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Characteristics, Outcomes, and Implications for Care of Firearm Injuries During Unrest in a Conflict Zone of India: A Clinical Retrospective Study

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Abstract

Background: Violence and Injuries are a significant global public health concern characterized by marked regional variation in incidence. It is estimated that violence and injuries account for 9% of all the global deaths. Violent injuries are the eighth leading cause of death, worldwide Developing countries carry the largest burden of injuries and approximately 90% of the deaths due to injuries occur in low and middle-income countries. Injuries also impose a huge financial burden among communities. High death toll firearm injuries cause significant morbidity, long-term physical and psychological disability for individuals, families, communities and society. Violence is a dynamic process. Large scale violence may take the form of mass uprising against oppression of dominant class. Such types of violence erupted in Kashmir (Northern India) since 1989 that left more than 65 thousand people killed and tens of thousands injured.

Objective: To study the characteristics, outcomes, and implications for care of firearm injuries during unrest in a conflict zone of India

Methods: A clinical retrospective cohort study of patients, all due to firearm-related injuries, was conducted between July 1, 2016, to December 31, 2016, at a large tertiary care teaching hospital (SKIMS) at Srinagar where majority of ballistic trauma patients report to Emergency Department for treatment. Medical records of all patients admitted were studied and the important details were recorded.

Results: The study showed that the firearm injury is more frequent in very young adults. The most common cause of firearm injury was bullets followed by pellets, tear gas shells and blast injury. Majority of injuries were due to Pellets 149 cases (62.08%), followed by Shells 45 (18.75%), Bullets 39 (16.25%) and Blasts 7 (2.91%). Upper limb involvement was 25% followed by head & neck (23%), lower limb (20%), chest and spine (17%), and abdomen (15%). The majority had injuries like fracture, haemothorax, brain contusions, vascular injury, lung contusions, pneumothorax etc. Majority of the patients were managed consevatively. Surgical interventions were performed in rest of the cases. Firearm injuries were detected mainly on head and neck region followed by chest region. Eye injury was observed in 8.33 percent patients. Mortality was slightly more than 5 percent in these patients, primarily due to bullet injuries followed by pellet injuries.

Conclusion: Considering the high volume of the injured, the situation in Kashmir is volatile and as such needs high-quality trauma care centers across the state to reduce the firearm related morbidity and mortality. Moreover, an Advanced Trauma Centre needs to be established in the capital city of Srinagar. A sound and dependable referral system will go a long way to avoid inconvenience to the patients, save the lives and limbs and reduce disability.

Keywords: Psychological disability; Injury; Trauma

Introduction

Violence and Injuries are a significant global public health concern characterized by marked regional variation in incidence [1]. It is estimated that violence and injuries account for 9% of all the global deaths, which is nearly 1.7 times the number of deaths resulting from HIV/AIDS, Tuberculosis and Malaria combined. Developing countries carry the largest burden of injuries and approximately 90% of the deaths due to injuries occur in low and middle-income countries [2]. The high number of cases of injury fatalities among the less economically empowered communities can be attributed to unsafe environments, lack of effective prevention programs and poor access to quality health care. Violence and Injuries result to considerable large number of hospital visits, hospital admissions and disabilities, and are a major cause of death. Injuries are responsible for 6% of all years lived with disability [2]. For every death related injury, there are a dozen more who get admitted, hundreds who visit the emergency department and a proportion of these will be left with a temporary or permanent disability [3]. Injuries also impose a huge financial burden among communities, which is incurred. The true magnitude of the economic costs of violence and injuries remain largely unknown, but estimates for specific injuries such as road traffic injuries have been documented to cost nearly 3% of a Countries Gross National Product [4].

The incidences of violent crimes with gunshot injuries have become increasingly more common, reflecting the deterioration of law and order in our society [5]. Violent injuries are the eighth leading cause of death, worldwide [6]. Besides high death toll firearm injuries cause significant morbidity, long-term physical and psychological disability for individuals, families, communities and society.

Violence is a phenomenon intrinsic to class-based society which are

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inherently unequal, apprehensive and oppressive. Violence is a dynamic process. Large scale violence may take the form of mass uprising against oppression of dominant class [7]. Such types of violence have recently surged in many conflict zones across the Asian and African continents. An armed conflict that erupted in Indian Kashmir since 1989 left tens of thousands killed and many more injured [8].

