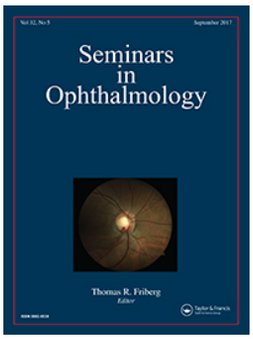

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ORIGINAL ARTICLE

Syrian Civil-War-Related Intraocular Foreign Body Injuries: A Four-Year Retrospective Analysis

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ABSTRACT

Purpose: To analyze the data of patients who underwent vitreoretinal surgery due to intraocular foreign body (IOFB) injuries that occurred in the Syrian civil war. *Methods*: Seventy-eight eyes of 78 patients who underwent vitreoretinal surgery due to IOFB injuries that occurred during the Syrian civil war were analyzed. *Results*: Forty-four eyes (56.4%) had traumatic cataract, 44 (56.4%) had retinal tears, 42 (53.8%) had vitreous hemorrhage, 18 (23%) had retinal detachment, 12 (15.3%) had endophthalmitis, and eight eyes had hyphema (10.2%). IOFBs consisted of metal in 62 eyes (79.4%), stone in eight eyes (10.2%), organic material in four eyes (5.1%), and glass in four eyes (5.1%). Approximately 86% of the eyes had initial VAs of 4/200 or worse. However, VAs improved in 64 eyes (82%) after the surgeries. *Conclusions*: Despite delays in treatment and the severity of injuries, 82% (64/78) of the eyes had an improvement in VA after the surgeries.

Keywords: Retina, surgery, trauma, vision, vitreous

INTRODUCTION

Although penetrating eye injuries are rare in the civilian literature, they are frequent in a combat environment. The incidence of combat eye injuries has been shown to be on the rise.[1] This may partly be explained by the increasing use of high-velocity projectiles and fragmentation explosives.[1] Explosions can result in ocular injuries with single or multiple intraocular foreign bodies (IOFBs). War-related penetrating ocular injuries with IOFBs are a considerable cause of permanent severe visual impairment.[2–4] Fortunately, significant advances in vitreoretinal surgery have improved the outcomes of these types of ocular injuries.[5]

The Syrian civil uprising/war has been taking place since the early spring of 2011. Human Rights Watch (HRW) has reported that the conflict in Syria is a war on civilians.[6] Unfortunately, hospitals in Syria have become part of this war. The World Health Organization (WHO) has determined that at least 57% of public hospitals have been damaged and 37% of them have been out of service, while at least 50% of the medical staff have left the country since the initiation of war.[6] Therefore, injured civilians have serious difficulties accessing treatment, with most of them being treated in neighboring countries (Turkey, Lebanon, or Jordan).

Recent studies have reported on infections and cranial wounds associated with the Syrian civil war.[7,8] However, to our best knowledge, there is no study evaluating ocular injuries associated with the war. In this study, we aimed to analyze data on patients who underwent vitreoretinal surgery in our clinic due to IOFB injuries that occurred during the Syrian civil war.

MATERIALS AND METHODS

Seventy-eight eyes of 78 consecutive patients who underwent pars plana vitrectomy (PPV) in the Gaziantep University Medical School Ophthalmology

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Department between November 2011 and October 2014 due to IOFB injuries that occurred during the Syrian civil war were enrolled in this retrospective study. The study was designed to assess the characteristics of the IOFB injuries and the results obtained after vitreoretinal surgery. Exclusion criteria were initial no light perception vision, intracorneal or intraorbital foreign bodies, and lack of follow-up data. The study was in accordance with the rules of the Declaration of Helsinki and was approved by the Gaziantep University Medical School Ethics Committee.

Each subject underwent standard ophthalmologic examination, including measurement of visual acuity (VA) by Snellen charts, slit-lamp examination, and funduscopy. Ocular ultrasonography was performed to confirm and localize IOFBs and to evaluate vitreous and retina if the fundus could not be evaluated because of media opacity. A computerized tomography (CT) scan was also performed to confirm and localize IOFBs.

