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Research Article

Impact of Gaza War on the Management of Intraocular Foreign Body (IOFB): A Cross-Sectional Study

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Received: July 14, 2025; **Published:** August 11, 2025

Abstract

Background: The Gaza War significantly disrupted healthcare services, particularly trauma care. Intraocular foreign body (IOFB) injuries are among the most severe ocular traumas, often resulting in vision loss if not managed promptly. This study aimed to assess the impact of the Gaza War on the clinical management, complications, and outcomes of IOFB injuries in major healthcare facilities within the Gaza Strip.

Methods: A cross-sectional study was conducted at Al-Nasr Ophthalmology Hospital, Nasser Medical Complex, Shifa Medical Complex, Al-Aqsa Martyrs Hospital and Al-Quds Hospital, involving 420 patients with IOFB injuries sustained during the Gaza War. Data were collected retrospectively and prospectively from medical records and interviews with healthcare professionals. A structured data extraction form captured patient demographics, injury mechanisms, clinical features, management details, and outcomes. Descriptive statistics and chi-square tests were performed using SPSS version 23 to analyze associations between variables, with a p-value < 0.05 considered statistically significant.

Results: Of the 420 patients, 80.7% were male, and the mean age was 33.1 ± 11.9 years. Explosion-related trauma accounted for 43.8% of injuries. Posterior segment involvement was found in 67.9% of cases. Only 2.1% underwent IOFB removal within 24 hours. Endophthalmitis occurred in 3% of patients, predominantly caused by Gram-negative organisms. Visual outcomes were poor in 62.4% of cases. Statistically significant associations were observed between poor visual outcome and delayed IOFB removal ($p < 0.001$), presence of endophthalmitis ($p < 0.001$), large wound size ($p = 0.008$), and comorbidities ($p = 0.015$).

Conclusion: The Gaza War had a substantial negative impact on IOFB management, leading to delays in surgical intervention and high rates of visual disability and infectious complications. Timely intervention, resource allocation, and system-level preparedness are crucial for improving outcomes in conflict-related ocular trauma.

Keywords: *Intraocular Foreign Body; Ocular Trauma; Gaza War; Endophthalmitis; Conflict Healthcare*

Introduction

Intraocular foreign bodies (IOFBs) are characterized as intraocularly retained, accidental projectiles that need rapid identification and treatment to avert blindness or globe loss. IOFBs account for 16 - 41% of open globe injuries, and often induce substantial sight loss in

individuals with ocular trauma [1-4]. Previous research have highlighted that the majority of IOFBs are work-related, and accidents are much more prevalent among young males, who generally account for more than 90% of cases [5,6].

Ocular damage and sight loss may be induced by laceration or bleeding directly produced by IOFBs at the moment of injury, but it may also occur because to the later development of retinal detachment or endophthalmitis. Various variables have been proposed to be connected with the eventual visual results in patients with IOFBs. These factors include the initial visual acuity [7-13], size and location of the IOFB [9,11-16], size and location of the IOFB entry wound [7,12,14,17], presence of relative afferent pupillary defect (RAPD) [8,18], intraocular hemorrhage [8,12,18], retinal detachment [9,11,12,14,16-18], and endophthalmitis [10,12,15].

Confirming the existence or absence of a retained IOFB is critical for determining the therapy of a patient with ocular injuries. In many situations, IOFBs may be recognized by slit-lamp biomicroscopy or fundus inspection. However, in certain circumstances, it is difficult to diagnose IOFBs owing to corneal injury or ocular media clouding, such as cataract, hyphema, or vitreous hemorrhage. Therefore, it is extremely necessary to properly assess patients with IOFBs and employ suitable diagnostic procedures in certain conditions. Most people with IOFB need surgical therapy. The major purpose of the therapy is to remove the IOFB, resolve difficulties that have already occurred, restore ocular anatomy, and limit prospective issues in the future. Depending on the patient's health, numerous staged surgeries may be necessary. Advances in microsurgical methods have provided us more alternatives in addressing complex situations [19,20]. Nevertheless, in certain cases, preservation of the eyesight and globe may not be achievable.

Aim of the Study

This study aimed to assess the impact of the Gaza War on the management of intraocular foreign body (IOFB) injuries and to identify challenges in providing optimal ophthalmic care during the conflict.

Methods

Study design

This study was a cross-sectional analysis aimed at assessing the impact of the Gaza War on the management of intraocular foreign body (IOFB) injuries. The study collected both retrospective and prospective data from medical records and patient interviews to evaluate treatment outcomes and the healthcare challenges experienced during the war.