Firearm injuries are potentially devastating to tissues, depending on the calibre of the weapon. In high velocity rifle and shotgun wounds, the damage to soft tissues and bone is massive with extensive tissue necrosis. On the other hand, low velocity pistol or handgun injuries are usually devoid of temporary cavitatory effects and severe soft tissue devitalisation. [9] Several studies have documented the pattern of firearm related injuries and deaths [10-12].

In recent years mass street protests are observed in conflict zones which at times become violent. The response from the government has been to control these protests, often resulting in mass casualties. The patterns of injuries encountered by health authorities are different depending upon the type of weapons used by security forces to quell the protesters. Initially conventional bullets were used, followed by rubber bullets, tear gas shells, and the latest introduction was pallet guns. Civil unrest is a form of protest against major socio-political problems; the severity of the action coincides with public expression(s) of displeasure. Subsequent clashes between security forces and civilian populations can lead to injuries. The situation in Kashmir can best be described as a "low-intensity conflict" [12]. Kashmir witnessed a fresh spate of protest and violence during 2010 and 2016. What predominates in such conflicts is the use of terror to exert social control, frequently by disrupting the social, economic and cultural relations. Kashmir is not merely a law and order problem but there are social, emotional, political and psychological aspects involved. Traumatic events can have a profound impact on the behavioral and physiological functioning of an individual and society at large [12].

Since July 2016 to July 2018, Srinagar-based hospitals received at least 4000 people with firearm injuries from across Kashmir, some of whom died because they lost the golden-hour while being transported between different hospitals for different kinds of treatment.

During 2016-2017, the Bone and Joint Hospital has treated 290, and over 350 have received treatment at SKIMS, 3300 injured patients, reported to SMHS Hospital, owing to its more accessible location in the city. Though, over the past couple of years, health professionals have set an example of service and provided round-the-clock medical care, resulting in minimum loss of life, yet the back- up of infrastructure and supportive services pose a major impediment. Patients with poly-trauma are required to shuttle between hospitals in the crucial time following their surgery. The transfers between hospitals for specialty services causes inconvenience to the injured and their families. Golden hour is lost in transportation of injured patients. With the existing health facilities, a patient is expected to get treated for head injury at Super Specialty Hospital of government Medical College, referred to Bone and Joint Hospital for extremity injury and expected to get his chest or abdominal injury addressed at SMHS Hospital. Scarcity of ICU beds and ventilators is a major constraint and patients who are critical are referred to SKIMS for life support and further management.

The aim of this study was to determine the magnitude, demographic profile, patterns and outcome of firearm injuries at a tertiary care hospital in a conflict zone.

Methods

A clinical retrospective cohort study of patients, all due to firearm-related injuries, was conducted between July 1, 2016, to December 31, 2016, at a large tertiary care teaching hospital (SKIMS) at Srinagar where majority of ballistic trauma patients report to Emergency Department for treatment. Medical records of all patients admitted were studied and the important details (patient profile, injury diagnoses, severity scores, hospital resource utilization parameters, length of stay, epidemiologic analysis of injury distribution, specific anatomic characteristics of injury, survival, and disposition) were recorded.

Patients with bullet, pellet, shell and blast injuries were included in the study. Patients with injuries due to stone or assault were excluded from the study. SKIMS is a tertiary care teaching cum referral hospital with 1000 hospital beds. Majority of the cases of ballistic trauma (excluding eye injury) report directly to this medical centre and all complex and critical patients are referred by other hospitals of Kashmir province for specialised care. SKIMS has advanced critical care facilities including Accident & Emergency Department (nearly 100 beds) and 25 ICU beds. It has also state-of-the-art Neurosurgery, Cardiac Surgery and Anaesthesiology & Critical Care Departments that are part of the multidisciplinary team, who treat ballistic trauma patients. Diagnostic departments like Radiodiagnosis and imaging, Laboratory Medicine, are essential components of the trauma care at this referral medical centre.

Observations

There were total of 391 cases of all types of injuries out of which 240 cases were due to firearm reported to the Emergency at SKIMS during July 2016 to December 2016 (the period of civil unrest). The age -wise distribution of these cases is (shown in Figure 1) reveals that majority of cases received by SKIMS were in the age group of 21-30 years (n=120, 50%) followed by 11-20 year age group (n= 95, 39.58%), 31-40 years (n=18 7.5%) and above 41 years (n= 7 2.9%). The results indicate that maximum number of cases were reported in the younger age groups of 21-30 years followed by 11-20 years and minimum incidence above 40 years (Figure 1).

