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Bomb blast injuries: tertiary care hospital in-patient experience over the last 20 years

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ORIGINAL ARTICLE

Bomb blast injuries: Tertiary care hospital in-patient experience over the last 20 years

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Abstract

Objective: To examine the distribution and nature of limb injuries in young bomb blast victimsand their management in a tertiary healthcare setting.

Methods: The retrospective study was conducted at the Aga Khan University Hospital, Karachi and data was searched using the University Medical Record Database with International Classification of Diseases-Ninth Revision-Clinical Modification codes for injuries and terrorism between 1990 and 2012. Data regarding injuries, including admission time, hospital stay duration, interventions and mortality, was collected and classified as per the New Injury Severity Score.

Results: There were 22 patients in the study; 19(86.3%) males and 3(13.7%) females. The mean age of the sample was 13.1±4.1 years. Median length of hospital stay was 9 days (range: 2-42 days). Sixteen (72.7%) patients required operative intervention. Patients rarely had accompanying injuries with limb injuries. Four (18%) patients needed open reduction and internal fixation. Two (9%) patients needed open reduction and external fixation. One (4.5%) patient required a limb amputation. One (4.5%) patient required ileal resection with ileoileal anastomosis due to shrapnel perforations. There was no mortality.

Conclusion: The young age group was not severely affected by limb trauma. Injuries sustained were infrequently accompanied by severe/critical injury severity scores.

Keywords: Blast injuries, Casualty, Pakistan, Injury severity score. (JPMA 65: S-132 (Suppl. 3); 2015)

Introduction

Blast injuries represent a unique category of trauma cases as they occur due to a combination of mechanisms of injuries. The victim may get affected by the primary blast wave that may lead to collision with fixed objects or traumatic amputations by shrapnel (nails, bearings, casing fragments) that act as missiles and cause penetrating injuries; by the secondary wave of wind caused by the negative pressure induced by the blast; and burns or poisonous effects of combustive materials used to manufacture the device.

The United States Counter-terrorism Centre has listed several types of explosive material, and the most prominent ones used in Pakistan include compounds regularly found in fertilizers such as ammonium nitrate or in items of daily use such as the more recently used potassium perchlorate found in certain bleaches. Improvised Explosive Devices (IEDs) are the most commonly used bombs that employ these explosive materials. There were 45 such explosions claiming 841 lives over 2004-2009 in Balochistan province alone and a further 351 incidents in the Khyber-Pakhtunkhwa province.[1]

In the light of this recent increase in the number of victims of IED explosions, contemporary literature on trauma has seen a new focus on data regarding the nature of injuries sustained after bomb blasts and their management. A retrospective study conducted in 2010, using the national Israel Trauma Registry, characterised the injuries received from terror explosions and compared them between adults, adolescents and children based on specified age groups. It was seen that children were more likely to sustain severe injuries compared to adults (27% vs 12%), specifically pointing towards traumatic brain injury (35% vs 20%) and were less likely to sustain injuries to extremities or open wounds.[2] Contrary to this, Arul et al.[3] analysed paediatric admissions to a British military hospital at Camp Bastion in Afghanistan from January 2011 to April 2011. They reported that majority of the patients (44%) had extremity-related injuries and 30% of the sample had critical injuries.

Review of literature shows a remarkable paucity of data in the paediatric population, which is especially true for Pakistan. The Aga Khan University Hospital (AKUH) is a tertiary healthcare centre located in Karachi. It receives patients from a wide geographical spread covering virtually all the four provinces of the country. The current study was planned to characterise injuries to paediatric

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and adolescent bomb blast victims.

Materials and Methods

The retrospective study was conducted at AKUH, Karachi, and data was searched using the institutional Medical Record database with International Classification of Diseases-Ninth Revision-Clinical Modification (ICD-9-CM) codes for injuries and terrorism between January 1990 and December 2012. Initially the database was mined using codes for limb injuries. These patients were then cross-referenced with the codes describing wartime event (E900-E990) and the resulting population was restricted to age group of 18 years or less.

Data concerning the nature of the bomb blasts was collected using information from local news media. Pertinent information included weight of the bomb, the location where it was detonated and the number of incidents and fatalities.

Injuries incurred by the bomb blast were noted by body region, and classified according to the Abbreviated Injury Scale (AIS). These values were then used to calculate New Injury Severity Scores (NISS) for each patient.[4] The treatment provided to each patient was also recorded, including emergency management and definitive surgical treatment.

Data was summarised using mean and standard deviation (SD) for continuous variables and frequencies and percentages for categorical variables. Median value was used where data was significantly skewed by extreme values. Associations were measured using correlations and confirmed using regression models. $P<0.05$ was considered significant. All statistics were performed using the R-statistical programming language and environment.[5]

Results

During the period under review, the Global Terrorism Database reported 6944 explosions with more than 100,000 deaths and 50,000 injuries. During this period, 282 blast victims were admitted to AKUH. Of them, 22(8%) patients met the inclusion criteria of the current study in terms of age.

