studies recently reported high safety and low risk of SO for evisceration (5-9) and interests in evisceration have increased because of its advantages, such as increased prosthesis motility after surgery (5, 10).

Different orbital implants such as allen, silicone, hydroxyapatite implant (HAI), polyethylene and dermis fat graft are used to replace lost orbital volume, maintain the structure of the orbit and implant motility to overlying prosthesis, and enhance cosmetic results (3, 11). Several studies have shown that the use of HAI is prevalent in Iran and some other countries (3, 12-14).

Eye removal and empty orbit still remain a deal for ophthalmologists and accepting the challenge of this type of surgery for patients and surgeons is psychologically difficult. In addition, physical and personal disability with eye removal causes socioeconomic impairment.

2. Objectives

The aim of different eye removal approaches has been to achieve normal appearance and satisfying motility with low complication rate. In this study, we analyzed different eye removal methods in Yazd Shahid Sadoughi hospital based on age, gender, implant type and its complications.

3. Patients and Methods

In this retrospective descriptive study, we reviewed the medical records of patients hospitalized in Shahid Sadoughi Hospital for eye removal surgery due to any reason during the last 10 years (from May 2002 to December 2011). All patients had complete satisfaction regarding their treatment. Retinoblastoma cases were excluded from the study. Based on the aims of the study, a questionnaire was

designed, including, demographic data, details regarding the involved eye (right or left), surgical technique, implant type, results and complications. All patients were followed for at least six months. Different types of implants were: HAI, sphere ball and dermis fat graft. Surgical techniques were: enucleation (removal of the entire eye, involving the separation of all connections and transection of the optic nerve), evisceration (removal of intraocular contents, leaving the sclera and extraocular muscles intact) and exenteration (removal of the entire content of the orbit including the periorbita, appendages, eyelids and sometimes varying amounts of the surrounding skin). Data was analyzed using the SPSS (version 16) software based on the aims, using descriptive statistics and chi-square test with statistical significance level set at 0.05.

4. Results

In this study, we investigated 102 cases, which had undergone eye removal surgery, including 70 males (68.6%) and 32 females (31.4%). The study population was mostly 20 to 50 years olds (53.9%); 62.7% on the right eye and 37.3% on the left eye.

Frequent eye removal surgery techniques were enucleation (90.2%), exenteration (5.6%) and evisceration (3.9%), respectively. The frequent type of implant was HAI (88.2%), sphere ball implants (7.8%) and dermis fat graft (3.9%), respectively.

In this study, all patients younger than 50 years old and 64.3% of patients older than 50 years underwent enucleation. Evisceration and exenteration were performed on 14.3% and 21.4% of cases, respectively (Table 1).

Based on gender, most males and females underwent enucleation (92.9% and 84.4%). Evisceration was performed on 2.9% of men and 6.3% of women, and exenteration on 4.3% of men and 9.4% of women; these differences were not statistically significant.

Trauma was the most frequent indication for enucleation (61.4%), endophthalmitis for evisceration (100%), and tumor for exenteration (83.3%); these data are shown in Table 2. During the follow up, 33.3% of cases experienced a few complications. The most common complications were discharge (15.7%) and implant exposure (3.9%) (Table 3).

Table 1. Frequency of Surgery Type Based on Age Groups [a,b]

Age Group	< 20, y	20-50, y	> 50, y	Total
Surgery type				
Enucleation	19 (100)	55 (100)	18 (64.3)	92 (90.2)
Evisceration	0 (0)	0 (0)	4 (14.3)	4 (3.9)
Exenteration	0 (0)	0 (0)	6 (21.4)	6 (5.9)
Total	19 (100)	55 (100)	28 (100)	102 (100)

[a] Data are presented as No. (%).
[b] P Value = 0.000, χ^2 = 29.301.

Table 2. Frequency of Surgery Etiology Based on Surgery Type [a,b]

Surgery Type	Enucleation	Evisceration	Exenteration	Total
Etiology				
Trauma	62 (67.4)	0 (0)	0 (0)	62 (60.8)
Blind Painful eye	16 (17.4)	0 (0)	0 (0)	16 (15.7)
Endophthalmitis	1 (1.1)	4 (100)	0 (0)	5 (4.9)
Tumor	0 (0)	0 (0)	5 (83.3)	5 (4.9)
Congenital origin	6 (6.5)	0 (0)	0 (0)	6 (5.9)
Others	7 (7.6)	0 (0)	1 (16.7)	8 (7.8)
Total	92 (100)	4 (100)	6 (100)	102 (100)

[a] Data are presented as No. (%)
[b] P Value = 0.000, χ^2 = 166.868

Table 3. Frequency of Postoperative Complications Based on Surgery Type [a]

Complication	Enucleation	Evisceration	Exenteration	Total
Hematoma and eyelid edema	2 (2.2)	1 (25)	0	3 (2.9)
Discharge and infection	12 (13.1)	2 (50)	2 (33.3)	16 (15.7)
Pain and injection	2 (2.2)	1 (25)	1 (16.7)	4 (3.9)
Implant exposure	4 (4.3)	0	Not application	4 (3.9)
Pyogenic granuloma	2 (2.2)	0	1 (16.7)	3 (2.9)
Others[b]	4 (4.3)	0	0	4 (3.9)
No complications	66 (71.7)	0	2 (33.3)	68 (66.8)
Total	92 (90.2)	4 (3.9)	6 (5.9)	102 (100)

[a] Data are presented as No. (%).
[b] Other complications were: blepharoptosis (2 cases), fornix contracture (1 case) and foreign body sensation (1 case).

