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Research Article

Management of Shotgun Injures

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Abstract

Introduction: This study aimed to determine the types of trauma inflicted on different areas of the body as a result of shotgun injuries, while also evaluating the diagnostic and therapeutic interventions performed.

Method: This was a descriptive-analytical cross-sectional study conducted on individuals injured by a shotgun during the 2022 unrest in Tehran. A total of 180 individuals were included. Injured individuals were categorized into police or security and protester groups and compared in terms of type of injury and severity. Data were collected from hospital records, including demographic information, injured body areas, trauma-related complications, and diagnostic and therapeutic measures. The Injury Severity Score (ISS) and Abbreviated Injury Scale (AIS) were calculated based on available data. Statistical analysis was performed using SPSS software.

Result: Out of 180 injured patients included in the study, 172 were male and eight were female. The mean age was 31.82 ± 11.47 years, ranging from 10 to 63 years. Among them, 106 were police or security personnel and 74 were protesters. The mean ISS for all patients was 1.48 ± 0.96. Comparison between the two groups showed that police or security personnel sustained more severe injuries (1.69 ± 1.24 vs. 1.18 ± 0.55; P = 0.01). Injuries to the head, face, neck, and chest were significantly more common among police or security personnel (P = 0.024), while abdominal, pelvic, and lower limb injuries were more prevalent among protesters (P = 0.015) . Imaging tools such as plain radiography and CT scans were used for diagnostic evaluation. All 21 cases of chest trauma were diagnosed by chest X-rays. Two cases required chest CT scans, which showed no lung or cardiac injury. In abdominal injuries, 51% of radiological assessments had positive findings. Among 40 cases of head and neck trauma, only one showed pellet penetration of the skull bone, and no brain tissue injury was observed. Regarding treatment, 42 patients (23.3%) required hospitalization, while 138 (76.7%) were treated on an outpatient basis. None required CPR or airway management.

Conclusion : Shotgun pellets has not high energy and usually cause minor injury but sometime may cause serious injuries. Removal during early hospitalization is not recommended. Deep pellets in limbs generally do not require removal unless surgery is indicated due to vascular or neurological damage. Chest injuries with deep or multiple wounds require more radiographic study. Deep or multiple wounds in the abdomen need additional evaluation to rule out serious intra-abdominal injuries. Greater caution is needed in managing facial and neck injuries, necessitating more intensive care.

Keywords: Penetrating Trauma, Shotgun, Pellet Gun.

Introduction

Shotguns are used worldwide by police for anti-riot objectives. Typically, their effective range does not exceed 100 meters, rendering them ineffective at long distances. However, at close range, they can cause severe damage due to the widespread dispersion of pellets and their varying destructive potential. Consequently, shotgun injuries vary in nature and severity [1, 2].

The transfer of kinetic energy, determined by the projectile's mass and velocity upon impact with body tissues, causes injuries. Shotgun-related trauma is not limited to a specific body area or organ and can result in

extensive trauma, particularly to the trunk and chest. The mechanisms of injury involve a combination of ballistic factors, physical characteristics of the pellets, and the physiological responses of the affected tissues. Factors such as pellet type, shooting distance, angle of impact, and tissue anatomy all influence the injury pattern [3].

Several factors determine the severity of trauma injuries. One critical aspect is the projectile's velocity, which determines its kinetic energy and, consequently, the severity of the injury. The extent of the trauma really hinges on both the weight of the projectile and how fast it is moving when it hits. By looking closely at the details of what happened, we can get a better idea of how severe the injuries might be. Important elements include the type of weapon used, the number of shots fired, the distance between the firearm and the target, and the target's position at the time of shooting [4].

The initial clinical assessment should mainly focus on life-saving actions and the safety of vital organs. After ensuring that any life-threatening conditions are under control, it is important to assess and treat any injuries to limbs and other organs. When it comes to using antibiotics for gunshot wounds, there seems to be a lot of differing opinions. Recommendations can vary depending on several factors, such as the type of firearm involved and the location of the injury [5]. While prophylactic antibiotic use in high-velocity gunshot injuries is well established, its role in managing low-velocity shotgun wounds is less clearly described [6].

Given that shotguns have been used in recent years during civil unrest by both protesters and law enforcement forces, and due to the varying types of weapons and the broad spectrum of injuries observed in medical centers, there is a need for further research. This study was designed to assess the nature of shotgun-related trauma and evaluate its management by identifying and analyzing the patterns of injury across different body regions. Additionally, we provide some recommendations to improve the quality of care and treatment for such injuries.

Methods

This was a descriptive-analytical cross-sectional study aimed at evaluating the injuries and improving the quality of care and treatment of patients affected by shotgun-related trauma. The study population included individuals injured by pellet guns during the 2022 unrest in Tehran. The research was conducted in three general hospitals in Tehran.