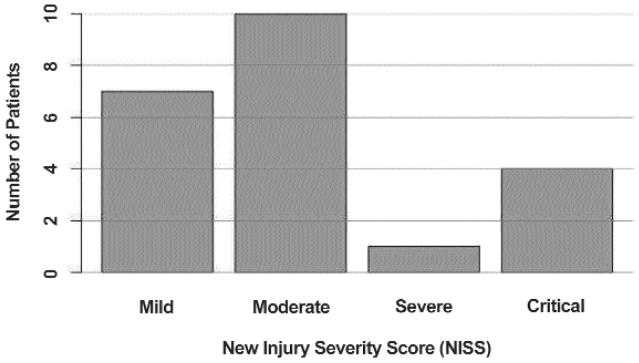


Figure-1: Number of patients in NISS group.

Table-1: Demographics and explosion characteristics.

Gender	N (%)
Male	19 (86.3)
Female	3 (13.6)
Type of Bombing	
Suicidal	4 (18.1)
Remote-Controlled	18 (81.8)
Median Weight of IED (kg)	6
Number of Bombings by Location	
Karachi	13 (59.1)
Quetta	8 (36.4)
Afghanistan	1 (4.5)
Target of Bombing	
Religious Observance	9 (40.9)
Market Place	7 (31.8)
Passer-by	2 (9.0)
Playing/Recreation	1 (4.5)
Median Fatalities in Recorded Bombings	43 (0 - 110)
Median Injured in Recorded Bombings	60 (3 - 200)

IED: Improvised explosive device.

Table-2: Injuries and associated infecting organisms.

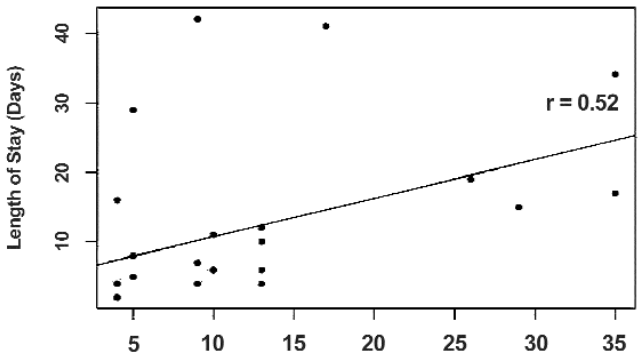
Location of Injury	N (%)
Head and Neck	1 (4.5)
Face	5 (22.7)
Chest	3 (13.6)
Abdomen	3 (13.6)
Extremity	19 (86.4)
External	14 (63.6)
Microorganisms reported on Culture	
Staphylococcus Aureus	1 (4.5)
Stenotrophomonas Maltophilia	1 (4.5)
Aspergillus Flavus	1 (4.5)
Mucor Species	1 (4.5)
Rhizopus	1 (4.5)

Of the 22 patients, 19(86.3%) were males and 3(13.7%) were females (Table-1). Mean age of the population was 13.1±4.1 years. Eight (36.4%) patients had no growth in their blood cultures. No patient had blood cultures that reported anaerobes. Injury to extremities was present in 19(86.4) cases (Table-2). Among the injured, 4(18%) were critical and 1(4.5%) severe in nature (Figure-1).

Mean length of hospital stay was 9 days (range: 2-42 days) (Table-3). NISS and hospital stay showed a correlation

Table-3: In-hospital patient characteristics.

Median Time to Admission (hours)	5.43 (0.85 - 159.97)
Median Length of Stay (days)	9 (2 - 42)
Surgeries Performed	N (%)
Wound Debridement	14 (63.6)
Open Reduction with External Fixation (Tibia x 2, Femur, Humerus)	4 (18.1)
Open Reduction with Internal Fixation (Femur, Tibia)	2 (9.0)
Amputation of Mangled Limbs	1 (4.5)
Ileoileal Anastomosis	1 (4.5)



NISS: New Injury Severity Scores.

Figure-2: Length o hospital stay for NISS.

Figure-3: Left Intramedullary Nail of femur, Anterio posterior (AP) (left) and Lateral (right) views.

(r=0.52) (Figure-2), but regression analysis of this correlation showed that NISS is a weak predictor of hospital stay ((p=0.01). Individuals with the same NISS stayed for differing durations. Age and NISS did not show any correlation.