Age and sex of patients, injured eye, type of injury, number of IOFBs, type and size of IOFB, associated ocular injuries, initial and final VAs, number of operations, type of tamponade used in surgery, and postoperative complications were noted. The International Society of Ocular Trauma (ISOT) Classification and Birmingham Eye Trauma Terminology (BETT) System were used in the present study.[9,10]

Intravitreal injections of Ceftazidime (2.25 mg/0.1 ml) and Vancomycin (1 mg/0.1 ml) were applied at the presentation in eyes with endophthalmitis. The diagnosis of endophthalmitis was made based on the clinical findings. After each surgical procedure, 2 mg gentamycin and 2 mg dexamethasone were injected subconjunctivally and topical applications of dexamethasone 0.1% and moxifloxacin 0.5% eye drops five times daily were prescribed for four weeks. Further, peroral moxifloxacin 400 mg once a day for 10 days was also given after the primary IOFB removal surgeries. Appropriate antibiotics were applied when resistant microorganisms to these antibiotics were found on cultures of vitreous samples. Non-endophthalmitis eyes did not receive intravitreal antibiotics.

Statistical Analysis

Statistical analyses were performed by SPSS version 22.00 (SPSS for Windows software; SPSS, Inc., Chicago, IL). Chi-squared test was used for comparison of the categorical variables. McNemar test was used for the analysis of VA grade changes within each ISOT zone, and Mann Whitney U test was used to test for differences between eyes with endophthalmitis and eyes with no endophthalmitis regarding the mean time from injury to IOFB removal. Statistical significance was set at $p<0.05$.

RESULTS

The mean age of the patients was 25.9±1.2 (range: 6–62 years). There were 68 males (87.1%) and 10 females (12.8%); 6 (7.6%) of them were children. Per ISOT classification, all injuries were type C (IOFBs). The entry site was Zone I (isolated to the cornea including the corneoscleral limbus) in 48 eyes (61.4%), Zone II (corneoscleral limbus to a point 5 mm posterior into the sclera) in 10 eyes (12.8%), and Zone III (posterior to the anterior 5 mm of sclera) in 20 eyes (25.6%). Forty-four eyes (56.4%) had traumatic cataract, 44 eyes (56.4%) had retinal tears, 42 eyes (53.8%) had vitreous hemorrhage, 18 eyes (23%) had retinal detachment, 12 eyes (15.3%) had endophthalmitis, and 8 eyes had hyphema (10.2%) at presentation or primary surgery. Nineteen eyes (24.3%) had macular involvement including macular injury in 11 eyes (14.1%), submacular hemorrhage in 7 eyes (8.9%), and a full-thickness posterior pole defect in macular area in 1 eye (1.2%). One patient had traumatic cataract in the fellow eye. The main reason for the IOFBs was explosions. The mean time from injury to IOFB removal was 12.2±6.3 (range: 1–35) days. This was irrespective of the presence of endophthalmitis (12.0±6.1 days in eyes with no endophthalmitis and 12.9±7.5 days in eyes with endophthalmitis ($p=0.703$)).

The IOFBs were found to be fixed to the retina in 44 eyes (56.4%), to the optic disc in 6 eyes (7.6%), and were found in the vitreous in 28 eyes (35.8%). They consisted of metal in 62 eyes (79.4%), stone in 8 eyes (10.2%), organic material in 4 eyes (5.1%), and glass in 4 eyes (5.1%). In eyes with endophthalmitis, the IOFB was stone in four eyes, metal in four eyes, organic material in two eyes, and glass in two eyes. The rates of endophthalmitis were significantly higher for stone (4/8, 50%), organic material (2/4, 25%), and glass (2/4, 25%) than for metal (4/62, 6.4%), and the difference was statistically significant ($p< 0.001$). In 42 (53.8%) of 78 eyes, IOFBs were removed through the scleral incision of PPV (Figure 1), and in the rest (43.5%) they were removed through the corneal incision after extracting to the anterior chamber (Figure 2). Seventy-two eyes (92.3%) had a single IOFB and six eyes (7.7%) had multiple IOFBs. The sizes of the IOFBs varied from <1 mm to 7.5 x 5.5 x 5.5 mm.

Thirty-two eyes (41.0%) underwent PPV, whereas 46 eyes (58.9%) underwent combined cataract extraction and PPV. In all cases, IOFBs could be removed during the first surgical procedure. The surgeries other than the first surgery were additional PPV procedures for the treatment of complications or removal of the silicon tamponade. None of patients underwent a scleral buckling procedure. Four eyes (5.1%) underwent only one surgical procedure, 61 eyes (78.2 %) underwent two, 14 eyes (17.9%) underwent three, and three eyes (3.8%) underwent four procedures.