Inclusion criteria were the availability of medical records with sufficient information from patients who sustained shotgun injuries during the specified time period. A total of 180 patients were included, and data were collected retrospectively from their hospital records.

In addition, to support clinical interpretation, consultations were conducted with experienced physicians who had participated in the management of these cases. Their expert opinions were used to gather specific clinical recommendations, which were presented at the end of the article.

We collected data from medical document files in hospitals, including demographic information, distributions, and severities of injuries across various body regions, and trauma-related complications. The gathered data were coded and analyzed using SPSS-22. To provide a more comprehensive conclusion, the different types and severities of injuries across anatomical regions were analyzed, and the outcomes of diagnostic and therapeutic interventions were assessed.

Results

Among the 180 patients included in the study, 172 were male and eight were female. The mean age of the participants was 31.82 ± 11.47 years, with an age range of 10 to 63 years. The patients were divided into two groups: police or security personnel (n = 106) and protesters (n = 74). A portion of the police or security personnel group, particularly members of the Basij militia, sustained more severe injuries due to a lack of professional experience during riot control operations.

Injury Severity Score

The mean Injury Severity Score (ISS) for all patients was 1.48 ± 0.96. When comparing the two groups, police or security personnel had a significantly higher mean ISS (1.69 ± 1.24) than protesters (1.18 ± 0.55), with a P-value of 0.01, indicating a statistically significant difference. These findings highlight the importance of considering the specific conditions and exposure risks of police or security personnel in planning for treatment protocols.

Injury Location and Type

Among the studied patients, 76.7% had superficial wounds, while 47.8% sustained deep wounds. An analysis of injury locations revealed that the lower limbs were the most frequently affected (33.4%), followed by the upper limbs (24.5%). Head and face injuries accounted for 18.3% of all cases.

There were 40 cases of head and neck injuries, none of which involved brain tissue damage. A total of 13 fractures were recorded, including six fractures in the lower limbs, 5 in the upper limbs, one maxillofacial fracture, and one skull fracture. One case involved pellet penetration into the abdominal cavity, necessitating laparotomy.

Table1. Number and Severity of Injuries (ISS) by Police or security personnel and Protesters Status

Variable	Police or security personnel	Protesters	P-Value
Number (percentage)	106 (58.8%)	74 (41.1%)	< 0.001
Mean Injury Severity Score (ISS)	1.69 ± 1.24	1.18 ± 0.55	< 0.001

Table2. Frequency Distribution of Injuries, Superficial Wounds, Deep Wounds, and Bleeding by Body Region

Region	Injuries (n, %)	Superficial Wounds (n, %)	Deep Wounds (n, %)	Bleeding (n, %)
Head, Face & Neck	41 (18.3%)	28 (20.2%)	13 (15.1%)	0 (0.0%)
Chest	26 (11.6%)	20 (14.4%)	6 (6.9%)	0 (0.0%)
Abdomen & Pelvis	27 (12.0%)	19 (13.7%)	8 (9.6%)	2 (25.0%)
Upper Limbs	55 (24.5%)	27 (19.5%)	28 (32.5%)	3 (37.5%)
Lower Limbs	75 (33.4%)	44 (31.8%)	31 (36.0%)	3 (37.5%)
Total	224 (100%)	138 (100%)	86 (100%)	8 (100%)

Treatments

The majority of patients (76.7%) were treated on an outpatient basis, while 23.3% required hospitalization. Additionally, 36.1% of the patients underwent surgical procedures, including pellet removal and fracture repair. The most significant number of surgeries were performed for trauma to the lower and upper limbs—one case involved intra-abdominal hemorrhage, which required laparotomy and repair of the small intestine and ureter.

Diagnostic Procedures

Among the injured individuals, various imaging modalities were used to diagnose injuries, including plain radiographs and CT scans.

In 21 cases of thoracic trauma, all chest X-rays were diagnostic. Two cases required chest CT scans, both of which showed no evidence of lung or cardiac injury. In abdominal injuries, 51% of plain radiographs and CT scans yielded positive findings. There were 40 cases of head and neck trauma without damage to the brain tissue. Only one case showed pellet penetration through the skull bone. These findings underscore the importance of imaging in guiding clinical decisions, particularly in cases involving deep wounds or injuries to vital organs.

Table3. Distribution of Therapeutic Interventions Among Patients

Intervention	Performed (n, %)	Not Performed (n, %)	Total (n, %)
Hospitalization	42 (23.3%)	138 (76.7%)	180 (100%)
CPR	0 (0.0%)	180 (100%)	180 (100%)
Hemorrhage Control	3 (1.7%)	177 (98.3%)	180 (100%)
Fracture Management	13 (7.2%)	167 (92.8%)	180 (100%)
Surgical Treatment	65 (36.1%)	115 (63.9%)	180 (100%)

Discussion

The findings of this study indicate that shotgun injuries, due to their unique ballistic properties, can result in a wide range of trauma, from minor superficial wounds to potentially life-threatening injuries. While most injuries observed in this study were minor and manageable in an outpatient setting, some cases, particularly those involving deep tissue or vital organs, required immediate and intensive medical attention.

