

Pattern of Injuries in Bomb Blast at Police Lanes and Its Association with Different Demographic Factors

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Abstract

Background: Bomb blast injuries are a significant cause of morbidity and mortality, particularly in conflict zones. In low- and middle-income countries, such injuries are increasingly common, with devastating consequences for the affected population. In Pakistan, bomb blast incidents have been on the rise, leading to substantial loss of life and health care burden. Understanding the pattern of injuries in these events and their association with demographic factors is crucial for improving response strategies and healthcare interventions.

Objectives: This study aimed to investigate the pattern of injuries in victims of a bomb blast at Police Lines in Peshawar, Pakistan, and analyze the demographic factors associated with these injuries.

Methodology: A cross-sectional study was conducted on 85 victims who died in a bomb blast, with autopsies performed at the forensic medicine department of Khyber Medical College, Peshawar. Data on injury types, body regions affected, and demographic characteristics (age, gender) were collected and analyzed.

Results: The study revealed that 98.8% of the victims were male, with a mean age of 40.9 years. The most common injuries included lacerations (71.7%), fractures (62.4%), and bruises (45.9%). Victims commonly sustained injuries to the brain (62.4%), heart (55.3%), and lungs (56.5%). The majority of deaths (88.2%) occurred immediately after the blast, with a postmortem interval mostly between 3-6 hours (37.6%). There was a predominance of male victims, and most injuries were multi-system, involving both the head and thoracic regions.

Conclusions: This study highlights the devastating impact of bomb blasts, particularly on males in the working-age group. The injury patterns observed—especially the prevalence of severe brain and chest injuries—underscore the lethal nature of such blasts. Immediate deaths were predominantly due to multisystem trauma. The findings suggest a need for improved emergency medical responses, enhanced forensic analysis, and preventive strategies to mitigate the toll of bomb blast incidents in conflict areas.

Keywords: Bomb blast, injuries, demographic factors, Peshawar, autopsy, trauma, forensic medicine, Pakistan, multisystem injuries, civilian casualties.

Introduction:

Every year, violence claims the lives of 1.6 million people worldwide, with LMICs accounting for 90% of the total^(1, 2). Each violent death results in dozens of hospitalizations, hundreds of emergency department visits, and thousands of outpatient visits³. Individual or community-level violence violates human rights and frequently has long-term implications for victims' physical and mental health. Every violent fatality leads to dozens of hospitalisations, hundreds of A&E visits, and thousands of outpatient (OPD) visits³. Individual or community-level violence is a violation of human rights, with long-term effects for victims' physical and mental health.³⁻⁴ Violence has far-reaching consequences that transcend beyond the family unit and harm the community and nation as a whole.⁵⁻⁷

The World Health Organisation (WHO) categorises violence

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into three types: self-directed, interpersonal, and collective⁸. Collective violence, such as bomb blasts, has become the most common type of violence.⁹ Evidence indicates that blasts and explosions inflict enormous damage in terms of fatalities, injuries, and infrastructure devastation.¹⁰ The public pays close attention to bomb blasts because of the serious health repercussions, which include death, disease, disability, and mental illness. Blast injuries not only cause premature fatalities, but they also use more health-care resources than other injuries because they occur in large numbers.⁷⁻¹¹

Furthermore, teens are the most vulnerable to more serious injuries affecting various body organs and systems.^{11,12} A report released between 2002 and 2009 found that civilians accounted for two-thirds of suicide terrorist-related fatalities in Pakistan.¹³ A case series study of medico-legal death autopsies from three major public hospitals in Karachi, Pakistan, from 2007 to 2011, discovered that the frequency of bomb blast injuries had gradually grown, with the highest number of injuries reported in 2010. Ninety-five percent of these cases were males aged 15 to 45.¹⁴

Blast injuries are caused by explosions, which have the potential to injure many systems and kill a single or multiple victims at once. These types of occurrences pose severe triage,

diagnostic, and management issues for healthcare providers. Explosions can produce multisystem, life-threatening injuries to one or many victims at the same time. These types of occurrences pose severe triage, diagnostic, and management issues for healthcare providers.¹⁵

The quantity and make-up of the explosive material (such as the presence of loose or propelled material or shrapnel; radiologic or biological contamination), the environment around the victim (such as the presence of protective barriers), the distance between the victim and the blast, the method of delivery if a bomb is used, and any additional Primary blast injuries are brought on by the blast wave's passage through the body. Main blast injuries are unique to high order explosives since only these explosions generate a blast wave.¹⁶ Debris released by the explosion's blast wind causes secondary blast injuries. Secondary blast injuries account for the bulk of injuries caused by explosions. Compared to primary blast injuries, secondary blast injuries are much more frequent.¹⁷

