



## Original research

# Pellet gun injury as a source of ocular trauma; a retrospective review of one hundred and eleven cases

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## Abstract

**Purpose:** To report the demographic data, treatment methods, and outcomes among patients with pellet gun eye injuries.

**Methods:** This study was a retrospective review of all pellet gun eye injuries coming to Farabi Eye Hospital, a referral ocular trauma center in Iran, from February 2009 to November 2013. Patients' demographics, type of injury, choice of management, complications, and post-treatment visual acuity were recorded.

**Results:** One hundred eleven patients with a mean age of  $25.7 \pm 15.6$  years entered the study. The most common age group was younger adults (16–45 years old) (61.3%). The mean uncorrected visual acuity after treatment was  $2.05 (20/2240) \pm 1.5$  logMAR. The most prevalent ocular zone was zone III (38.7%), and an intraocular foreign body was present in 97 patients (87.4%). Lid laceration and periocular tissue damage were present in 27 patients (24.3%). Lensectomy and vitrectomy were the most common treatment (31.5%). In most patients (87.4%), the injury was non-deliberate, and the most common time of hospitalization was the same day (45.0%). The only statistically significant indicator of post-treatment visual acuity was ocular trauma score (OTS) at admission ( $P < 0.001$ ). At the end of follow-up, enucleation was performed for 20 patients (18%), and thirty-six patients (32%) were no light perception (NLP) in vision.

**Conclusion:** Pellet gun injuries were more common among young male patients, and the only statistically significant indicator of post-treatment visual acuity was OTS at admission.

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**Keywords:** Demographic; Eye; Injury; Pellet gun; Outcome

## Introduction

Today, various types of air guns are freely available to the public. Kratz et al. suggested that air guns are favorable among children and youngsters due to their low cost, availability, lack of age restriction, and their similarity to real

guns.<sup>1</sup> Most children look at these weapons as a toy, and parents think the projectile has very little power of penetration.

Eye injuries, especially among children and young adults, constitute a substantial part of the events related to air guns.<sup>2–4</sup> Based on the United States Eye Injury Registry Database, ball bearing (BB) guns and pellet guns are the most frequent gun injuries in the emergency setting, accounting for nearly 6% of all ocular injuries.<sup>5,6</sup>

According to Shuttleworth et al., air guns have various mechanisms including, pop guns, pellet guns, BB guns, soft air guns, and paintball guns, all of which use compressed air or another form of compressed gas to propel the projectile.<sup>7</sup>

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Pellet guns are one of the cheapest and most widespread air guns. According to Sharif et al., a standard pellet gun bullet weights 0.345 g and enters the globe at average speed of about 72 Meter/Second which has the power to penetrate through the skin, entire globe, and even the orbital bones.<sup>8</sup> Trauma caused by the collision of the pellet gun projectile with the globe and orbit has the potential to cause diverse injuries including penetrating trauma, hyphema, foreign body entrance into the globe and orbit, traumatic cataract, retinal detachment, optic nerve damage, endophthalmitis, and loss of eyesight.

Although BB gun-related injuries have been reported in numerous reports there is a relatively limited number of studies related to pellet gun injuries.<sup>5,7–13</sup> Earlier reports have indicated the severity of this type of trauma and advocated for improving public awareness and encouraging prophylactic measures to reduce their danger.<sup>5,9,14</sup>

The purpose of the present study is to report a large number of pellet gun injuries treated in our center in a 5-year time frame. Patients' demographics, type of injury, choice of management, and treatment outcomes including the final visual acuity are reported.

## Methods

### Patients

The present study was a retrospective, case series study including all patients with eye injuries caused by pellet gun referred to Farabi Eye Hospital in a five-year period from January 2009 till December 2013. This hospital is in charge of ophthalmic emergencies, servicing a large portion of Iran, and also serves as a referral center admitting severe cases of eye trauma from all over the country. The study was approved by the Ethics Committee of Tehran University of Medical Sciences. The required information was obtained through review of patients' medical records. The inclusion criteria were sustaining eye injury caused by pellet gun and being Iranian (several patients from other countries were excluded to keep the consistency of data). The exclusion criteria were history of eye accidents and/or endophthalmitis as well as eye surgery for any reason before the present accident.

### Data collection

A special data sheet was designed to retrieve the data from medical records before the start of the study. The information retrieved from patients' records included age, sex, types of pellet gun, the deliberate firing of gun (according to the judicial authorities' opinion), place of residence (Tehran, other big cities, villages, and countryside), the time interval between trauma and patient's referral to hospital, the eye region of trauma, the presence of eyelid and periocular tissue lacerations, the presence of foreign body (projectiles) inside the eye [intraorbital foreign body (IOFB)] and the presence of foreign body in the orbit (IOFB), visual acuity at admission to hospital, penetration of the globe, presence of Marcus Gunn pupil, endophthalmitis, eye perforation, and retinal detachment as

well as ocular trauma score (OTS). OTS is a good grading system for detecting the prognosis of ocular trauma.<sup>15</sup> Patients with any missing data in each of these variations were excluded from the study.

Also, the method of treatment and treatment outcomes at six months after the treatment were recorded. Patients were divided into three age groups including children (under 16 years old), young and middle aged (16–45 years old), and older patients (more than 45 years old). The OTS scoring system was used to categorize the severity of eye injuries. Patients older than 18 years had received oral ciprofloxacin 750 mg/12 h for three days. Patients under 18 years old had received IV vancomycin 10 mg/kg/day every 6 h and IV ceftazidime 30 mg/kg/day every 8 h for three days.

### Compliance with ethical standards

The present study was approved by the Ethics Committee of Tehran University of Medical Sciences. The study was performed in accordance with the ethical standards as laid down in the Declaration of Helsinki. None of the authors has any conflict of interest with the subject matter of the study.

### Statistical methods

To present data, we used mean, standard deviation (SD), median, and range. To assess the equality percent of subjects in the different variables, we used one group Chi-square test. To compare the visual acuity between different groups at baseline, we used the Mann-Whitney and Kruskal-Wallis tests, and to evaluate the changes of visual acuity in different groups, we used Wilcoxon-Signed rank test. To compare the final visual acuity between groups when the baseline values were adjusted, we used analysis of covariance (ANCOVA). All statistical tests were performed using SPSS software version 24 (Armonk, NY: IBM Corp.). *P*-value less than 0.05 was considered statistically significant.

## Results

In total, 116 medical records of patients with pellet gun injuries who met our inclusion and exclusion criteria were studied. Patients' demographic findings including age, sex, place of residence, time between incident and hospitalization, and the intentional nature of trauma are presented in Table 1. The mean age of patients was  $25.7 \pm 15.6$ . Ninety-four patients were male, and 17 patients were female, indicating a statistically significant higher prevalence of pellet gun injuries among male patients ( $P < 0.001$ ). The most common age group was 16- to 45-year-old patients ( $P < 0.001$ ). Most patients were admitted on the same day ( $P < 0.001$ ), and the number of non-deliberate accidents was statistically higher than deliberate shootings ( $P < 0.001$ ).

Table 2 presents patients' findings before treatment including the visual acuity of the injured eye, the ocular zone of injury,<sup>9</sup> presence and severity of Marcus Gunn pupil, the presence of intraocular foreign body and eyelid laceration, the

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