5. Discussion

In this study, we reviewed the files of participants who had undergone eye removal surgery. The more frequent type of surgery was enucleation (90.2%) and its most common indication was trauma (67.4%). Endophthalmitis was the only indication for all of the eviscerations. Enucleation was the most common eye removal surgery according to numerous studies in Iran (15, 16), while some other studies, reported that evisceration was more common (5, 17, 18). Jung et al. reported that 72.9% of eye removal surgeries were evisceration, while only 13.7% of eye removal surgeries were enucleation. Trauma was the most common indication of both techniques (17).

In a study by Nakra (5), evisceration was performed in 61.9% of eye removal surgeries and its cause was a painful blind eye (57.7%), while 38.1% of cases underwent enucleation and its most common indication was melanoma (56.7%).

According to a study by Saeed et al. (18), enucleation and evisceration were performed in 42.8% and 57.2% of eye surgeries, respectively. The indication for evisceration was endophthalmitis, trauma and painful blind eye. They noted that the advantage of evisceration over enucleation is preservation of soft tissue, better cosmetic results, excellent implant motility, lower risk of intracranial infection and implant extrusion. Nevertheless, Levine suggested a higher risk of sympathetic uveitis in evisceration (6). Although, evisceration was the preferred method according to Saeed's survey, yet evisceration is decreasing since the last two decades maybe as a result of the attempt to preserve globe shell. However, some other studies reported an increasing trend in favor of eviscerations (18, 19).

Disruption of globe integrity in evisceration theoretically increases the risk of exposing uveal antigens, which could cause autoimmune reaction and lead to sympathetic ophthalmia (SO). However, there is controversy over this hypothesis as there are reports that approve and others that disapprove the occurrence of sympathetic ophthalmia as a result of evisceration (20-23). According to the Tari et al. study (24), vertical and horizontal movement was diminished in the enucleation group compared to the evisceration group. In another study, there was no significant cosmetic difference between enucleation and evisceration except that in evisceration, implant movement was higher and complications after surgery were lower than enucleation (5).

The causes of exenteration in our study were; malignant tumors (5 cases) and mucormycosis in one case. In Kaur's study (25), the indications of exenteration were primary orbit malignancies (44%), eyelid malignancies (32%), retinoblastoma (16%) and conjunctiva malignancies (8%). In Nemet's study (26), eyelid basal cell carcinoma, conjunctival squamous cell carcinoma, malignant melanoma, lacrimal gland malignancies and refractory ocular infection were the most frequent indications of exenteration. Therefore, exenteration is performed for treatment of potentially life threatening malignancies and infections arising from orbit, paranasal sinuses or periocular skin (27, 28).

An ideal orbital implant offers excellent motility, cosmetic results and a few complications. Various orbital implants are available. In our study, the most frequent implant was hydroxyapatite (88.2%); this was consistent with other studies (5, 12-14, 29-32). In the past 11 years, HAI has been widely used because of its high biocompatibility and anti-inflammation properties (33). Other studies show that some other implants such as Medpor were more common (17, 33-35).

The rate of complications in our study was 33%, which was consistent with other researches by Viswanathan (32) (21%), Bagheri (14) (21.8%) and Nakra (5) (21.9%). Yuan (12) reported no complications in his study while, Jung (17) reported that the rate of complications was 72.1% after enucleation and 27.1% after evisceration. This difference is related to operation techniques, causes of eye removal surgery and difference in the definition of complications.

The most frequent complication in our study was infection and discharge (15.7%) while this complication was 1.77% in Bagheri (14), 0% in Nakara (5), 6.4% in Jung (17) and 7.5% in Su (35) studies. In Park's survey (29) a case of conjunctiva discharge and a case of implant infection was reported, which was less than our study. Most of our patients improved with topical antibiotics and conservative treatment, except for four cases in which exposure and ischemic area curetted and were repaired with graft. Blepharoptosis was the main complication (10.5%) in Jung's study (17) and pyogenic granuloma (13.7%) in Su's study (35). The amount of implant exposure in several studies was reported to be from 0% to 20% by different surgeons (5, 17, 24, 31, 36-38) in contrast with, 3.9% for our cases.

Enucleation with HAI was the most frequent technique of surgery in this study as it was safe with low complication. Nevertheless, it is not the ideal method and a search for the most convenient method and implant with lower rate of complications is necessary.

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