

“BOMB BLAST INJURIES OF ORTHOPEDICS AND ITS ASSOCIATED MORBIDITY AND MORTALITY AT DISTRICT HEADQUARTER HOSPITAL MIRANSHAH”

Alamzeb Khan

ABSTRACT

Objective: To determine the morbidity and mortality in bomb blast orthopedics injuries at a district headquarters hospital.

Methodology: This descriptive study was done at department of Orthopaedic & Traumatology, District Headquarters Hospital, Miranshah, North Waziristan Agency, KPK during one year period. A total of 83 patients injured in bomb blast having orthopedic related injuries were selected. Those cases having orthopedics injuries other than bomb blast were excluded from the study.

Results: Out of 83 patients, majority 67.46% were males and 32.54% were females. Maximum cases 40.96% were in the age range of 41-50 years with a mean age of 28+03.00 years. In these patients, lower extremities injuries were 65%, and upper extremities injuries were 35%. Among lower extremities; feet fractures were 22%, tibia/fibula fractures 16%, femur fractures 14%, pelvic bone injuries 07% and multiple lower extremities sites fractures were 06%. In upper extremities; ulna/radius fractures were 16%, humerus fractures 11%, hand fractures 05% and multiple upper extremities sites fractures were 03%. Amputation done in 10% cases and mortality was 12% in multiple injured cases

Key words: Bomb blast-injuries-fractures-orthopedic; morbidity and mortality.

INTRODUCTION

Worldwide, bombings are an increasingly effective and frequent terrorism tool. Explosions are the most common cause of casualties associated with terrorism.¹⁻⁴

Bombings are clearly the most common cause of casualties in terrorist incidents. Recent terrorism has included an increasing use of suicidal/homicidal bombers that deliberately accompany the explosive device (often wearing it) to ensure that the maximum effect is derived from the explosive device. These bombers have walked or driven into buses, subways, cafes, residential areas, guard-posts, and governmental buildings.^{5,6}

In the recent years, most of penetrating limb injuries are not caused by bullets but by explosive devices or ammunitions such as bombs, grenades, or land mines.⁷⁻¹¹

Orthopedic injuries may occur by any of a variety of blast effects; blast waves may lead directly to fractures, projectiles may penetrate and injure extremities, bodies tumble and extremities strike fixed objects in the blast environment, and, finally, extremities are crushed, burned, and neurovascularly compromised.¹²

Address for correspondence:

Dr. Alamzeb Khan

Assistant Professor,
Orthopedic Department,
KGN Hospital Bannu, KPK.
Email: alamzeb671@gmail.com
Mob: 0334-8811239

Musculoskeletal trauma is the most common blast injury. The higher bone rigidity compared to skin and muscle produces a greater resistance and results in greater energy transfer, and commonly results in fracture of the bone.¹³

Musculoskeletal trauma resulting from an explosive detonation is also manifested as primary, secondary, tertiary, or miscellaneous blast injury, in isolation or in combination. Although relatively uncommon in survivor's primary blast injury, especially high energy released can fracture bones and cause limb avulsions.¹⁴

Traumatic amputations due to primary blast injury have a dismal prognosis because victims have been exposed to extreme overpressure.¹⁵ In one series, 11% of blast fatalities had traumatic amputation, and their survival rate was 1%.¹⁶ In the Oklahoma City bombings, one-third of survivors sustained musculoskeletal injuries, and one-third of these victims had multiple fractures.¹⁷

Blast injury has an overall lethality of about 7.8% in open air. This jumps to 49% when the blast occurs in confined spaces. 70% of victims will sustain minor soft tissue injuries.¹⁸ Traumatic amputations will occur in about 11%. Traumatic amputations serve as a marker of severe multisystem trauma and subsequent high mortality.¹⁹

The objective of this study was to determine the morbidity and mortality in bomb blast orthopedics injuries reported at a district headquarters hospital.

METHODOLOGY

This study was conducted at the department of trauma and Orthopedics, district headquarters hospital, Miranshah, North Waziristan, KPK. A total of 83 patients who were brought to this hospital with orthopedics related bomb blast injuries were included in this study irrespective of their age and sex. Bomb blasts from January 2013 to January 2014 were included as per inclusion criteria. Those patients who had orthopedic trauma due to fire arm injury, stab injury, road traffic accident were excluded from study.