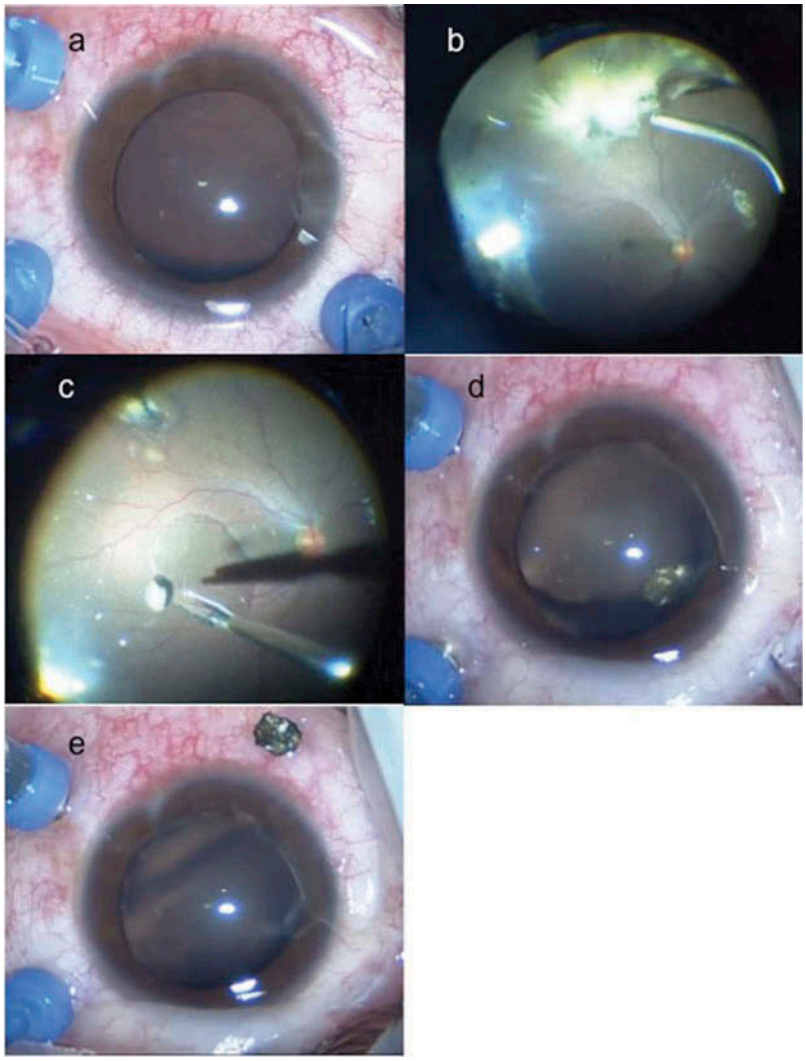

FIGURE 1. A patient undergoing vitreoretinal surgery due to a metallic intraocular foreign body. Intraoperative images of corneal scar caused by foreign body trauma at 5 o'clock sector (a), vitreous hemorrhage at inferior quadrant (b), intraocular foreign body and chorioretinal scar and pigment changes at 5 o'clock sector (c), forceps removal of foreign body through the scleral incision (d, e).

The mean number of surgeries was 2.2. Silicon oil (34 eyes), perfluoropropane (C_3F_8) (12 eyes), sulfur hexafluoride (SF_6) (6 eyes), and air (2 eyes) tamponades were used to stabilize the posterior pole.

The initial and final VAs of the eyes and the grades of the injuries according to ISOT classification are shown in Table 1. Approximately 86% of the eyes had initial VAs of 4/200 or worse. However, VAs of 64 eyes (82%) improved after the surgeries. VA did not change in eight eyes (10.2 %) and reduced in six eyes (7.7%), compared to initial values. The ISOT zones and initial and final VAs of the eyes are given in Table 2. There were significant changes in VAs of the eyes in each zone. Nine out of 48 eyes (18.7%), 1 out of 10 eyes (10%) with Zone II injury, and 2 out of 20 eyes with Zone III injury had endophthalmitis, and the difference between these rates was not significant (p=0.751). The initial VAs of the patients with endophthalmitis were between light perception and 2/200, whereas the final VAs ranged from 2/200 to 20/100. Mean follow-up period was 7.8 (3–18) months. Retinal tears occurred in three eyes (3.8%) during IOFB removal. Postoperative complications were proliferative vitreoretinopathy or recurrence of retinal detachment in eight eyes (10.2%), choroidal detachment in four eyes (5.1%), seclusio pupillae in six eyes (7.7%), and phthisis bulbi in three eyes (3.8%). None of the patients experienced sympathetic ophthalmia during the follow-up period.