Shotgun injuries, especially from close distance (<5 meters and especially <3 meters), cause complex injury patterns with high lethality and fractures of ribs. The massive bleeding, additionally caused by trauma of

parenchyma and vessels, leads to death in a short time. Ricochets can have particularly problematic effects because they hit other body areas (e.g., the contralateral thorax or abdomen) and cause additional damage.[7]

A comparison with similar studies reveals noticeable differences in both the severity and distribution of injuries. For instance, a study conducted in Texas, USA, in 1967 reported a higher incidence of head and neck injuries, with 53% of patients requiring surgery, a rate significantly higher than that observed in the present study [8]. Moreover, another study in the USA in 1987, shotgun wounds may inflict substantial soft-tissue loss, bone defects, and comminution, and loss of nerve and vessel continuity in the upper extremity [9]. In contrast, our findings revealed that injuries to the lower and upper limbs were more prevalent, likely due to differences in weapon types and shooting conditions.

In this study, 36.1% of patients underwent surgical intervention. In a comparable study from the United States, in-hospital mortality reached 14%, and permanent physical disability was reported in 6.5% of cases. Notably, no fatalities were reported in our study. This discrepancy could be attributed to differences in weapon type, shooting distance, and healthcare infrastructure [10].

A focused review of patients with thigh injuries in other studies has shown severe trauma, including femoral artery lacerations. In contrast, no injuries to major arteries were reported in our series [11]. Most surgical procedures in our study involved pellet removal and fracture management, particularly in the lower extremities. While some patients presented with superficial wounds and minimal bleeding, others exhibited more complex injuries requiring surgical intervention.

The absence of cases requiring CPR or airway management further supports the general hemodynamic stability of the study population. One of the key differences observed across various studies may relate to shooting range, as shotguns cause greater destruction at close range, but their effect diminishes as distance increases. Other contributing factors include variations in emergency medical training and the availability of specialized care.

It has been reported one martyr of security personnel because of severe injury by multiple pellet injury in his face and neck [11,12], but we did not recognize any death in archives and documents.

Conclusion

Based on this study, it can be concluded that injuries caused by shotgun pellets are generally minor and superficial, and can often be managed with outpatient care. However, in a limited number of cases, such injuries may result in serious or life-threatening conditions. Therefore, unnecessary diagnostic and therapeutic interventions should be avoided; these patients must be evaluated and managed according to standard trauma care principles. Further diagnostic and therapeutic measures should only be undertaken when clinically indicated. The following recommendations were agreed upon by specialists from various medical disciplines involved in the management of such injuries:

1. It is recommended that patients who have sustained more than five pellet wounds to a single region or limb undergo more intensive observation, as a higher number of impacts increases the likelihood of more serious injuries.
2. The removal of superficial pellets should be postponed until an assessment is completed and the absence of more serious conditions is confirmed. This procedure is not recommended during the initial hospitalization phase.
3. In general, the removal of deeply embedded pellets in the limbs is not necessary unless surgical intervention is required for other reasons, such as neuro-vascular injuries.
4. In the cases with chest injuries, a chest radiograph (X-ray) should be performed regardless of clinical presentation.
5. Abdominal injuries with deep or multiple wounds may require further diagnostic evaluation, even in the absence of early clinical signs; complications can occur later.
6. All facial and neck pellet injuries should be considered potentially dangerous. Patients should only be discharged even if serious injuries have been ruled out through appropriate diagnostic evaluations.
7. Ocular injuries caused by pellet impacts must be evaluated and treated by an ophthalmologist.
8. Prophylactic administration of antibiotics and tetanus immunization should be considered routine, although their necessity remains debated.

Recommendations

This study examined injuries resulting from pellet guns and demonstrated that the severity and impact of such trauma can vary depending on the location and extent of the wounds. To minimize injury severity in similar urban conflict scenarios, police and security personnel should be trained to not shot this type of guns in close range and they use protective equipment for theme selves' protection, including body armor and helmet.

Given the nature of these injuries and the importance of documentation for future treatment and follow-up, it is advised to obtain photographic records of the wounds while maintaining medical professionalism and confidentiality. Further research is recommended to evaluate the long-term complications of these injuries.

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Conflict of Interest Disclosures

There is no conflict of interest.

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Authors' Contributions

All authors contributed equally in this study.

Ethical Statement

This study was approved by the Ethics Committee of Baqiyatallah University of Medical Sciences under the code: IR.BMSU.BAQ.REC.1403.053.

Declaration of Generative AI and AI-assisted technologies

None.

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