- The gender-wise distribution of cases reveals that majority of cases were males (n= 229, 95.41%) while females were only 11 (4.58%). This indicates that incidence of firearm injuries was far more in males compared to females.
- The Rural / Urban distribution of cases indicates more cases received from rural areas (n=184, 76.66%) than Urban areas (n= 56, 23.33%). The inference drawn was that Rural urban ratio of cases was 3.2: 1 meaning rural population was involved 3.2 times more than urban population.
- The Speciality wise admission of firearm cases received in Emergency Department shows that Neurosurgery admissions were 124 (51.66%), followed by Cardiothoracic & Vascular 52 cases (21.66%), Plastic Surgery 44 cases (18.33%), General Surgery 14 cases (5.83%), other specialities 6 cases (2.5%). The Speciality-wise distribution of the cases reflect that firearm injuries were inflicted mainly on head & neck region followed by chest region.
- The Length of Stay of firearm injury cases in the hospital reveals that majority of cases were discharged in 1-2 days (118 cases, 49.16%). The next group who stayed the most was for 6-10 days

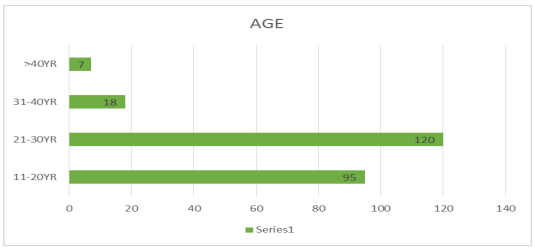

Figure 1: Age-wise distribution of cases.

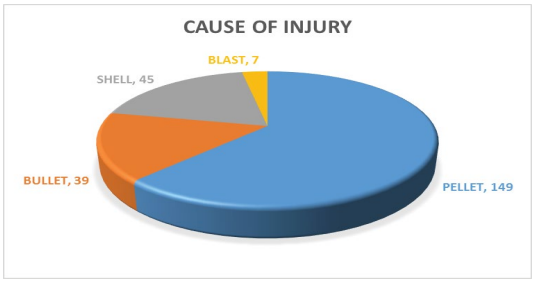

Figure 2: Different causes of firearm injuries.

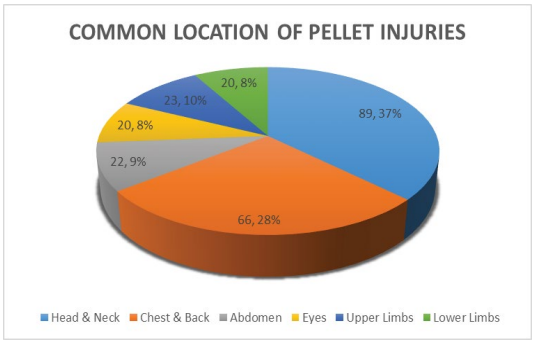

Figure 3: Target organs of pellet injuries.

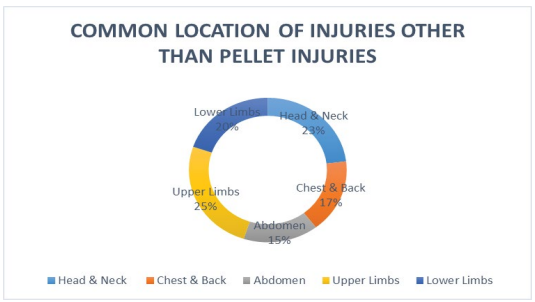

Figure 4: Target organs due to non-pellet injuries.

(54 cases, 22.5%), followed by 3-5 days (28 cases, 11.66%), 11-15 days (17 cases, 7.08%) and > 15 days (23 cases, 9.58%). The results show that most of the firearm cases received, had a short length of stay and were discharged within 2 days. It also shows that good number of cases had a stay of more than 10 days ranging from 11 to 15 days.

- The firearm cases received by the hospital were distributed as per the cause of firearm which is shown in Figure 2. The figure clearly indicates that majority of injuries were due to pellets 149

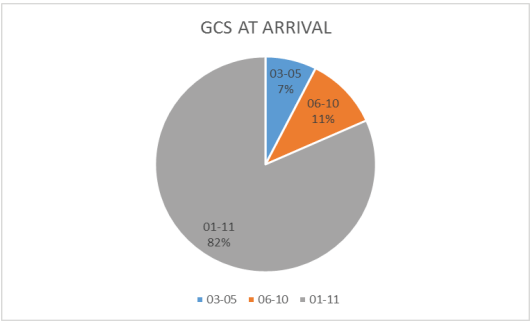

Figure 5: Glasgow Coma Score of cases at arrival.

