Original Article :

Pattern and Impact of gunshot injuries in Najran region, Saudi Arabia.

Saeed Ali Alsareii[1], Salem Ali Alatef Sultan[2], Alamri Abdulrahman Manaa[1], Mansour Yousef AlAsmari[1], Hajr Hassan Al-Wadei[1], Abdulbari Mohammed AlAwadhi[2], Abdulhadi Mohamed Elbashir[1]

1. Department of Surgery, College of Medicine, Najran University, Najran, Kingdom of Saudi Arabia.
2. Department of Surgery, King Khalid Hospital, Najran, Kingdom of Saudi Arabia.

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Corresponding Author:

Saeed Ali Alsareii
Department of Surgery, College of Medicine, Najran University, Najran, Kingdom of Saudi Arabia
Email: alsareii997@hotmail.com, alsareii@nu.edu.sa

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Abstract

Background and Aims:
Gunshot injuries are common in war zones. This study retrospectively looks at the pattern of gunshot injuries presented to a tertiary care hospital in war zone.

Methods:
A retrospective analysis of data was carried out for 239 patients treated at King Khalid Hospital, Najran Saudi Arabia, for gunshot injuries from April 2016 to December 2017. The demographic data, anatomical site of gunshot injury, type of injury, and clinical outcome were analyzed.

Results:
The most affected age group was 16–35 years, while the most common site of injury was the lower extremities. War injuries accounted for 71% and civilian assaults for 29%. Wounds with inlet and outlet accounted for 55%, while injuries with only inlet wounds were 45%. The mortality rate was 7.9%, out of which the patients with head injuries had the highest mortality. There was a statistically significant positive relationship between head injury site and mortality ($p < 0 .001$), association between head injury site and penetration status ($p = 0.006$, as well as head injury site and nationality ($p = 0.001$).

Conclusions:
Findings reveal pattern of gunshot injuries in war zone consistent with the reported literature. Complete treatment and rehabilitation of patients with such injuries in active war zone can strain the tertiary care facilities.

Keywords:
Gunshot injuries, wounds, head injuries, mortality, civilian assaults.

Introduction

Since the beginning of civilization, trauma and violence remained major outcomes of conflicts throughout human evolution on earth [1]. Firearms are a common source of violence and injury in human ecology. Gunshot injuries present an ongoing burden on community and hospital resources on a global scale. The prevalence of handguns and various low velocity rifles is increasing, leading to a corresponding increase in the number of individuals seeking medical attention for gunshot wounds at local healthcare facilities. Gunshot injuries to the extremities can encompass a range of complex injuries involving soft tissue, bone, vascular structures, musculotendinous components, and nerve structures. An accurate understanding of anatomy is essential for the assessment and management of such injuries [2,3].

Fortunately, in the civilian population low-velocity missiles predominate, otherwise, tumbling, fragmentation, cavitation, and exit wounds are much greater with high-velocity missiles [3]. Fire arm injuries (FAI) which could be incurred in both the military and civilian contexts may arise mainly due to war, communal clashes, sectarian, political, or military violence, robbery, and suicidal attempt. In the context of developing countries, these are mostly caused by poverty, unemployment, political instability, and lack of education, infrastructure, facilities, poor governance, tribal culture, or unequal distribution of wealth [4]. Subsequently, an increasing trend in FAI has been noted in the recent past in most parts of the developing world. Besides, the bilateral and international political and regional conflicts also resulted in armed tensions in many parts/countries of the world which have significantly increased FAI [5]. The advancement of weapons have complicated the patterns and impact of FAI with the passage of time. Among others, the eruption of war in Yemen has also tremendously increased the gunshot and FAI referrals to hospitals in Najran that is a town in the southern region of the Kingdom of Saudi Arabia (KSA) near the border of Yemen, having a lowest population density of 2.8 per square kilometer [6]. The purpose of this study was to look at the pattern of gunshot injuries in the war affected region of Saudi Arabia.