All these patients were received in mass trauma unit and then shifted to orthopedic trauma centre. All these patients were resuscitated and evaluated on arrival to the hospital. The patient was individualized on the basis of clinical parameters and group as stable and unstable. After hemodynamic stabilization decision regarding surgical intervention was made on the basis of clinical features and radiological examination. In this manner patient were grouped as those requiring conservative management or surgical intervention.

Initially all patients were treated at the Emergency Department, resuscitated and transferred to the operating room for definitive care including general surgical wound debridement and skeletal fixation of their fractures and few stable patients were operated on routine operating list. For all patients, we use external fixators and backslab to stabilize the fractures. All patients received triple antibiotics and anti-tetanus injections.

RESULTS

Among the bomb blasts in North Waziristan, from January 2013 to January 2014, there were 83 casualties reported in trauma and orthopedic unit, district headquarters hospital, Miranshah, KPK. Out of 83 patients, 56 (67.46%) were males, and 27 (32.54%) were females. Maximum cases 34 (40.96%) were in the age range of 41-50 years, age range was from 02-75 years with a mean age of 28 ± 03.00 years (Table No. 1).

All of the patients received in mass trauma unit, where 36 (43.37%) patients were operated in emergency operating room, and 47 (56.62%) patients were operated in orthopedic operation theater later on routine list.

Majority of the injuries in these patients were lower extremities injuries 54 (65%), upper extremities injuries 29 (35%). Among lower extremities; feet fractures were 19 (22%), tibia/fibula fractures were 14 (16%), femur fractures were 12 (14%), pelvic bone injuries were 6 (07%) and multiple lower extremities sites fractures were 5 (06%).

In upper extremities; ulna/radius fractures were 14 (16%), humerus fractures were 09 (11%), hand fractures were 4 (05%) and multiple upper extremities sites fractures were 2 (03%). Morbidity including amputation

Table No. 1 Various Characteristics of Patients (N=83)

DEMOGRAPHIC DATA	NO. OF CASES	PERCENTAGE
Age ranges:		
01 – 10 years	03	03.61%
11 – 20 years	06	07.22%
21 – 30 years	19	22.89%
31 – 40 years	34	40.96%
41 – 50 years	13	15.66%
51 – 60 years	05	06.02%
61 – 70 years	02	02.40%
71 – 80 years	01	01.20%
Gender distribution:		
Male	56	67.46%
Female	27	32.54%

Table No. 2 Various Data of Cases (N=83)

DATA OF CASES	NO. OF CASES	PERCENTAGE
Surgery done:		
In emergency operation theater	36	43.37%
In routine operation theater	47	56.62%
Site of injuries:		
Lower extremities	54	65%
Upper extremities	29	35%
Distribution of lower extremities injuries:		
Feet fractures	19	22%
Tibia/fibula fractures	14	16%
Femur fractures	12	14%
Pelvic bone injuries	06	07%
Multiple lower extremities sites fractures	05	06%
Distribution of upper extremities injuries:		
Ulna/radius fractures	14	16%
Humerus fractures	11	11%
Hand fractures	04	05%
Multiple upper extremities sites fractures	02	03%
Morbidity and Mortality:		
Amputation	08	10%
Mortality	10	12%

was done in 08 (10%) cases and mortality was recorded in 10 (12%) multiple injured cases (Table 2).

DISCUSSION

Conventional weapons and explosives continue to be the most commonly employed instruments of destruction by terrorists worldwide. Such attacks are occurring with increasing frequency and ferocity. The effects of bombings and blast injuries are both physically and psychologically devastating. Explosions combine four mechanisms of injury. In addition to these causes of injury and death, crush injury, entrapment, and compartment syndrome magnify the devastation of blast trauma.¹²

Age is an important determinant of outcome in patients with traumatic injuries. Older and younger patients with traumatic injuries have a lowered probability of survival compared to those between the ages of 18 and 55 years with equivalent injuries.²⁰⁻²⁴ In our series maximum patients were in middle age group of 41-50 years which were belonged to earning livelihood group of people.