Tertiary blast injuries happen when a structure falls and injures someone, or when a person is flung through the air and strikes another object by the blast wind. Primary, secondary, and tertiary blast injuries are not the same as quaternary blast injuries. They can be caused by exposure to fire, fumes, radiation, biological agents, smoke, dust, poisons, environmental exposure, or the psychological impact of the incident.¹⁸

The purpose of this study is to examine the pattern of injuries received after bomb blasts in police lanes and how these injuries alter depending on demographic parameters such as age, gender, and duty status. Police personnel are regularly targeted in such attacks, therefore understanding the nature and distribution of injuries is critical for improving emergency response, medical management, and preventive initiatives. Identifying these connections can aid in the development of focused interventions, improved protective measures, and optimal resource allocation for high-risk groups.

Methodology

This was a cross sectional study in which all bodies presented to forensic medicine department Khyber medical college Peshawar who were victims of police lines bomb blast (85) of any age and gender were included while cases with incomplete documentations. As autopsies were performed as per legal guidelines so no ethical approval was needed.

Results

Out of the total 85 subjects who died in the bomb blast, autopsies revealed that 98.8% (n=84) were males and 1.2% (n=1) were females. The mean age of the subjects was 40.9 +/- 9.9 years ranging from 23 to 64 years. Among the subjects, 24.7% (n=21) had abrasions, 45.9% (n=39) had bruises, 71.7% (n=61) had lacerations, 62.4% (n=53) had fractures, and 20.0% (n=17) had burns. More details about the body regions injured can be found in table 1.

Results

The demographic data included 281 participants aged between 11 and 16 years, with a mean age of 13.5 years and a standard deviation of 1.44. Results showed a significant correlation between the frequency of sweet consumption and the presence of enamel erosion, with higher consumption leading to more pronounced damage. Cold drinks, particularly carbonated beverages, were identified as major contributors to the degradation of tooth surfaces, with a notable prevalence of acidic pH levels causing enamel demineralization. Male students exhibited slightly higher rates of dental erosion compared to female students, possibly due to differing dietary habits. Furthermore, students who consumed both sweets and cold drinks frequently displayed the most severe dental surface deterioration, highlighting the compounded effects of these dietary factors. These findings underscore the critical need for dietary awareness and preventive dental care among school-aged children. The study involved 281 school students aged 11 to 16 years, with the largest group being 11-year-olds (22.1%). Females dominated the sample, comprising 72.2%, while 6th class students represented the highest educational level (34.5%). This diverse demographic ensures robust insights into the impact of sweets and cold drinks on tooth surfaces as shown in table 1.

Table 1: Injuries described according to regional body parts

Body Regions	Abrasions n=85 (%)	Bruises n=85 (%)	Lacerations n=85 (%)	Fractures n=85 (%)	Burns n=85 (%)
Skull	1 (1.2)	1 (1.2)	18 (21.2)	25 (28.2)	-
Forehead	11 (12.9)	14 (16.5)	13 (15.3)	-	-
Face	2 (2.4)	4 (4.7)	3 (3.5)	-	13 (15.3)
Neck	-	-	2 (2.4)	-	-
Chest	9 (10.6)	23 (27.1)	22 (25.9)	-	5 (5.9)
Ribs	-	-	-	28 (32.9)	-
Abdomen	4 (4.7)	4 (4.7)	13 (15.3)	-	4 (4.7)
Limbs	6 (7.1)	2 (2.4)	9 (10.6)	5 (5.9)	5 (5.9)

The causes of death in bomb blast victims were multifactorial due to injuries affecting various organs. Some individuals sustained injuries to multiple organs, while others had single-organ injuries. Specifically, 62.4% (n=53) had brain injuries, 55.3% (n=47) had heart injuries, and 56.5% had lung injuries. Additionally, 1.2% (n=1) suffered injuries to major neck vessels, and 1.2% (n=1) had injuries to a major leg vessel. The subjects who had immediate deaths were 88.2% (n=75) and 11.8% (n=10) had delayed deaths, figure 1. The postmortem interval of the subjects is given in table 2.