Patients and Methods

Data of 239 patients was collected retrospectively from computerized records of patients with gunshot injuries treated at King Khalid Hospital Najran Saudi Arabia between April 2016 and December 2017.

Data was analyzed using the Statistical Package for Social Sciences version 22

(SPSS 22). The main characteristics of the variables and risk factors were described as frequency and percentages. The variables studied were: age, sex, nationality, site of injury, type of injury (whether civilian assault or war injury), length of hospital stay, and mortality. Cross-tabulations and measures of association were also computed for mortality and other variables. A p-value of less than 0.05 was considered significant.

Informed Consent Statement

In view of retrospective analysis, a waiver of informed consent was obtained from the Institutional Review Board (IRB). The study was approved by the institutional ethical committee.

Results

The sample comprised of 239 patients, ranging in age from 15 to 55 years. The results show that the most affected age group was 16–35 years (N = 183, 78.6%) as reported in Table 1.

Table 1. Age distribution of patients with gunshot injuries (N = 239).

Age in years	Frequency	Percentage (%)
15 and below	10	4.2
16 - 25	105	43.9
26 - 35	83	34.7
36 - 45	34	14.2
46 - 55	7	2.9
Total	239	100.0

The male to female ratio was 59:1, with 235 (98.3%) males and 4 (1.7%) females (see Table 2). The most common site for injury was the lower extremities (N = 68, 28.5%), followed by the upper extremities (N = 59, 24.7%), and the head (N = 35, 14.6%). War injuries accounted for 71% (N = 170) while civilian assaults for 29% (N = 69). Wounds with inlet and outlet were 55% (N = 131), where 45% (N = 108) were having inlet only.

Table 2. Gender distribution of patients (N = 239).

Gender	Frequency	Percentage
Male	235	98.3
Female	4	1.7
Total	239	100.0

Figure 1 shows that the mortality rate was higher with head injury patients (N =11) than others. This was followed by the chest (N =3) and the abdomen (N = 3); the lowest numbers of fatalities were recorded for injuries to the extremities, see Appendix 1 for further details.

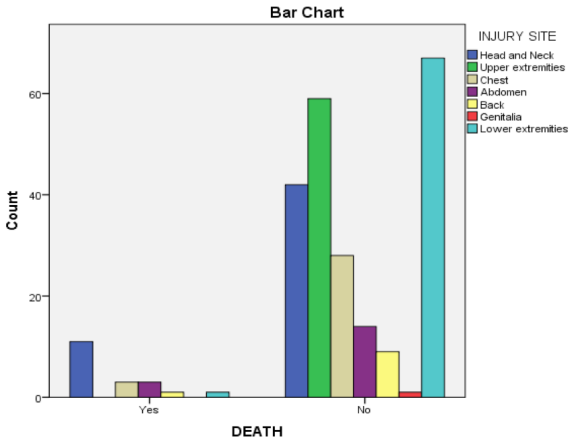


Figure 1. Death in relation to the injury site

Figure 2 shows the pattern of death according to penetration status. The highest number of deaths were in patients with inlet and outlet injuries affecting upper and

lower extremities, followed by the head and neck injuries. The highest number of patients with head and neck injuries were Yemenis followed by Saudis, See Appendix 1 for further details.