In this study we found that a majority of males were injured due to bomb blasts, while in contrast to our results in a study²⁵ overall, females comprised 63.1% of the victims compared to 37.9% males, giving female to male ratio of 1.6:1. Hadden et al²⁶ found a similar overall ratio. During the world trade centre attack in New York, there were more female victims (66.1%), which compares with the above findings.²⁷ However, the female to male ratio was reversed (1:1.4) when considering those who were admitted to hospital in the study done by Hadden et al.²⁸ In our study majority of males injured due to reason that in this part of the country males are the major earner of the families and they are engaged in daily business in bazars, markets, shops and fields while females are busy in routine works at their homes.

Many injuries such as soft tissue crush or fractures are caused by tertiary mechanism when the victims are thrown to the ground or other objects.²⁸ Miscellaneous orthopedic blast injuries are much less common than secondary blast injuries and may include burns from the thermal effects of explosions or from secondary fires.²⁹

Most orthopedic blast trauma, however, is caused mainly by the secondary effect; penetrating fragment injury, which is the main cause of injury both in warfare and in most terrorist attacks in the Middle East and depends on subject distance from the detonation center, the shape and size of the fragments, and the number of foreign bodies implanted or created by the explosive.³⁰

Trauma to the musculoskeletal system in an explosion may be due to primary, secondary, or tertiary mechanism alone or in combination. Blast overpressure and high-velocity blast winds generated by the explosion may fracture bones or cause tumbling of victims leading to traumatic amputations. Projectiles from the explosion can lead to fractures.³¹⁻³³

In our study lower extremities injuries constitute (65%) of cases, including feet fractures, tibia/fibula fractures, femur fractures, and pelvic bone injuries. Upper extremities injuries were 35%, including ulna/radius fractures, humerus fractures, and hand fractures.

While in the Israeli experience, fractures and lacerations of the upper and lower extremities occurred at 38%. Crush injuries, severe soft tissue injuries, and penetrating injuries of the extremities from projectiles were present as well.³⁴ From October 2000 to June 2003, 71 suicide bombings with 906 victims were treated in Israel. Twenty-one percent of victims required orthopedic surgery.³⁵ In the Madrid bombings, shrapnel wounds and fractures constituted 36% and 18% of musculoskeletal trauma, respectively.³⁶ In the Oklahoma City bombings, 35% of survivors sustained musculoskeletal injuries, with 37% of these victims having multiple fractures.³⁷ Victims may have multiple shrapnel sites leading to extensive soft tissue damage and open fractures.³⁸

Traumatic amputations have a poor prognosis as victims have usually been exposed to extremely high blast over-pressures; however, large projectiles can also cause amputation.^{33,36,39} Eleven percent of fatalities in one series had traumatic amputation, and the survival rate was 1% for victims with traumatic amputation.³⁹

In our study amputations were done in 10% cases, while in a study three lower limbs and one upper limb were amputated. Of the lower limb amputations, two were below knee and the other was above knee. In all cases, the limbs had been traumatically amputated.⁴⁰

Almogy and Nelson have shown in their studies that the presence of certain external signs of trauma is associated with more severe injury. Signs such as limb amputations, burns, open fractures, and multiple long bone fractures are associated with an extremely high fatality rate at the scene.^{41,42}

The rate of amputation of the upper extremity has been linked to the load of the explosion. Higher rates of amputation and secondary amputations (after failed vascular repair) have also been reported with specific injuries or injury mechanisms.^{43,44}

Mortality rates vary widely between incidents. An analysis of 29 large terrorist bombing events between 1966 and 2002 showed 8,364 casualties, including 903 immediate deaths and 7,461 immediately surviving injured. Immediate death/injury rates were higher for bombings involving structural collapse (25%) than for confined space (8%) and open air detonations (4%).⁴⁵ In our study mortality rate was 12% which is comparable with the national and international literature.

CONCLUSIONS

In this study the morbidity and mortality in bomb blast orthopedics injuries was reported in majority of males patients, age ranges between 41-55 years. In

our study lower extremities injuries were recorded in majority of cases. Morbidity and mortality in this study was according to the national and international literature.

