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Incidence of Orbital Trauma in Gunshot Injuries during July Revolution of 2024 in Bangladesh

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Abstract

A significant civilian casualties due to gunshot wounds with orbital injuries, being a particularly devastating type of trauma, were incurred during the July Revolution of 2024 in Bangladesh. Those injuries resulted in complex ophthalmic and craniofacial damage that required specialised care. This study aims to describe the pattern of injuries, management procedures, and visual outcomes of orbital gunshot injuries treated in the National Institute of Ophthalmology & Hospital (NIOH), Dhaka, Bangladesh, a specialized, tertiary-level eye care hospital in the country. This cross-sectional study was conducted between July and December of 2024. A total of 612 patients were included in this study among total 1002 firearm trauma presentations. Detailed information about the patients' surgical interventions, visual outcomes, and imaging findings were documented. Among 1002 gunshot injury patients, 612(61.1%) had orbital involvement, predominantly unilateral (93.6%). Radiological evaluation revealed the presence of metallic foreign bodies (68.5%) and fractures (52.3%). About 82.4% of cases with orbital injuries need ocular and adnexal surgery. Approximately 64% of the procedures involved vitreoretinal surgery. Postoperatively, 73% of patients experienced some improvement in vision; however, those with bilateral injuries showed poorer outcomes, with 51.5% experiencing further vision loss. These findings highlight the severe ocular morbidity from conflict-related orbital trauma. Conclusion: Vision loss is the most frequent morbidity from orbitofacial injuries caused by gunshots. Bilateral cases tend to exhibit the most severe outcome. These findings emphasise the essential need for updated trauma strategies, protective gear, and improved eye care in conflict zones to preserve vision and reduce disability.

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Introduction

Orbital gunshot injuries represent a devastating form of ocular trauma that carries significant morbidity and visual impairment.[1] The incidence of injuries rises significantly in socio-political civil unrest and causes a burden on the health system to manage the mass casualties. During socio-political and armed conflicts, the incidence of such injuries rises dramatically, presenting unique challenges to healthcare systems.[2,3] In July 2024, the oculo-facial injuries occurred to an extreme extent in the July 2024 mass uprising movement in Bangladesh, which placed an overburden on the ophthalmic care system.[4] Ophthalmic injuries consists of 5% of all combat injuries and are particularly detrimental due to high-velocity impacts and the presence of intraocular foreign bodies.[5,6] The diversity of orbit's anatomy makes it vulnerable to multisystem damage, often involving the eyeball, orbital walls, optic nerve, and orbital soft tissues.[7] Studies from conflict zones

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demonstrate that 40-60% of orbital gunshot injuries result in permanent vision loss, emphasising the need for prompt, specialised intervention.[8,9]

In developing countries like Bangladesh, managing all types of trauma, including firearm injuries, is complicated by limited resources, delays in treatment, and a lack of specialized trauma centres.[10] As the country's top ophthalmic care facility, the National Institute of Ophthalmology & Hospital (NIOH) handles all cases, including complex cases, and also studies the injury patterns and outcomes.[11] Reports highlighted the prevalence of gunshot injuries (60-70%), high rates of retained intraorbital foreign bodies (45-55%), and a frequent need for enucleation (15-25%).[12,13] The following one of three mechanisms, forceful direct tissue destruction, shockwave effects, and secondary contamination can be occured in orbital gunshot injury.[14] Moreover, metal and bone fragments often cause additional damage, while heat generated by the friction of projectiles worsens tissue injury.[15] These factors collectively contribute to the poor prognosis observed in such cases, with only 20-30% of patients typically achieving functional vision post-treatment.[16]

This study aims to: (1) characterise the epidemiological patterns of orbital gunshot injuries during the July Revolution 2024, (2) analyse the spectrum of radiological findings and surgical interventions, and (3) evaluate final visual outcome.

Our findings will provide crucial data for developing evidence-based management protocols in resource-limited conflict settings, while contributing to the global literature on warfare-related ophthalmic trauma.[17,18] The results may inform emergency preparedness plans for future civil disturbances and guide the allocation of specialised ophthalmic trauma services.[19]

Methods

This cross-sectional study was conducted in the National Institute of Ophthalmology & Hospital (NIOH), Dhaka, Bangladesh, between July and December of 2024. Among 1002 gunshot injury patients, we primarily enrolled 612 admitted cases requiring imaging studies. Standardised clinical examination, including visual acuity testing, slit-lamp biomicroscopy, and dilated fundoscopy, was the assessment tool. A CT imaging of the orbit is still now gold standard modality to evaluate the orbital foreign bodies. All patients underwent an initial radiographic assessment, including orbital x-rays, to detect fractures and metallic foreign bodies, followed by B-scan ultrasonography for intraocular evaluation. Data were materialized from electronic medical records, including demographic parameters, injury characteristics, imaging features, surgical strategies, and functional (vision) outcomes. Statistical calculation was performed using Microsoft Excel to measure frequencies, percentages, and means. This comprehensive approach enabled detailed documentation of orbital gunshot injury patterns during civil conflict. The Institutional Review Board of the National Institute of Ophthalmology & Hospital (NIOH), Dhaka, Bangladesh approved the study protocol (NIOH-IRB/2024/Ocular-12). We maintained all ethical compliance through obtaining written informed consent and ensuring patients' confidentiality by adopting anonymised handling of data.