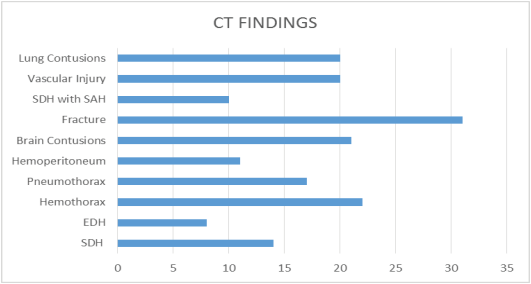

Figure 6: CT-Scan findings of firearm cases.

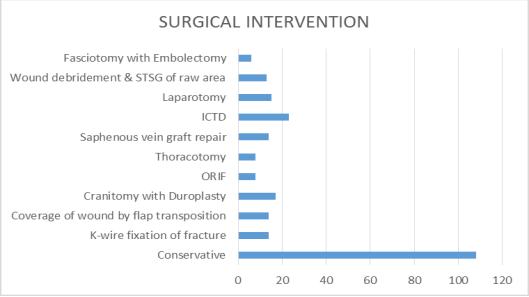

Figure 7: Different types of surgical interventions carried.

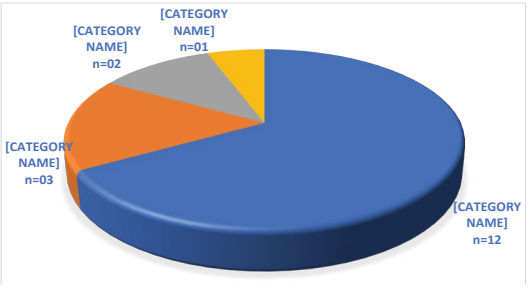

Figure 8: Cause of death.

cases (62.08%), followed by shells 45 cases (18.75%), bullets 39 cases (16.25%) and blasts 7 cases (2.91%) (Figure 2).

- The parts of body involved in pellet injury cases (Figure 3) shows that head & neck region was involved in most of the cases, i.e., 89 cases (37%), chest and back 66 cases (28%), upper limb 23 cases (10%), abdomen 22 cases (9%), eye 20 cases (8%) and lower limb 20 cases (8%). In majority of cases injuries were inflicted on vital areas.

- The parts of body involved in non-pellet injury cases (Figure 4) shows that upper limb involvement was (25%) followed by head & neck (23%), lower limb (20%), chest and back (17%), abdomen (15%).
- The Glasgow Coma Scale of cases at the time of their arrival was studied which shows that majority of firearm cases received by SKIMS had a GCS score of 01-11 (82%), followed by 06-10 (11%) and 03-05 (7%) (Figure 5).
- The CT-Scan findings of all firearm cases received in SKIMS were studied which shows that majority had injuries like fracture, hemothorax, brain contusions, lung contusions, Pneumothorax etc (Figure 6).
- The course of management in firearm cases was studied which shows that majority of the cases were managed conservatively. Surgical Interventions performed in various cases are shown in Figure 7.
- The intensive care unit interventions were done for 41 (17.08%) cases who had clear-cut indications for the same while majority of cases 199 (82.92%) did not require any ICU intervention.
- The firearm cases received in SKIMS were also studied for their mortality and it was seen that 18 patients (5.41%) expired from fatal injuries: 12 deaths due to bullets, 3 deaths due to pellets, 2 deaths due to shell injury and one death occurred due to blast injury (Figure 8). The firearm cases were studied for eye injuries which shows that 20 cases (8.33%) suffered eye injuries and after initial management were referred to SKIMS Medical College for eye treatment. The total number of referred cases was 25 (10.41%) who were shifted from primary care health facilities in the peripheries to SKIMS.

Discussion

Firearm injury is a common problem in this conflict zone because of civil unrest, the legally and illegally acquired firearms by some people, increasing violence, clashes of civilians with security forces, other forms of interpersonal violence, etc. In a US study including 3049 patients treated at a trauma centre, there were 1347 stab wounds and 1702 gunshot wounds; clearly signifying the contribution of Firearm-related injuries [13]. In 2010, guns took the lives of 31,076 Americans in homicides, suicides and unintentional shootings. This is the equivalent of more than 85 deaths each day and more than three deaths each hour [14]. Gun related violence is the most common in poor urban areas and in conjunction with gang violence, often involving juveniles or young adults [15,16]. On the other hand, in European countries; rates of death from firearm injuries are lower. In Sweden, for example, the mortality rate due to firearm injuries is about 200 per year, mainly due to suicides [17].