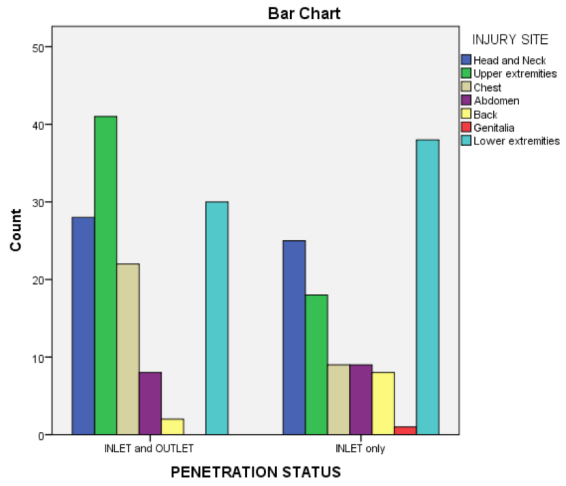


Figure 2. Distribution of death for penetrating and non-penetrating wounds

Given the nominal character of data, a non-parametric chi-square test was applied. After meeting both the assumptions, the statistics of the chi-square test reported in Table 3 show a significant positive relationship between head injury site and mortality [(23.32, p=0 .001)]. Similarly, the chi-square results demonstrate a statistically significant relationship between head injury site and penetration status (18.42, p = 0.006), as well as injury site and nationality (68.12, p = 0.001). The results reveal that there is a significant difference among the victims of head injury, penetration status and nationality.

Table 3: Results of Chi-Square test to assess relationships between variables

Tests	Value	df	Asymptotic Significance (2-sided)	Relationship
Pearson Chi-Square	23.32[a]	6	0.001	Death Mortality and Injury Site
Likelihood Ratio	26.05	6	0.000	
Linear-by-Linear Association	11.78	1	0.001	
Pearson Chi-Square	18.14[a]	6	0.006	Penetration Status and Injury Site
Likelihood Ratio	19.02	6	0.004	
Linear-by-Linear Association	2.21	1	0.136	
Pearson Chi-Square	68.12[a]	36	0.001	Nationality and Injury Site
Likelihood Ratio	55.69	36	0.019	
Linear-by-Linear Association	2.40	1	0.121	

Discussion

Trauma and interpersonal violence are escalating in many countries, a situation referred to as neglected epidemic some time ago [7]. The World Health Assembly (WHA) has declared firearm injury (FAI) as a global issue of public health "due to its significant morbidity, long-standing physical, psychological, mental and economic disability of the individuals, families, communities, and countries [8,9]. Firearm injury (FAI) is associated with substantial emo-

tional, physical, and financial burden on community and hospitals [10]. These injuries may result in prolonged hospitalization, high treatment cost, and above all death of patients [10-14]. Injuries at vital organs can also cause instant death. Moreover, the cost of treatment of survivors could also be huge particularly when the injuries are at the head, chest, abdomen, or spine [15-17].

Demographic characteristics of patients who sustained gunshot injuries in our study were consistent with the findings reported in most of the literature reviewed [1-7]. There was a substantial predominance of males as noted by a ratio of 59:1. This is similar to other studies carried out in Nigeria and Pakistan [12,13]. This was explained by the fact that males are more involved in outdoor and interpersonal activities, as well as clashes in wars and other conflicts. The age of patients was in the range of 15–55 years, with those aged 16–35 years the most affected (N = 183, 78.6%). The preponderance of young patients can be explained by the fact that people in this age group are more active in conflicts, and tend to be emotional and violent, hence being more prone to gunshot injuries [8,12,13]. The most frequent site of gunshot injuries in this study was the lower extremities, followed by the upper limbs and the head. The greater involvement of the lower limbs than other parts of the body has also been reported by many other similar studies [2,14,18].

The high mortality in our study can be attributed to the substantial number of war injuries with use of high velocity weapons. The highest mortality rate was found among head injury patients ($p = 0.001$) as compared to those with injuries at other anatomical sites. A high prevalence of mortality with the involvement of head has also been widely reported in other studies [8,19-21]. In terms of the pattern of mortality with duration of hospital stay, there are three peaks: immediate death on day first, within ten days, and after two weeks or more. This pattern is almost similar to the "trimodal distribution of death" for major trauma resulting from road traffic accidents[22,23]. Gunshot injuries are serious medical issues resulting in substantial number of fatalities, especially in war zones. The findings of this study show that mortality rate is significantly higher when site of the injury is head as compared to other injuries or injuries at other organs of the body. However, despite a higher mortality rate from gunshot injuries, the ratio is still lower than the fatalities caused by road/traffic accidents. Road/traffic accident is a serious and fatal issue, especially in Saudi Arabia, where it takes 19 lives per day and 4 injuries every hour.