DISCUSSION

Ocular trauma is one of the main reasons of blindness among the civilian population worldwide.[11] Ocular traumas which occur in a combat environment due to explosions have poorer functional outcomes because of the severity, delay in treatment, and presence of toxic IOFBs.[12]

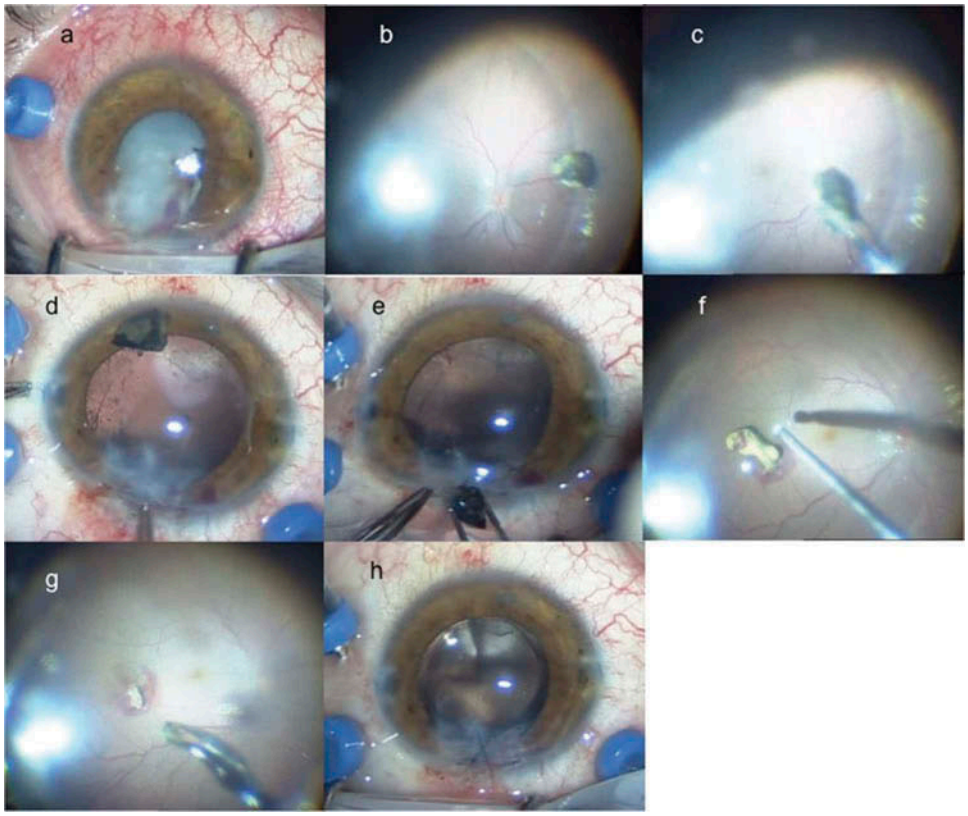

FIGURE 2. A patient undergoing vitreoretinal surgery due to an intraocular foreign body (stone). Intraoperative images of cornea, iris, and lens injuries due to foreign body trauma (a), intravitreal foreign body (b), forceps removal of foreign body (c) through the posterior capsulotomy, anterior chamber (d), and corneal incision (e). After the extraction of the foreign body, a granulation tissue caused by foreign body trauma was removed (f, g) and an intraocular foldable lens was implanted (h).

TABLE 1. The initial and final visual acuities and the grades of the injuries according to International Society of Ocular Trauma (ISOT) classification of the study subjects.

Visual Acuity	Grade	Initial number (%)	Final number (%)
≥ 20/40	1	2 (2.5)	11 (14.1)
20/50 to 20/100	2	2 (2.5)	11 (14.1)
19/100 to 5/200	3	7 (8.9)	13 (16.6)
4/200 to light perception	4	67 (85.8)	40 (51.2)
No light perception	5	0 (0.0)	3 (3.8)

All of patients had Type C Open-Glob Injury (intraocular foreign body).

There were no cases of relative afferent pupillary defect.