Results

This study analyzed 612 patients presenting with gunshot injuries and orbital trauma during the July Revolution 2024 in Bangladesh. Among them, 39(6.37%) patients had bilateral involvement, and 573 patients (93.63%) had unilateral involvement.

This finding suggests that presentation with one eye was much more common than bilateral presentations. Positive results were observed in 28 bilateral (4.9%) and 552 single-ocular 94.5% through B-scan. Similarly, positive results for x-ray imaging were observed in 32 bilateral (5.6%) and 510 single-ocular (87.2%) cases. These findings indicate that positive diagnostic results were more frequently observed in single-eye involvement than in bilateral-eye involvement (Table-I).

Table-I: Radiological findings in patients with orbital gunshot injuries (N=612)

Modality	Bilateral (n=39)		Single-eye (n=573)	
	Frequency	Percentage	Frequency	Percentage
B-scan positive	28	4.9	552	94.5
X-ray positive	32	5.6	510	87.2

Among single eye injuries (n=573), the most common type was the lens tear 238(41.5%), followed by retinal detachment 122(21.3%), optic nerve injury 109(19.3%) and vascular haemorrhage 104(18.2%). For bilateral injuries (n=39), retinal detachment was the most common 18(46.2%), followed by vascular bleeding 12(30.8%), optic nerve injury 7(17.9%) and globe rupture 2(5.1%) (Table-II). Among the types of surgery performed, retinal surgery was the most common 322(63.9%). followed by glaucoma surgery 176(34.9%) and cornea implant surgery was performed in 6(1.2%) patients (Table-III).

After surgery, for single-ocular involvement (n=471), 352(74.7%) patients maintained their vision, while 119(25.3%) lost their vision, while in patients with bilateral involvement, (n=33), vision was maintained in 16(48.5%) patients, while 17(51.5%) lost their vision. In total, vision was maintained in 368(73%), while permanent vision loss occurred in 136 (27%) (Table-IV).

Table-II: Injury types in single and bilateral eye injury patients (N=612)

Injury type	Single-eye (n=573)		Bilateral (n=39)	
	Frequency	Percentage	Frequency	Percentage
Retinal detachment	122	21.3	18	46.2
Vitreous hemorrhage	104	18.2	12	30.8
Globe rupture	238	41.5	2	5.1
Optic Nerve Injury	109	19	7	17.9

Table-III: Types of surgery (N=504)

Surgery type	Frequency	Percentage
Retinal surgery	322	63.9
Glaucoma surgery	176	34.9
Cornea implant surgery	6	1.2

Table -IV: Outcomes of surgery (N=471)

Outcome	Single-eye (n=471)		Bilateral (n=33)	
	Frequency	Percentage	Frequency	Percentage
Restored vision	352	74.7	16	48.5
Vision lost	119	25.3	17	51.5

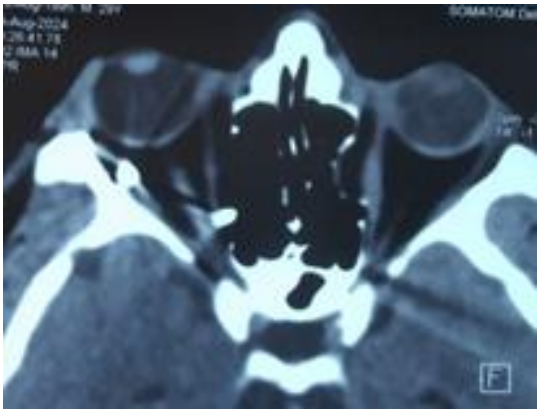

Fig. 1: Twon round metallic pellet retro-orbital part of the right orbit, one pellet like orbital foreign body is located at lateral wall and another pellet like orbital foreign body is in the posterior orbit along the medial orbital wall.

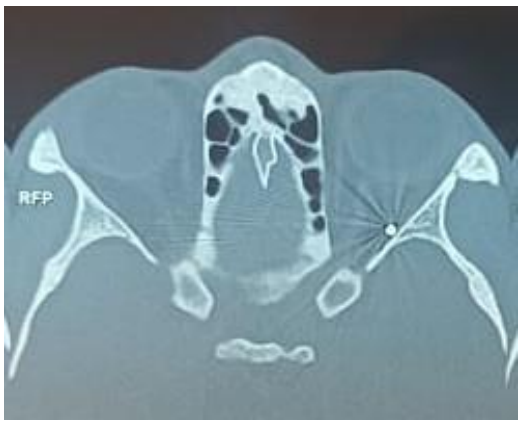

Fig. 2: A round small metallic foreign body is in the posterior orbit along the lateral orbital wall of the left eye.

