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Shotgun pellets and its morbidity on eyes: A hospital based study from one of the two referral ophthalmology centers of J&K state

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Abstract
Objective: The uncontrolled use of the shotgun pellets in the valley has blinded thousands of civilians in the last decade of continuous mob violence. Our main objective of this study was to evaluate the extent of the morbidity on the eyes due to continuous use of pellets by law enforcing agencies of the state on the street protesters.
Methods: This was a prospective hospital based study in which a total of 412 patients were included for analyses irrespective of their age, sex, occupation, ethnicity, residence. All these patients were received in the accidental and emergency department of our institution after being fired with pellets.
Results: The mean age of our patients was 18.9 years with SD of 8.6 years. The age ranged from 7-46 years. In this study males were 367 (89%) and females were 45 (11%). Out of total 412 patients, 334 (81%) were in the age group of 15-25 years. Among all the victims right eye was involved in 190 (46%) cases, left eye in 177 (43%) and 45 (11%) cases presented with bilateral involvement. Maximum number of patients 284 (69%) out of 412 were having penetrating type of injury and the main site of injury was cornea found in 169 (41%) of patients. Out of total 412 cases vitreous hemorrhage was recorded in 268 (65%) of cases. 346 (84%) of cases were having foreign body (projectile) in the eyes at the time of presentation.
Conclusion: Security agencies introduced shotgun pellets as non lethal weapon, but the ground reality proved it contrary to that, the main reason being that security personnel were not at the very first properly trained how to use the shot gun pellets.

Keywords: pellet, ocular injury, visual acuity, retinal detachment

1. Introduction
The uncontrolled use of the shotgun pellets in the valley has blinded thousands of civilians in the last decade of continuous mob violence alone. A recent civil society fact-finding report notes that the concentration of security forces in the state is among the heaviest in the world. An estimated 700,000 Army, paramilitary and state police forces watch over a population of just 1.35 million. It was for the first time in 2010 when shot gun pellet, the so called non lethal weapon was introduced by the police in the Jammu and Kashmir state during the public mass uprising against the killing of a young separatist leader. In other parts of the world the ocular pellet injuries are usually accidental in nature. Few studies have been conducted on this topic till date [1-2]. The extent of ocular damage depends on several factors: shape and type of pellet, distance from which the pellets are fired, tissue resistance and its velocity [3-4]. Even some studies have shown that perforating injuries with involvement of posterior segment structures have very poor prognosis [5-6]. According to Sharif *et al.* [7] a standard pellet gun bullet weights 0.345 g and it enters the globe of the eye at an average speed of about 72 meter/second, which has the power to penetrate through the skin, entire globe, and even the orbital bones. Our main objective of this study was to evaluate the extent of the morbidity on the eyes due to continuous use of pellets by law enforcing agencies of the state on the street protesters.

2. Material and Methods
This was a prospective hospital based study from one of the two referral ophthalmology centers of J&K state, in which a total of 412 patients were included for analyses irrespective of their age, sex, occupation, ethnicity, residence. All these patients were received in the accidental and emergency department of our institution after being fired with pellets. The study was approved by the ethical committee of our institution. On the arrival of these patients in our department, we used to collect the information about the patients demographic data like age, sex, laterality of eye involvement and time interval between incident and first contact with the physician. After filling the above data, we gathered the details of the pattern of clinical findings of the eye injuries as such, site of injury (whether conjunctival, scleral, corneo-limbal, corneo-scleral, corneal or periocular), type of injury (whether perforating, penetrating, avulsive or rupture)- Figure-1, anterior segment for (hyphema, status of iris, lens involvement or vitrous in anterior chamber), posterior chamber (retinal detachment, vitreous hemorrhage, macular involvement or pre-retinal hemorrhage), condition of the periorbital tissue for presence or absence of the injury, presence or absence of foreign body (projectile) inside the eye, visual acuity at the time of presentation to the hospital (like 6/6, 6/12, >6/12 vision, finger count close to face, hand movement close to face, accurate perception of light/ray or defective perception of light/ray). All the above

data was then compiled and analyzed accordingly.

3. Results

The present study was a prospective study in which we included 412 patients, who presented to us with different type of injuries to their eyes due to shotgun pellets fired by the security forces on the street protesters. In our patients the mean age was 18.9 years with SD of 8.6 years. The age ranged from 7-46 years. In this study males were 367 (89%) and females were 45 (11%). Out of 412 patients, 334 (81%) were in the age group of 15-25 years, 49 (12%) patients were less than 15 years of age and 29 (7%) patients were more than 25 years of age. Right eye was involved in 190 (46%) cases, left eye was involved in 177 (43%) and 45 (11%) patients had bilateral involvement of eyes at the time of presentation. The demographic data of all the patients is given in Table-1. The record of clinical findings of all these patients on admission is given in Table-2. Maximum number of patients 284 (69%) out of 412 were having penetrating type of injury and the main site of injury was cornea, found in 169 (41%) of patients. Out of total 412 cases vitreous hemorrhage was recorded in 268 (65%) of cases. In the present study 169 (41%) of patients were having visual acuity of defective perception of light/perception of ray at the time of presentation. Out of 412 cases, 346 (84%) of cases were having foreign body (projectile) in the eyes at the time of presentation.