With a population of more than 1.2 billion and an area of 3.3 million square kilometres, India is home to approximately 17 per cent of the world's population but constitutes just 2.4 per cent of its land area (MHA, 2011). India's rates of violence vary greatly from state to state, and city to city, ranging from relatively high to negligible. These rates are reflected in the nation's well-known diversity in languages, literacy, economic status, and cultural customs. Nearly 40 million civilian owned firearms are in India, out of an estimated 650 million civilian guns worldwide. About 6.3 million of the 40 million firearms—just over 15 per cent—are licensed. From 1999 to 2008 the total number of reported deaths from firearms, including suicides and accidents, fell by nearly half, from 12,147 in 1999 to 6,219 in 2008. Compared to firearm fatality rates in much of the world, India's are not particularly high. In 2008, India officially reported a national firearm murder rate of 0.36 per 100,000 people (NCRB, 2009a, p. 60). Equivalent to roughly one-tenth of the rate of firearm murders in the United States, India's rate is instead comparable to much of Europe's (Gun-Policy). But Indian national statistics reveal extreme variations across states and cities. While no place in India—even among the most conflict-ridden regions-approaches the levels of violence found in the worst-affected parts of the world, the situation is much worse in some areas than in others [18].

The great regional differences in firearm deaths belie any simplistic interpretation of national trends. Both the murder rate and the firearm fatality rate are much higher in the states and territories which have particular characteristics that help to explain their exceptional gun problems. Although it is far from the only factor at work, in the states of Arunachal Pradesh, Bihar, Jammu and Kashmir, Manipur, Nagaland, Uttar Pradesh, and Uttarakhand, international borders represent a complicating factor that facilitates smuggling. Chhattisgarh and Jharkhand are especially affected by Naxalite–Maoist violence, whereas Jammu and Kashmir, Manipur, and Nagaland are subjected to separatist violence and Bihar experiences especially serious caste-related conflicts. Compared to firearm fatality rates in much of the world, India's are not particularly high. In 2008, India officially reported a national firearm murder rate of 0.36 per 100,000 people against an average national murder rate of 2.8 murders per 100,000 people annually. Equivalent to roughly one-tenth of the rate of firearm murders in the United States, India's rate is instead comparable to much of Europe's [18].

In our study the frequency of firearm was highest in patients aged 21-30 years (50%). This is consistent with a study done by Chowdhary et al. which revealed that Out of 282 firearm injured patients, 258 were males and 24 were females, with male to female ratio of 10.7:1 [10,11]. Male preponderance reported by other workers was also found in other studies [19-21]. The male to female ratio was 20.8:1. Some of the reasons adduced for male predilection in various studies are that males, particularly in younger age group, are generally more aggressive and more adventurous in demonstrating resistance to perceived threats [22-25]. In our study the most common site of injury was Head & neck region. This is in line to other studies where chest or head are the common sites [25,26].

As violence was witnessed more in rural area so a linear relationship was observed. Kennedy et al. suggested that in centres where adequate facilities are available, speciality-wise admission was done and 51.66% cases were admitted to Neurosurgery ward followed by Cardiovascular Surgery (21.66%). The study shows that many cases could be managed conservatively and if indicated, surgery was performed [27]. In this study, only those patients with definite indications were explored while hemodynamically stable patients with equivocal clinical signs were observed in order to minimize the risk of negative Surgical exploration. Moreover, previous studies have shown that in wounds above waistline the mortality rate rises with increase in vital organ damage [28,29]. A positive linear relationship was demonstrated in this study too. This can be attributed to young age of injured persons, sites of injuries, early reporting/ referrals to other hospitals, rapid surgical intervention, improved pre-, intra- and post-operative patient care.

Tabish et al. [8] in a study in 2004 found that some patients of ballistic trauma who expired were brought in a critical condition to SKIMS, either in coma or in shock. Delay in transporting the patients to hospital, lack of Emergency Medical Services System, non-availability of First Aid, loss of a Golden Hour, loss of blood, improper

transportation, etc were the factors that were beyond the control of doctors at SKIMS thus resulting in death of some patients. However, once the patients were received at SKIMS, prompt and quality care was provided to them by the multidisciplinary teams [8].