Discussion

This study presents the first comprehensive analysis of orbital gunshot injuries during Bangladesh's July Revolution of 2024, revealing critical insights into injury patterns, management challenges, and visual outcomes in a resource-constrained conflict setting. In this study, the majority (61.1%) of injuries were orbital injuries among all firearm-related instances, a figure notably higher than the 30-40% reported in other conflict zones.[20] This discrepancy may reflect the unique nature of civilian clashes, which often involve close-range firing with handguns and shotguns, unlike the organised engagements of conventional warfare. The orbital anatomy is uniquely vulnerable in such scenarios of unrest and close-quarter combat.[21] This difference may reflect the different nature of civil conflicts, which often involve close-range, indiscriminate fire from handguns and rifles, as opposed to the more disciplined engagement of conventional warfare. The anatomical prominence of the orbital region makes it uniquely vulnerable to riot and close combat scenarios.[21] The overwhelming incidence of unilateral injuries (93.6%) is in line with the data from the global conflict, where the statistical probability of a single projectile causing a bilateral injury is low.[22] However, the incidence of bilateral trauma in our cohort (6.4 per cent) was significantly higher than the 2-3 per cent commonly reported in studies on military involvement.[23] This higher rate strongly suggests explosive munitions, such as improvised explosive devices or grenades, which produce multiple impacts, or cases where victims are struck by multiple separate bullets, which would indicate a situation of extreme violence. The high sensitivity of B-scan ultrasound (94.5% in unilateral cases) confirms its established role as a first-line, portable, and cost-effective tool for initial evaluation in resource-constrained environments.[24] However, the critical finding is its significantly lower detection rate for bilateral injuries (4.9% positive). This is probably because in these devastating cases, the more serious and extensive damage to the body, where structural collapse and deep bleeding occur, renders ultrasound less effective.

This limitation highlights the need for computed tomography (CT) as the gold standard for the evaluation of major and bilateral orbital trauma, especially for surgical planning, despite the limited

availability of this technology.[25] The high surgical intervention rate (82.4) emphasises the severity and depth of orbital gunshot wounds. The range of procedures required is a stark illustration of the complexity of injuries. The high frequency of retinal surgery (63.9%) is mirrored by reports from the recent conflicts in Syria and Iraq, which highlight the vulnerability of the posterior segment to blows and foreign objects to the eye.[26]

On the other hand, the very low corneal transplantation rate (1.2) is in contrast to the data on ocular trauma in peacetime, where corneal lacerations are more frequent.[27] Overall, the 73.0% coverage of eyes appears favourable compared to the conflict zone average of 50-60%.[28] However, this figure should be interpreted with caution, as the concept of vision retention encompasses a wide range of visual abilities, from 20/20 to simply being able to perceive light. A more granular analysis will reveal the true extent of these injuries. The most striking finding is the dramatic difference in results by laterality. Patients with bilateral injuries were 2.1 times more likely to lose their vision (51.5%) than their unilateral counterparts (25.3%).[29] This is consistent with the established poor prognosis for binocular combat eye injuries and underlines the need for urgent triage. In mass casualty events, patients with bilateral injuries must be prioritized for immediate intervention to save any potential vision, as the risk of total blindness is critical.[30]

This study has several limitations: (1) a single-centre design may limit generalizability, (2) a short follow-up period prevented assessment of long-term outcomes, and (3) a lack of weapon-specific data constrained ballistic analysis. Additionally, (4) pre-hospital mortality cases were not captured, potentially underestimating injury severity. These factors need to be addressed in future research.

Conclusion

This study highlights the severe ocular morbidity caused by orbital gunshot injuries during civil conflict, with unilateral injuries predominating but bilateral cases demonstrating worse outcomes. The findings underscore the critical need for specialised trauma protocols, rapid imaging assessment, and multidisciplinary care in mass casualty events. Future efforts should focus on preventive measures, improved surgical training, and long-term rehabilitation strategies to address the devastating visual consequences of conflict-related orbital trauma. To address orbital gunshot injuries in conflicts, we recommend: (1) mandating protective eyewear for civilians and security forces, (2) deploying mobile ophthalmic units with imaging capabilities, (3) implementing standardised trauma protocols, (4) enhancing vitreoretinal surgical training, and (5) establishing vision rehabilitation programs. These measures would significantly improve prevention, acute care, and long-term outcomes in conflict zones.

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