MANAGEMENT OF ORTHOPEDIC INJURIES FOLLOWING MAY 2014 TWIN BOMB BLAST IN JOS, NORTH CENTRAL NIGERIA

Idumagbodi Amupitan *FWACS (Ortho)* *
Kenneth N Ozoilo *FMCS***
Michael B Ode *FWACS (Ortho)* *
Icha I Onche *FMCS (Ortho)* *

Addresses:
**: Department of Orthopedics and Trauma, Jos University Teaching Hospital, Jos.*
***: Division of Trauma, Surgery Department, Jos University Teaching Hospital, Jos.*

Correspondence:
Dr. Amupitan Idumagbodi
Department of Orthopedics and Trauma
Jos University Teaching Hospital, Jos.P. O. Box 2074.
Email: Idumagbodi@yahoo.com Cell: +234 803 6585417

ABSTRACT
Explosive and blast injuries used to be a very significant issue with military medicine but with the current security challenges facing the country it is now significant in the civilian population and needs to be addressed as such.
The aim of this study was to show the pattern of injury, challenges and share our experiences in the management of orthopedic injury following bomb blast.

Materials and methods:
This is a hospital based retrospective study carried out at the Jos university teaching hospital. Records of patients were examined and data extracted using a proforma which was analyzed using epi. Info 3.1.0 and results presented as means and tables.

Results
A total of 51 patients presented due to the bomb blast, 36 (70.6%) of the patients sustained injuries to the extremities but only 15 (29.4%) required orthopedic care. Male female ratio was 2:1 and their ages ranged between 23-80 years mean 36.1±14.6. Eleven (73.3%) orthopedic patients presented immediately following injury to the A&E while the remaining 4 (26.7%) where referred from other peripheral centers where initial resuscitation was carried out. Seven of the patient where managed non-operatively while eight were managed operatively. The duration of admission ranged from 1-90 days median of 19 days. All patients except 1 stayed less than 35days.

Conclusion
Injuries are being seen with increasing frequency in the civilian setting as a result of an upsurge in terrorist bombings and the extremity is the commonest site of such injuries. A proportion of the patients will require complex orthopedic procedures, however majority of the patient still sustain non-life threatening injuries and the difficulty in identifying the severely injured patient can be addressed with an adequate field and hospital triage.

Key Word: *Orthopedic Injuries, Twin blast in Jos.*

Introduction

Bomb blast injuries are no longer confined to battlefields. Injuries normally confined and managed by military surgeons are now being seen by doctors in civilian practices. [1, 2] Explosive devices have also been a preferred weapon of domestic and foreign terrorists, since they are relatively cheap to manufacture and can cause a large number of casualties. Although blast and fragment injuries have traditionally been the purview of military surgeons, these injuries are being seen more frequently among noncombatants during peacetime because of increasing worldwide terrorism. [3] Blast injury could result from explosive devices such as land mines, rockets, mortars grenades and improvised explosive devices. [3] Though most injuries in civilian population are due to improvised explosive devices, they produce

complex forms of injury because these devices are not standardized. Blast attacks tend to generate a large number of fatalities and could result in mass casualties but most survivors are not seriously injured and outpatient care is sufficient. In a mass casualty incident there is a need to increase to surge capacity of the center, mobilize resources initially from within the hospital and later outside the hospital.[4,5] There also tends to be the concept of revise triage where the less critically injured patients tend to present first and the more critically injured patients present later.[6,7]Blast trauma is a complex event pathophysiologically and cause complex injuries to several organs system with different symptoms. A blast produces different patterns of injury in an open space compared with effects that occur in confined spaces.

The mechanism of blast injuries is divided into four general types based on the pathophysiologic basis (primary, secondary, tertiary and quaternary blast injuries)[8, 9]. Primary blast or blast wave injury is caused by the direct effect of blast over pressure on the tissue and it is typically experienced by persons close to the explosion. The range of primary blast injury include fractures, amputations, crush injuries, burns, cuts, lacerations, acute occlusion of arteries, air embolism-induced injury compartment syndrome among others. Secondary blast injuries are caused by flying objects that are energized by the explosion and become projectiles. These are the most common cause of extremity injury and even death. Tertiary blast injuries are caused by displacement in which the whole body or limbs are propelled by the shock wave. This could result in traumatic amputations, fractures and severe soft tissue injuries. Quaternary blast injuries refer to all explosion related injuries not resulting from the mechanism above most times are burns.

The aim of this study was to show the pattern of injury, challenges and share our experiences in the management of orthopedic injury following bomb blast.

Patients and methods

This a descriptive study carried out on all patients that presented to the Jos University Teaching Hospital after the twin bomb blast in the terminus area of Jos Plateau State North Central Nigeria in April 2014. Initial data was collected from the casualty register, operation register and the Trauma register. Data collected included demographics, location of the blast, site of injury, initial treatment received. All the subsequent treatment complication and outcome was imputed into the data collection form. Data was analyzed using epiinfo.

Jos University Teaching Hospital is a 500 capacity bed hospital with a 28 couch multi-disciplinary emergency unit located in Jos, the capital of Plateau State in North central Nigeria.