4. Discussion

Shot gun pellets have been introduced as the latest method for mob control, assuming to have its lower morbidity and mortality. A battery of firearms have been used in the last 30 years to control violent protests in the valley, like live bullets, rubber bullets, PAVA shells, chili powder and tear gas shells. The mean age of our patients in the study was 18.9 years with SD of 8.6 years. The age ranged from 7-46 years. The maximum number of patients 334 (81%) involved were in the age group of 15-25years. Our findings are at par with the results noted by Shuttleworth *et al.* [1] in a study of 105 patients with air gun injuries, where they observed that 74% of their patients were less than 18 years of age with a mean age of 17.5 ± 9.12 years. The age group mostly affected in the study conducted by Francis Kwasi *et al.* [8] was between 10 to 35 years with a mean age of 19.9 with SD of 5 years, which is almost similar to our results. In the present study we found that 367 (89%) patients were males and 45 (11%) of patients were females. In the study conducted by Langley *et al.* [9] on 718 patients of air gun injuries, the male female ratio was 6:1. Bowen *et al.* [10] in their study of 105 cases with pellet gun injuries have reported a 7.5:1 male to female ratio. Our results were also close to the results recorded by Francis Kwasi *et al.* [8] in their study, where they noted that out of 32 patients who were affected, 30 (93.75%) were males and the other 2 (6.25%) were females. From these observations we can conclude that it is males who take part in mob violence more as compared to females. Though pellets mostly involve one eye at a time, but it may involve both the eyes in some cases. In the current study we found that right eye was involved in 46% cases, left eye in 43% of cases and both eyes were involved in 11% of cases. Assaf *et al.* [11] in his study also noted the bilateral involvement in some cases of ocular pellet injury. In a study conducted by Shuttleworth *et al.* [1] in 2009, observed that the majority of the victims of shot gun ocular pellet injuries reported to hospital immediately after the incident, barring few patients who presented late. Similarly in the present study we have seen that maximum number of patients were admitted on the same day of incident, 354 (86%) patients.

Trauma to eyes due to shot gun pellets may be either acute or chronic on the basis of their clinical presentation. Majority of the times these acute injuries occur:- injury to cornea, corneo-limbal or corneo-scleral laceration, hyphaema, globe rupture, vitreous hemorrhage, macular involvement, retinal detachment etc [12]. In the current study we observed the similar findings, with vitreous hemorrhage being the most common presentation seen in 268 (65%) patients out of 412 patients, cornea was involved in 169 (41%) cases, and retinal detachment was noted in 152 (37%) of cases. We also noted that penetrating injury was present in 284 (69%) patients, which is similar to results observed by S Kounser and K A Ganaie [13] in their study. In our study we found that foreign body (projectile) in the eye was present in 346 (84%) victims. Tabatabaei SA *et al.* [14] in their study also noted that foreign body was present in the eye of 97 patients out of 116 patients (83%). Our results were at near to par with the results recorded by S Kounser and K A Ganaie [13] in their study conducted on 237 patients.

Table 1: Demographic data of patients with ocular pellet injury.

Age	**Mean with SD**	**18.9 SD 8.6 years**
	Range	**7-46 years**
Age groups	<15 years	49 (12%) cases
	15-25	334 (81%)
	>25	29 (7%)
Sex	Males	367 (89%) cases
	Females	45 (11%)
Side of eye involvement	Right eye	190 (46%) cases
	Left eye	177 (43%)
	Both eyes	45 (11%)
Time gap between incident and presentation	Same day of incident	354 (86%) cases
	Next day onwards	58 (14%)

Table 2: Pattern of injury on presentation to hospital.

Type of injury	**Penetrating**	**284 (69%) cases**
	Perforating	46 (11%)
	Avulsive	33 (8%)
	Rupture	49(12%)

Site of entry	Sclera	115 (28%) cases
	Cornea	169 (41%)
	Cornea + limbal	41 (10%)
	Cornea + Sclera	37 (9%)
	Conjuntiva	29 (7%)
	Periocular	21 (5%)
Anterior segment	Hyphema	260 (63%) cases
	Lens injury	169 (41%)
	Vitreous in A.C	74 (18%)
Posterior segment	Retinal detachment	152 (37%) cases
	Vitreous hemorrhage	268 (65%)
	Pre-retinal hemorrhage	181 (44%)
Intraocular foreign body	Present	346 (84%) cases
	Absent	66 (16%)

Fig 1: Penetrating pellet injury to cornea-scleral junction.

5. Conclusion

A battery of firearms have been used in the last 30 years to control violent protests in the valley, like live bullets, rubber bullets, PAVA shells, chili powder and tear gas shells. Security agencies introduced shotgun pellets as non lethal weapon, but the ground reality proved it contrary to that, the main reason being that security personnel were not at the very first properly trained how to use the shot gun pellets. By firing the pellets below the waist is the best technique to avoid the lethal effects of the pellets.

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