These findings have far-reaching impli-

cations in terms of proloned or life-long disability, psychological trauma, social burden and cost of treatment for thousands of people who have suffered gunshot wounds in the war zones. Furthermore, proloned treatment and rehabilitation of these patients in tertiary care centeres incur additional burden on their human resource, finances, bed occupancy and valuable time that can be effectively utilized for even more salvageable and deserving trauma patients in the acute stage of their injuries.

Long-term rehabilitation centers can play a crucial role in helping individuals with gunshot injuries regain their independence, improve their quality of life, and contribute positively to their communities. Here are some ways in which these centers can help:

Comprehensive medical care:

Rehabilitation centers specialize in providing comprehensive medical care to patients with complex injuries, including gunshot wounds. They have a team of trained medical professionals who work together to develop individualized treatment plans that address the patient's physical, emotional, and psychological needs [24].

Physical therapy: Patients with gunshot injuries often require extensive physical therapy to help them regain mobility and strength. Rehabilitation centers provide a range of physical therapy services, including exercise programs, gait training, and other specialized interventions to help patients improve their physical function [25].

Occupational therapy:

Occupational therapy is another important aspect of rehabilitation for gunshot injury patients. Rehabilitation centers provide occupational therapy services to help patients improve their ability to perform daily activities, such as dressing, bathing, and cooking [26].

Psychological counseling:

Gunshot injuries can have a significant impact on a person's mental health. Rehabilitation centers provide psychological counseling and support to help patients cope with the emotional and psychological effects of their injuries [27].

Vocational training:

Rehabilitation centers also provide vocational training to help patients develop skills and pursue careers that are compatible with their physical abilities. This can help patients regain their independence and become productive members of their communities [28].

Highlighting the physical burden that gunshot injury patients place on a tertiary care hospital is crucial in understanding the broader implications of such injuries.

In the acute stage, gunshot injuries often require immediate and intensive medical intervention, including surgeries, post-operative care, and specialized treatment for potential complications such as infections or organ damage. This can lead to prolonged hospital stays, high bed occupancy rates, and increased healthcare costs due to the complexity of care required.

Moreover, gunshot injuries can result in varying degrees of disability, ranging from temporary limitations to permanent impairments. The rehabilitation stage further adds to the burden on tertiary care hospitals as patients require ongoing physical therapy, occupational therapy, and counseling to facilitate their recovery and reintegration into daily life. The hours lost as a result of disability not only impact the individuals but also contribute to the strain on hospital resources [29].

Given these challenges, it becomes evident that a dedicated rehabilitation center specializing in gunshot injury recovery could help alleviate the unnecessary workload on tertiary care hospitals. By providing comprehensive and specialized care during the rehabilitation phase, such a center could potentially reduce the length of hospital stays, bed occupancy, and associated costs at tertiary care hospitals. This approach would ensure that patients receive the appropriate care for their recovery while also optimizing the allocation of resources in tertiary care settings. Such centers could effectively contribute to both patient recovery and the overall efficiency of healthcare institutions. Overall, long-term rehabilitation centers can provide patients with the resources and support they need to recover from gunshot injuries and lead fulfilling lives [30]. By helping patients regain their independence and contribute positively to their communities, these centers play a vital role in promoting the overall health and wellbeing of individuals and society as a whole.

Conclusion

Our cross sectional retrospective analysis of gunshot injuries in a war zone has shed some light on the pattern of such injuries that is consistent with the available literature. The spectrum of implications of gun shot injuries can be exhaustive and among others the long-term treatment and rehabilitative burden they can pose at a tertiary care hospital is well imaginable. Establishment of a parallel long-term longitudinal treatment facility for the victims of gunshot injuries may help expedite their rehabilitation, as well as, reduce extraordinary burden on the resources of tertiary care hospitals.

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