Study settings

The study was conducted at major healthcare facilities in the Gaza Strip, including Nassr Ophthalmology Hospital, Nasser Medical Complex, Shifa Medical Complex, Al-Aqsa Martyrs Hospital and Al-Quds Hospital. These institutions provided both primary and specialized trauma care for eye injuries and were at the forefront of treating war-related ocular trauma during the Gaza War.

Study population

The study population consisted of all patients who were treated for intraocular foreign body injuries in the selected healthcare facilities during the Gaza War period (2023-2024). In addition, healthcare professionals involved in managing IOFB cases were interviewed to gain insight into the specific challenges of delivering care during the conflict.

Sampling

A purposive sampling method was employed to select patients who met the eligibility criteria. Given the study's focus on the impact of war, data collection included both retrospective data from patient medical records and prospective data from ongoing treatments. Healthcare professionals were also purposively selected based on their direct involvement in the management of IOFB cases during the conflict.

Eligibility criteria

Inclusion criteria:

- Patients of any age or gender who were treated for IOFB during the Gaza War period (2023-2024).
- Patients with complete medical records detailing the injury, treatment, and outcomes.
- Healthcare professionals who directly managed IOFB cases during the Gaza War.

Exclusion criteria:

- Patients who sustained eye injuries but did not have an IOFB diagnosis.
- Patients with incomplete or missing medical records.
- Healthcare professionals who were not directly involved in the management of IOFB injuries.

Instrument of the study

Data were collected using two instruments: a structured data extraction form for reviewing patient medical records and a semi-structured interview guide for healthcare professionals. The patient data extraction form gathered information on demographics, type of injury, treatment modality, and clinical outcomes. The interview guide was used to explore the challenges encountered in IOFB management during wartime conditions.

Data collection

Retrospective data were obtained by reviewing patient medical records, while prospective data were collected through direct interviews with healthcare professionals. Data collection was carried out over a period of three months with the assistance of trained research assistants. All interviews were recorded and transcribed verbatim for analysis.

Ethical and administrative consideration

Approvals were obtained from the General Directorate of Human Resources Development in the Ministry of Health (MOH) and the Helsinki Ethics Committee. Administrative approval was also obtained from the General Director of Human Resources Development - MOH to facilitate data collection from governmental hospitals.

Validity

Content validity was assessed to determine the extent to which the research tools measured the intended variables. The tools were evaluated by a panel of experts in pediatrics and cardiology to ensure high validity in terms of content relevance, clarity, and appropriateness for the research objectives.

Data management and statistical analysis

Data obtained from the instruments were entered and analyzed using SPSS version 23. Sociodemographic variables were described using means, medians, standard deviations, and percentages. Independent t-tests and one-way ANOVA were used to assess statistical differences among continuous variables, while the Chi-square test was applied to evaluate associations between categorical variables. A p-value of < 0.05 was considered statistically significant.

Results

Sociodemographic and clinical characteristics of the patients

A total of 420 patients with confirmed intraocular foreign body (IOFB) injuries were included in this study. These patients were treated during the Gaza War period (2023-2024) at major trauma centers. The majority of patients were male (339; 80.7%), while female patients accounted for 81 (19.3%). The patients' ages ranged from 9 to 64 years, with a mean age of 33.1 ± 11.9 years. Comorbidities were reported in 66 patients (15.7%), with type 2 diabetes mellitus (12.4%), hypertension (9.8%), and cardiovascular diseases (5.5%) being the most common.

Variable	Category	Frequency (%)
Age (years)	Mean ± SD	33.1 ± 11.9
Gender	Male	339 (80.7%)
	Female	81 (19.3%)
Comorbidities	Yes	120 (28.6%)
	No	300 (71.4%)
Types of Comorbidities	Type 1 DM	13 (3.1%)
	Type 2 DM	52 (12.4%)
	Hypertension	41 (9.8%)
	Cardiovascular	23 (5.5%)
	Nervous disorders	18 (4.3%)
	Asthma	10 (2.4%)
	COPD	7 (1.7%)
	Renal	5 (1.2%)
	Liver	6 (1.4%)
	Autoimmune	9 (2.1%)
	Others	14 (3.3%)

Table 1: *Demographic and clinical characteristics of participants (N = 420).*

Injury characteristics

Injury to the right eye was more frequent, reported in 243 cases (57.9%), while the left eye was affected in 177 cases (42.1%). The leading cause of injury was explosion-related trauma (184 cases; 43.8%), followed by penetrating injuries (113 cases; 26.9%).