REFERENCES

1. Halpern P. Bomb blast and crush injuries. In: Tintinalli JT, Stapczynski J, Ma OJ, eds. *Tintinalli's emergency medicine: a comprehensive study guide*. 7th ed. McGraw-Hill; 2011:p 38-43.
2. Centre for diseases control (CDC). Explosions and blast injuries: a primer for physicians. 2011 [Online]. [Cited on December 01, 2014]. Available at: URL:// <http://www.bt.cdc.gov/masstrauma/explosions.asp>.
3. Sutphen SK. Blast Injuries: a review. Medscape. 2005 [Online]. [Cited on December 01, 2014]. Available at: URL:// <http://www.medscape.org>
4. DePalma RG, Burris DG, Champion HR, Hodgson MJ. Blast Injuries. *N Engl J Med*. 2005;352:1335-42.
5. Stein M, Hirshberg A. Medical consequences of terrorism. The conventional weapon threat. *Surg Clin North Am*. 1999;79:1537-52.
6. Gutierrez de Ceballos JP, Turegano Fuentes F, Diaz PD, Sanz Sanchez M, Llorente CM, Guerro Sanz JE. Casualties treated at the closest hospital in the Madrid, March 11 terrorist bombings. *Crit Care Med*. 2005;33:S107-S12.
7. Burkle FMJM, Newland C, Meister SJ, Blood CG. Emergency medicine in the Persian Gulf War-Part 3: Battlefield casualties. *Ann Emerg Med*. 1994;23:755-60.
8. Bowyer GW. Management of small fragment wounds: experience from the Afghan border. *J Trauma*. 1996;40(3 Suppl):170-2.
9. Rukovanski M. Spinal cord injuries caused by missile weapons in the Croatian war. *J Trauma*. 1996;40(3 Suppl):189-92.
10. Wiedeman JE. Rocket grenade injuries: patient management in a field hospital setting. *Mil Med*. 1994;159:77-9.
11. Aboutanos MB, Baker SP. Wartime civilian injuries: epidemiology and intervention strategies. *J Trauma*. 1997;43:719-26.
12. Lemonick DM. Bombings and blast injuries: a primer for physicians. *Am J Clin Med*. 2011;8:134-40.
13. Rose SC, Fujisaki CK, Moore EE. Incomplete fractures associated with penetrating trauma: etiology, appearance and natural history. *J Trauma*. 1988;28:106-9.
14. Guy RJ, Glover MA, Cripps NP. Primary blast injury: pathophysiology and implications for treatment. Part III: injury to the central nervous system and limbs. *J R Nav Med Serv*. 2000;86:27-31.
15. Sutphen SK. Blast Injuries: a review. Medscape. 2005 [Online]. [Cited on December 01 2014]. Available at <http://www.medscape.org>.
16. Arnold J, Halpern P, Ming-Che T, Smithline H. Mass casualty bombings: a comparison of outcomes by bombing type. *Ann Emerg Med*. 2004;43:263-73.
17. Mallonee S. Physical injuries and fatalities resulting from the Oklahoma city bombing. *JAMA*. 1996;276:382-7.
18. Boffard K, MacFarlane C. Urban bomb blast injuries: patterns of injury and treatment. *Surg Ann*. 1993;25:29-47.
19. Hull JB, Cooper GJ. Pattern and mechanism of traumatic amputation by explosive blast. *J Trauma*. 1996;40(3 Suppl):S198-205.
20. Garcia VF, Brown RL. Pediatric trauma: Beyond the brain. *Crit Care Clin*. 2003;19:551-61.
21. MacKenzie EJ, Rivara FP, Jurkovich GJ, Nathens AB, Frey KP, Egleston BL, et al. A national evaluation of the effect of trauma-center care on mortality. *N Engl J Med*. 2006;354:366-78.
22. MacLeod J, Lynn M, McKenney MG, Jeroukhimov I, Cohn SM. Predictors of mortality in trauma patients. *Am Surg*. 2004;70:805-10.
23. Moreau AR, Westfall PH, Cancio LC, Mason AD Jr. Development and validation of an age-risk score for mortality prediction after thermal injury. *J Trauma*. 2005;58:967-72.
24. Nirula R, Gentilello LM. Futility of resuscitation criteria for the "young" old and the "old" old trauma patient: A national trauma data bank analysis. *J Trauma*. 2004;57:37-41.
25. Museve GK. The 7th August 1998, Nairobi American Embassy bomb blasts survivors with Orthopaedic conditions. *East Afr Orthop J*. 2007;1:26-32.
26. Hadden WA, Rutherford WH, Merret JA. The injuries of terrorist bombing. A study of 1532 consecutive patients. *Brit J Surg*. 1978;65:525-31.
27. New York City Dept. of Health. Rapid assessment of Injuries on the World Trade Center-New York City. Sept. 2001. *Morb Mort Weekly Rep*. 2002;51.
28. Wightman JM, Gladish SL. Explosions and blast injuries. *Ann Emerg Med*. 2001;37: 664-78.
29. Stein M, Hirshberg A. Medical consequences of terrorism. The conventional weapon threat. *Surg Clin North Am*. 1999;79:1537-52.
30. Weil YA, Mosheiff R, Liebergall M. Blast and penetrating fragment injuries to the extremities. *J Am Acad Orthop Surg*. 2006;14:S136-9.
31. Kluger Y. Bomb explosions in acts of terrorism-detonation, wound ballistics, triage and medical concerns. *Isr Med Assoc J*. 2003;5:235-40.
32. Wightman J, Gladish S. Explosions and blast injuries. *Ann Emerg Med*. 2001;37:664-78.
33. Covey D. Blast and fragment injuries of the musculoskeletal system. *J Bone Joint Surg*. 2002;84:1221-34.