Even non-fatal wounds caused by gunshot, teargas and pellets frequently have severe and long-lasting effects, including disfigurement and/or permanent disability. All such wounds are surgical emergencies which require immediate hospital treatment. The immediate damaging effects of the missile on the victims, observed in the current study, include: loss of blood and the hypovolemic shock. In a few cases, immediate effects resulted in death due to exsanguinations, hypoxia caused by pneumothorax, heart failure and brain damage. Non-fatal gunshot wounds resulted in serious disability in few cases [12].

Decreasing the burden of injuries is among the main challenges for health care delivery system in the twenty-first century. To promote low-cost improvements in injury care, in both the pre-hospital and hospital-based arenas needs serious consideration of health planners and policy-makers. The benefit of such improvement is evidenced by the gross disparities in outcome between low- and middle-income countries on one hand and high-income countries on the other. Persons with life-threatening but salvageable injuries are more likely to die or develop disability if proper trauma care is not available [12].

In a study by Tabish et al. [12] it was observed that conventional ammunition (bullets, pellets, rubber bullets, and tear gas shells) were used by security forces in Kashmir in crowd control during the 2010 civil unrest. There were also stone pelting incidents causing injury to some of the patients. The latest addition was the pellet guns. This leads to a real challenge to the treating physicians. When assessing the likely severity of gunshot wounds, numerous variables that affected management of trauma include: the particular type of weapon used, the caliber of the weapon, the type of the bullet and its propellant charge (i.e., a standard velocity), the range at which the victim was shot (i.e., wounds inflicted), the site of injury and the number of wounds inflicted. 'Frequently, victims of gunshot wound in Kashmir (during the year 2010) have been hit several times. An individual shotgun pellet is comparatively small, though victims are usually hit by large numbers of pellets simultaneously; the degree of injury is severe, particularly when the wound is inflicted at close range. The patients present with multiple pellets, sometimes hundreds causing diagnostic difficulties to the treating clinicians. We gradually developed protocols for such patients'.

The study [12] revealed that young people were injured during violence suggesting that majority of victims were males who were involved in the street protests, most of them in the age group of 13 to 25 years and many were students by profession. Patients admitted in SKIMS were injured on streets in different localities and districts while protesting against security forces. The results are almost similar to the study by Tabish et al. [12] that shows that maximum number of injured admitted belonged to 13-25 years age group.

Conclusion

Our study showed that the firearm injury is more frequent in very young adults (12-30 years age group) and the males are more commonly affected. The most common cause of firearm injury was bullets followed by pellets, tear gas shells and blast injury. Majority of injuries were due to Pellets 149 cases (62.08%), followed by Shells 45 cases (18.75%), Bullets 39 cases (16.25%) and Blasts 7 cases (2.91%). Upper limb involvement was (25%) followed by head & neck (23%), lower limb (20%), chest and spine (17%), and abdomen (15%). The study also revealed that majority had injuries like fracture, haemothorax, brain contusions, vascular injury, lung contusions, pneumothorax etc. The course of management shows that 110 out of 240 patients were managed conservatively. Surgical interventions were performed in rest of the cases. Firearm injuries were detected mainly on head and neck region followed by chest region. Eye injury was observed in 8.33 percent patients. Around 17 percent patients were treated in ICU. Mortality was around 7 percent in these patients, primarily due to bullet injuries followed by pellet injuries.

Most of the firearm cases received had a short length of stay and were discharged within 2 days. The Length of Stay of firearm cases in the hospital shows that majority of cases were discharged in 1-2 days (118 cases, 49.16%), for 6-10 days (54 cases, 22.5%), for 3-5 days (28 cases, 11.66%), for 11-15 days (17 cases, 7.08%) and > 15 days (23 cases, 9.58%). The results show that most of the firearm cases received had a length of stay between 2-15 days. Decreasing the burden of injuries is among the main challenges for health care delivery system in the twenty-first century. There should be coordinated national data-collection systems to facilitate effective control measures. Since a successful firearm-surveillance system will not only reduce the morbidity and mortality but will additionally reduce the national and regional fiscal burden. These efforts must be supported by measures at the international level to prevent illegal firearm influx. All efforts should be supplemented by psychosocial and psychoeducative interventions for the young males. Rehabilitation programmes for the persons with disability must be in place. Conflict resolution needs a strong political will as human life is very precious.

Proper health care facilities are essential to treat the injured. High-quality trauma care centers should be established across the state to reduce the firearm related morbidity and mortality. Although this is capital-intensive, the resultant reduction in mortality, morbidity and burden of firearm-related trauma will justify such an allocation of resources. A sound and dependable referral system will go a long way to avoid inconvenience to the paients, save the lives and limbs and reduce disability.

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