Table 2: Postmortem intervals in subjects who died of bomb blast injuries

Postmortem interval	Frequency (n=85)	Percentage (%)
1-3 hours	11	12.9
3-6 hours	32	37.6
4-9 hours	14	16.5
9-12 hours	5	5.9
12-18 hours	5	5.9
18-24 hours	18	21.2

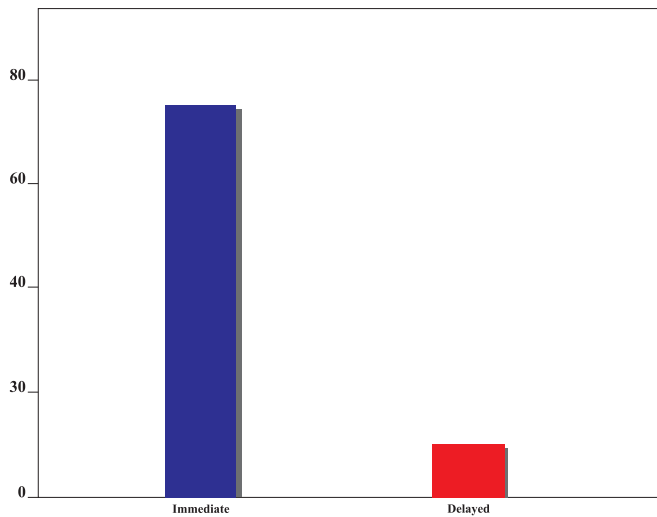


Figure 1: Fatal Period of the autopsies after bombblast injuries

Discussion

The data presented in this study highlights the demographic and injury patterns of bomb blast victims, with a predominance of male victims (98.8%) and a mean age of 40.9 years. This aligns with findings from other studies in Pakistan^{14,15} which also reported a high proportion of male victims. This gender difference is likely due to the higher likelihood of males being present in public spaces, workplaces, or conflict zones where bomb blasts frequently occur. The mean age of victims in this study (40.9 years) is consistent with the age range reported in study from Pakistan¹⁶, which noted that most victims were adults in their 30s and 40s.

The injury patterns observed in this study, particularly the high prevalence of lacerations (71.7%) and fractures (62.4%), are consistent with the findings of autopsy-based study¹⁷. Blast injuries often result in multiple trauma types due to the combined effects of the blast wave, shrapnel, and secondary impacts. The high incidence of brain injuries (62.4%) and thoracic injuries i.e. 55.3% heart injuries and 56.5% lung injuries underscores the lethal nature of bomb blasts, as these injuries are often fatal. Similar findings were reported in study from Afghanistan¹⁸, which highlighted the vulnerability of the head and chest to blast-related trauma.

The postmortem interval data in this study reveals that most victims (37.6%) were autopsied within 3-6 hours of death, which is critical for accurate forensic analysis. This is consistent with the findings of a study¹⁹, which emphasized the importance of timely medical and forensic interventions in mass casualty incidents. However, delayed postmortem intervals (e.g., 18-24 hours in 21.2% of cases) can complicate the determination of the exact cause of death, as noted in the previous mentioned autopsy-based study.¹⁷

Comparisons with studies from India^{20,21}, reveal similar injury patterns, with a high prevalence of head and chest injuries. However, Indian studies often report a higher proportion of burn injuries, which may reflect differences in the types of explosive devices used or the proximity of victims to the blast epicenter. For example, a study from India reported that 30-40% of bomb blast victims sustained burns, compared to only 20% in this study.

In Pakistan, studies^{14,15} have consistently highlighted the devastating impact of bomb blasts on civilian populations. These studies, along with the current data, underscore the need for improved emergency response systems, forensic capabilities, and preventive measures to mitigate the impact of such attacks. The high proportion of immediate deaths (88.2%) in this study further emphasizes the importance of pre-hospital care and rapid trauma management in saving lives.

Conclusions

This study highlights the devastating impact of bomb blasts, particularly on males in the working-age group. The injury patterns observed—especially the prevalence of severe brain and chest injuries—underscore the lethal nature of such blasts. Immediate deaths were predominantly due to multisystem trauma. The findings suggest a need for improved emergency medical responses, enhanced forensic analysis, and preventive strategies to mitigate the toll of bomb blast incidents in conflict areas.

Limitations

As the study size is very limited so there cant be generalizability of results. Moreover information bias and personal bias can also occur.

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Author Contributions

1. Hakim Khan Afridi - Conceptualization and Methodology of study
2. Muhammad Wasif - Data Collection and Manuscript writing
3. Mahnoor Ali – Data collection and Manuscript review
4. Lema Shinwari - Data Analysis
5. Qurat ul Ain - Data Interpretation
6. Muhammd Bilal - Review