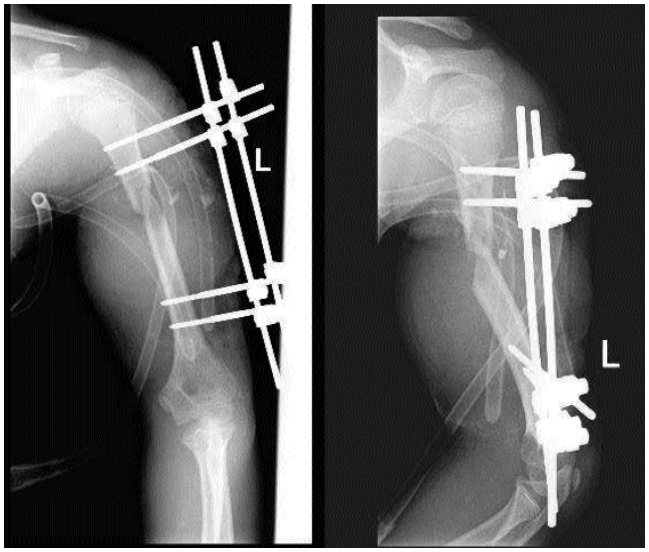


Figure-4: Open Reduction External Fixation of Left Humerus Fracture, Anterio posterior (AP) (left) and Lateral (right) views.

Wound debridements consisted mostly of irrigation with saline and hydrogen peroxide. Four (18%) wound debridements entailed removal of foreign bodies and required a re-look debridement. Only 4(18%) open fractures required operative reduction; and 2(9%) were immobilised with cast and 1(4.5%) was left to heal spontaneously under cuff and collar. One (4.5%) patient required a four-ring Ilizarov fixator for a left tibial fracture. Another (4.5%) patient was treated with a dynamic compression plate(DCP) for a left femur fracture. A left open humerus fracture (4.5%) was treated with an external fixator, and a (4.5%) left femur fracture was treated with a monoplanar external fixator.

Overall, 21(95.5%) patients required transfusion of packed red blood cells (PRBCs). A mean of 6.6+/-6.6 units of PRBCs were transfused. Five (22.7%) patients also required transfusion of fresh frozen plasma with a mean of 11.8+/-6.3 units.

Discussion

The Global Terrorism Database (GTD)has reported 2358 explosions since January 2009.[1] This study, while including a time frame from 1990 till 2013, captured victims from 8 explosions occurring within the period from 2009 to 2013. The study noted 5 explosions in Karachi, 4 in Quetta of the neighbouring Balochistan province and 1 in Afghanistan. According to the GTD, since 2009 there have been 99 explosions recorded in Karachi in which 699 were injured and 174 were killed. Furthermore, there were 124 recorded explosions in Quetta in which a total of 681 were injured and 179 were

killed. The discrepancy in our patient load and the GTD data can primarily be explained by the fact that in our region, the provision of healthcare is fragmented between government and private healthcare setups. Emergency care heavily depends on caretaker's judgement, resources and distance to the closest healthcare facility that can cater to the relevant trauma instead of a comprehensive ambulatory care network. In our cohort, only one patient suffered injury severe enough to cause death. Contemporary studies[6] have noted that children are more liable to severe injuries owing to the fact that their short stature brings vital organs, such as the brain and heart, closer to the explosive device. In our study majority of the patients did not receive injuries to critical areas and this may be explained by the fact that children are usually farther from the epicentre of the blast, and their shorter stature makes them harder targets for dispersed projectiles and shrapnel and they are often shielded by other objects.

Our findings are in sync with Mirza et al.[7] who noted that extremity injuries were the most prevalent amongst the paediatric population. As children get older, they get taller which would once again suggest that older children would be affected more seriously by bombing. However, it was noted in this study that with increasing age the number of injures other than limb trauma decreased with no particular predominance of body region in younger children and that age did not display any correlation with NISS. This may possibly be due to the decreasing head-to-body size ratio in older children, i.e. older children have larger limbs and torso in relation to head size which they reflexively use to shield themselves.[8]

Our study was remarkable in the sense that majority of the patients were male. Similar trend has been reported by Mirza et al.[7] although their comparison was amongst all age groups. Studies exploring victims of terror events have identified that victims of indiscriminate methods such as IEDs are usually females and children.[9] However, this is in contrast with our findings, which could be explained by the differing social roles of males and females in Pakistani society as female children tend to stay at home. The preferred time of the event was mostly during religious observances whereas blasts during peak market timings appeared to be a close second.

Majority of our victims mostly underwent wound debridement procedures during the course of their hospital stay whereas 4 patients underwent external fixator application and two patients had internal fixation (Figures-3-4). Only one case of amputation was documented. Jaffe and Peleg[2] have reported that children were more likely to sustain traumatic brain injury than adults (35% vs. 20%) whereas the statistics quoted for open wounds and external limb injury amongst their comparative populations are less remarkable (39% vs. 59% and 35% vs. 57% respectively). Altogether, there doesn't seem to be much difference in outcome for the same American Spinal Injury Association Impairment Scale (AIS) grading, as specific injuries warrant specific interventional procedures with a mostly similar outcome.

To our knowledge, our study is the first one to analyse blast injuries in children in South Asia. In the light of recent increase in blast injuries, more studies with long-term follow-up are required to guide future patient management of these gruesome injuries.

Conclusion

The young age group was not severely affected by limb trauma. Injuries sustained were infrequently accompanied by severe/critical injury severity scores.

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