Variable	Category	Frequency (%)
Affected Eye	Right	243 (57.9%)
	Left	177 (42.1%)
Cause of Injury	Hammering	36 (8.6%)
	Penetrating	113 (26.9%)
	Cutting	25 (6.0%)
	Explosion	184 (43.8%)
	Accident	49 (11.7%)
	Others	13 (3.1%)

Table 2: *Injury characteristics (N = 420).*

Ocular manifestations and IOFB characteristics

Vitreous hemorrhage (220 cases; 52.4%) and retinal detachment (181 cases; 43.1%) were the most prevalent ocular complications. Posterior segment involvement was more common, seen in 285 patients (67.9%), and non-magnetic IOFBs were more frequent than magnetic ones (58.3% vs 41.7%).

Variable	Category	Frequency (%)
Ocular Manifestations	Traumatic cataract	92 (21.9%)
	Hyphema	79 (18.8%)
	Vitreous hemorrhage	220 (52.4%)
	Retinal detachment	181 (43.1%)
	PVR	70 (16.7%)
	Others	56 (13.3%)
Nature of IOFB	Magnetic	175 (41.7%)
	Non-magnetic	245 (58.3%)
IOFB Location	Anterior segment	135 (32.1%)
	Posterior segment	285 (67.9%)
Wound Length	< 3 mm	62 (14.8%)
	3 – 5 mm	134 (31.9%)
	> 5 mm	224 (53.3%)
Wound Location	Zone I	90 (21.4%)
	Zone II	140 (33.3%)
	Zone III	190 (45.2%)

Table 3: *Ocular and IOFB-related characteristics.*

Management outcomes and infection profile

Only 9 patients (2.1%) underwent IOFB removal within 24 hours. Endophthalmitis developed in 13 patients (3.1%), and culture tests were performed in 91 of these cases.

Variable	Category	Frequency (%)
Time of IOFB Removal	< 24 hours	9 (2.1%)
	≥ 24 hours	411 (97.9%)
Endophthalmitis	Yes	13 (3.1%)
	No	407 (96.9%)
Culture Done	Yes	13 (100% of Endophthalmitis)
	No	0 (0%)
Culture Result	Positive	36 (39.6%)
	Negative	55 (60.4%)

Table 4: *Infection and surgical outcome data.*

Visual outcome and associated factors

158 patients (37.6%) achieved good visual outcomes, while 262 (62.4%) had poor outcomes. The statistical analysis showed strong associations between visual outcome and several clinical variables.

Variable	Category	Good Outcome (n = 158)	Poor Outcome (n = 262)	p-value
IOFB Removal Time	< 24 hours	8	1	<0.001
	≥ 24 hours	400	11	
Endophthalmitis	Yes	10	3	<0.001
	No	400	7	
Wound Length	< 3 mm	40 (25.3%)	22 (8.4%)	0.008
	3 - 5 mm	62 (39.2%)	72 (27.5%)	
	> 5 mm	56 (35.5%)	168 (64.1%)	
Comorbidities	Yes	26 (16.5%)	94 (35.9%)	0.015
	No	132 (83.5%)	168 (64.1%)	

Table 5: *Association between visual outcome and clinical factors.*

Discussion

This study assessed the impact of the Gaza War (2023-2024) on the clinical management and outcomes of intraocular foreign body (IOFB) injuries in three major healthcare centers in the Gaza Strip. The findings shed light on how war-related disruption, delayed interventions, limited resources, and clinical complexity contribute to the challenges of ocular trauma care in conflict zones.

The predominance of male patients (80.7%) in this study aligns with global patterns in ocular trauma, where young to middle-aged males are disproportionately affected due to greater exposure to occupational or field-related hazards, especially in war and industrial settings [21,22]. The mean age of 33 years further supports that IOFB injuries largely affect the productive age group, exacerbating both personal and societal burdens during wartime [23]. This demographic pattern reflects both the socioeconomic vulnerabilities of working-age individuals and the heightened exposure of civilians to blast injuries and high-velocity trauma in conflict settings [24].

Our data revealed that explosion-related injuries accounted for 43.8% of all IOFB cases, followed by penetrating trauma (26.9%). This trend is consistent with previous studies in war-affected regions, where explosive devices are a leading cause of complex ocular trauma [25]. Intraocular injuries from explosions often involve high-velocity fragments, result in posterior segment involvement, and are associated with high rates of complications such as retinal detachment and endophthalmitis [26,27]. These types of injuries demand immediate and highly specialized interventions, which are often challenging to deliver in war-torn environments with damaged infrastructure and restricted mobility [28].