34. Singer P, Cohen J, Stein M. Conventional terrorism and critical care. *Crit Care Med.* 2005;33(1 suppl):S61-5.
35. Kluger Y, Peleg K, Daniel-Aharonson, Mayo A. The special injury pattern in terrorist bombings. *J Am Coll Surg.* 2004;199:875-9.
36. De Ceballos J, Fuentes F, Diaz D, Sanchez M, Llorente C, Sanz J. Casualties treated at the closest hospital in the Madrid, March 11, terrorist bombings. *Crit Care Med.* 2005;33:S107-12.
37. Mallonee S. Physical injuries and fatalities resulting from the Oklahoma City bombing. *JAMA.* 1996;276:382-7.
38. Almogy G. Suicide bombing attacks: update and modifications to the protocol. *Ann Surg.* 2004;239:295-303.
39. Stein M, Hirshberg A. Medical consequences of terrorism. The conventional weapon threat. *Surg Clin North Am.* 1999;79:1537-52.
40. Ramasamy A, Harrison SE, Stewart MPM, Midwin-
ter M. Penetrating missile injuries during the Iraqi insurgency. *Ann R Coll Surg Engl.* 2009;91:551-8.
41. Almogy G, Luria T, Richter E, Pizov R, Bdolah-Abram T, Mintz Y, et al. Can external signs of trauma guide management? Lessons learned from suicide bombing attacks in Israel. *Arch Surg.* 2005;140:390-3.
42. Nelson JT, Wall DB, Stedje-Larsen ET, Clark RT, Chambers LW, Bohman HR. Predictors of mortality in close proximity blast injuries during operation Iraqi Freedom. *J Am Coll Surg.* 2006;202:418-22.
43. Prichayudh S, Verananvatna A, Sriussadaporn S. Management of upper extremity vascular injury: outcome related to the Mangled Extremity Severity Score. *World J Surg.* 2009;33:857-63.
44. Ball CG, Rozicki GS, Feliciano DV. Upper extremity amputations after motor vehicle rollovers. *J Trauma.* 2009;67:410-2.
45. Arnold JL, Halpern P, Tsai MC, Smithline H. Mass casualty terrorist bombings: a comparison of outcomes by bombing type. *Ann Emerg Med.* 2004;43:263-73.

ONLINE SUBMISSION OF MANUSCRIPT

It is mandatory to submit the manuscripts at the following website of KJMS. It is quick, convenient, cheap, requirement of HEC and Paperless.

Website: www.kjms.com.pk

The intending writers are expected to first register themselves on the website and follow the instructions on the website. Author agreement can be easily downloaded from our website. A duly signed author agreement must accompany initial submission of the manuscript.