Thach et al.[13] reported the outcomes of IOFB injuries that occurred in Operation Iraqi Freedom. Only 2 of 55 patients (3.6%) were female and there was no patient under 18 years in their population. In addition, Colyer et al.[14] evaluated perforating globe injuries (through-and-through) during Operation Iraqi Freedom. Likewise, there were no women or children in their study population. In the present study, in which the war impacts civilians, although most of the IOFB injuries were among young male adults, there were also children (6/78) and women (10/78) affected. Barak et al.[15] analyzed the ocular injuries in the second Lebanon war among Israeli soldiers and civilians. Similar to our results, they also recorded women and children in their study population.

IOFBs particularly raise the risk of retinal breaks and detachments, choroidal hemorrhage, subretinal fibrosis, and macular pucker.[16] In addition, macular lesions due to IOFBs have been shown to be the most important prognostic factor for final best-corrected VA.[17]

Non-combat IOFB injuries are usually caused by a single, non-contaminated object. In addition, patients are usually able to access health services without delay. Conversely, in the combat environment, the IOFB injuries are generally caused by a blast in a dusty environment and there is usually a delay in health care access.[13] Both Thach et al.[13] and Colyer et al.[18] had no cases of endophthalmitis in their series from Operation Iraqi Freedom. They explained that the high temperature produced by an explosion might cause sterilization of small IOFBs before entering the eye and that might result in the absence of endophthalmitis. However, in agreement with our results, previous studies have

TABLE 2. The International Society of Ocular Trauma (ISOT) zones and initial and final visual acuities (VAs) of the eyes.

	Initial VA				Final VA				
	Grade 1-2 n (%)	Grade 3 n (%)	Grade 4 n (%)	Grade 5 n (%)	Grade 1-2 n (%)	Grade 3 n (%)	Grade 4 n (%)	Grade 5 n (%)	*P value
Zone I (n=48)	1 (2)	3 (6)	44 (92)	0 (0)	5 (10)	7 (15)	35 (73)	1 (2)	0.005
Zone II (n=10)	2 (20)	2 (20)	6 (60)	0 (0)	8 (80)	1 (10)	1 (10)	0 (0)	0.016
Zone III (n=20)	1 (5)	2 (10)	17 (85)	0 (0)	9 (45)	5 (25)	4 (20)	2 (10)	0.003

The initial and final VAs are graded according to ISOT classification; Grade 1-2: VA ≥ 20/50; Grade 3: 19/100 ≥ VA ≥ 5/200; Grade 4: 4/200 ≥ VA ≥ light perception; Grade 5: no light perception.

*McNemar test, for comparison of VA grades within each zone.

shown that endophthalmitis rates are high (5–15%) in combat environments, in spite of the heat produced by explosions.[18] On the other hand, the proportion of endophthalmitis was higher for nonmetallic IOFBs than metallic IOFBs among our patients, which was in agreement with the explanations of Thach et al. and Colyer et al.

The preoperative VAs of our patients were lower than that stated in previous studies investigating penetrating ocular injuries with IOFBs in noncombat environments.[4,19,20] The lower preoperative VAs of our population might be associated with the nature of IOFB injuries related to combat environment, the high rate of macular involvement (including macular injury and submacular hemorrhage), the high rate of endophthalmitis, or the delay in presentation to our clinic in Gaziantep, a city in Turkey near the Syrian border.

Thach et al.[13] reported initial VAs of hand movements or worse in more than 48% of patients from Operation Iraqi Freedom. VAs of many of their patients improved postoperatively, similar to what we found.

The main reason for the IOFBs in our population was explosions. IOFBs in Operation Iraqi Freedom contained metal in 68% of eyes, glass in 14% of eyes, and stone in 14% of eyes, due to the use of explosive devices.[13] On the other hand, in the Lebanese civil car, IOFBs were metal in 94.2% of eyes, glass in 3.7% of eyes, and stone in 2% of eyes because of the use of rockets.[15]

Our study was a retrospective analysis of medical records. Therefore, we couldn't obtain all of the required data. In addition, our sample size was not large enough to allow accurate statistical calculations (i.e., regression analysis) for investigating factors associated with the outcomes.

In conclusion, we analyzed the characteristics and outcomes of eyes that underwent vitreoretinal surgery due to IOFB injuries related to the Syrian civil war. Despite delay in treatment and the severity of injuries, VA improved in 82% (64/78) of the eyes after the surgeries.

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DECLARATION OF INTEREST

The authors have no conflict of interest to declare. No financial support was received for this study. The authors alone are responsible for the content and writing of this article.

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