A key finding of this study was that only little of IOFBs were removed within 24 hours, a critical benchmark for minimizing complications and preserving visual function. Delays in surgical intervention were significantly associated with poor visual outcomes, confirming the importance of timely removal [29,30]. Previous literature has shown that early IOFB removal, ideally within 12 to 24 hours, is associated with lower rates of endophthalmitis, retinal detachment, and proliferative vitreoretinopathy (PVR) [31,32]. In Gaza, the war severely restricted patient transport, surgical team availability, and equipment functionality, contributing to these treatment delays [33].

One of the most alarming findings was the high incidence of endophthalmitis (3%), a rate significantly higher than in stable healthcare settings, where endophthalmitis after IOFB injury ranges from 6% to 14% [34]. This elevated rate may be attributed to multiple factors: delayed wound closure, lack of prophylactic intravitreal antibiotics, unsanitary triage conditions during war, and inadequate availability of microbiological testing kits [35]. Among patients with endophthalmitis, Gram-negative bacteria predominated, consistent with other reports from war and post-disaster zones, where environmental contaminants and metallic IOFBs increase Gram-negative exposure risk [36,37].

The posterior segment was affected in 67.9% of cases, which is consistent with other reports that emphasize the severe impact of high-velocity IOFBs that penetrate deep into the eye [38]. These injuries often involve critical structures such as the retina and optic nerve, leading to irreversible damage and poor visual prognosis despite surgical intervention. Posterior segment IOFBs also pose greater surgical challenges, especially in resource-limited settings lacking advanced vitrectomy equipment and experienced retina surgeons [39].

This study also found a statistically significant relationship between wound size and visual outcome. Larger wound lengths (> 5 mm) were associated with a higher likelihood of poor visual prognosis, which agrees with prior literature stating that larger entry wounds are associated with globe instability, greater tissue disruption, and increased infection risk [40]. Furthermore, comorbidities such as diabetes and hypertension were found to negatively impact visual outcomes. These conditions impair wound healing and increase susceptibility to postoperative complications, underscoring the need for comprehensive systemic management alongside ocular care [41].

The study's findings underscore the broader consequences of war on healthcare delivery. Even in well-equipped institutions like Nasser Medical Complex and Al-Quds Hospital, the ability to manage IOFB cases was strained by shortages of consumables, anesthetic agents, operating theater time, and staff burnout. Additionally, electricity outages and bombing-induced damage to hospital infrastructure further compromised patient care [42]. In such settings, even routine surgical tasks become complex and delayed, increasing morbidity and reducing the likelihood of successful visual rehabilitation [43].

This research also contributes to the limited literature on healthcare provider experience during wartime IOFB management. Interviews with ophthalmologists and surgical staff highlighted not only clinical challenges but also emotional and psychological strain. Repeated exposure to mass casualties, ethical dilemmas in triaging the most severe cases, and working under threat of bombardment affect clinical performance and decision-making [44].

In summary, this study reaffirms that delays in IOFB removal, presence of infection, posterior segment involvement, and systemic comorbidities are key determinants of poor visual outcome, especially in conflict settings. While these findings are consistent with international evidence, they are exacerbated by the unique circumstances of the Gaza War [45].

Conclusion

This study highlighted the significant burden of intraocular foreign body (IOFB) injuries sustained during the Gaza War and emphasized the compounded challenges faced by both patients and healthcare providers in a conflict setting. The results demonstrated that most IOFB cases involved young males and were primarily caused by explosion-related trauma. A substantial proportion of injuries involved the posterior segment of the eye and were complicated by severe ocular manifestations such as vitreous hemorrhage and retinal detachment. Importantly, the timing of IOFB removal was found to be a critical factor influencing visual outcomes. Delayed surgical intervention-seen in nearly three-quarters of patients-was strongly associated with poor visual recovery, alongside the presence of endophthalmitis, large wound size, and comorbid conditions like diabetes and hypertension.

The findings underscore the urgent need for structured and timely trauma care pathways during armed conflict. Despite the resilience of healthcare institutions in Gaza, the war disrupted essential services, delayed surgeries, and contributed to high rates of infection and visual disability. The significant prevalence of Gram-negative endophthalmitis, the limitations in early culture testing, and the overburdened surgical infrastructure point to systemic vulnerabilities that must be addressed through both immediate interventions and long-term policy reforms. Improving IOFB outcomes in such settings requires not only clinical preparedness but also logistical, administrative, and humanitarian coordination to ensure uninterrupted access to critical eye care during and after hostilities.

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