Following the arrival of the first wave of injured patient and the news that a bomb blast had occurred in the town, a mass casualty was declared by the senior surgical registrar on ground. There was virtually no field triage and hospital triage was done in the anteroom of the Accident and Emergency (A&E) and patients placed into various categories: A red requiring urgent attention, B yellow urgent attention but can wait, C green minor injuries and D dead or the unsalvageable. The Cascade Call out System was activated, and all doctors and nurses who could be brought in summoned. Doctors and nurses were first mobilized from other parts of the hospital and elective surgical procedures stopped temporarily. After the initial stabilization, definitive Orthopaedic management was commenced for those who required it.

Results

A total of 51 patients presented due to the bomb blast, 36 (70.6%) of the patients sustained injuries to the extremities but only 15 (29.4%) required orthopedic care. Male to female ratio was 2:1 and their ages ranged between 23-80 years, mean 36.1±14.6. Traders made up 8 (53.3%) while the others are as shown in table 1. Eleven (73.3%) orthopedic patients presented immediately following injury to the A&E while the remaining 4 (26.7%) where referred from other peripheral centers where initial resuscitation was carried out. Eleven (73.3%) of the patients presented as multiple injuries while 4(%) had isolated injuries, the spectrum of injuries are shown in table 2. Table 3 shows the initial management received by the patients. Seven of the patient where managed non-operatively while eight were managed operatively and this is as shown in table 4. The duration of admission ranged from 1-90 days, median of 19 days All patients except 1 stayed less than 35days. The patient who spent 90days had multiple surgical procedures and rehabilitation. Three of the patients developed of surgical site infection post-surgery but resolved after appropriate treatment. Thirteen of the patients were discharged home after treatment,

one signed against medical advice and 1 died. The patient who died was an 82 year old man who was multiply injured and diabetic, his injuries included burns and multiple lower limb fractures. He was initially managed at a peripheral hospital.

Table 1; occupation of the victims

occupation	Frequency	Percent	Cum Percent
civil servant	3	20.0%	20.0%
other	1	6.7%	26.7%
students	3	20.0%	46.7%
trading	8	53.3%	100.0%
Total	15	100.0%	100.0%

Table 2: pattern of injuries Sustained

Injuries	Frequency	Percentage
Fractures	10	66.7%
Burns	6	40.0%
Blunt abdominal injuries	1	6.7%
Penetrating injuries	4	26.7%
Traumatic amputations	2	13.3%
Lacerations avulsions	5	33.3%
Soft tissue injuries	5	33.3%

(Some patients sustained more than one injury)

Table 3; Initial management administered

Procedure	Frequency	Percentage
Intravenous Fluids	14	93.3%
Antibiotics	14	93.3%
Tetanus Toxoid	15	100%
Suturing	7	46.7%
Blood transfusion	7	46.7%
Debridement	11	73.3%
Chest tube insertion	4	26.7%
Analgesic	15	100%

Table 4; Definitive Procedure

Procedure	Frequency	Percentage
Plate and Screw fixation	2	13.3%
Intramedullary Nailing	4	26.7%
Wiring	1	6.7%
Amputation	3	20.0%
Application of External Fixator	2	13.3%

Discussion

Young males accounted for the majority of the injured patient which is comparable to other studies with most of the patients sustaining injury to the extremities (70.6%) even though only a small proportion required advance orthopedic care and this is comparable with other studies within the country. This could be explained by the fact this is the most active age group and also have to provide for their various families financially. Traders accounted for the bulk of the injured individuals; this is not farfetched because the blast happened in a market. Student and civil servants were also involved on account of the close proximity of a university and various office complexes close to the site of the blast. The bulk of the patients were treated by simple resuscitation and this highlights the need for adequate and appropriate field and hospital triage to prevent the problem of identifying the severely injured patient in a multitude of patients.

Most Orthopaedic trauma is caused by the secondary effect of blast—penetrating fragment injury. However other mechanism of injury were also present in this study, the tertiary and Quaternary mechanism as evidenced by the closed fractures which must have resulted from the whole body or limb being propelled by the shock waves and the cases of burns.

No prospective randomized trial of the diagnosis and/or preferred treatment of blast extremity injuries have yet been published. The overwhelming majority of studies are retrospective, primarily uncontrolled descriptive trials. In addition, most of the descriptions come from military settings, in which tertiary facilities with modern surgical equipment and experienced personnel are often unavailable at the scene of action. For high-energy trauma patients, a systematic approach, using Advanced Trauma Life Support protocols, was applied as early as possible was employed [11, 12]Nonoperative treatment of selected wounds caused by small-fragment debris has been successful but remains controversial and avoided in the care of the patients [11]. Successful surgical treatment depends on meticulous wound débridement, with excision of nonviable tissue and foreign material likely to cause infection; adequate drainage; and delayed closure.[11, 12]

Definitive fracture fixation in penetrating blast extremity injury has always varied between modern trauma care standards and fixation methods described in war injury literature.[11, 12, 14] Most of the literature on treating fractures was based on external fixation or cast.[12, 13] The patients that sustained closed fracture or in whom early wound closure was successfully achieved various form of open reduction and internal fixation was done with good satisfactory outcome. However external fixators and cast was used in the care of patients requiring complex wound care and this has always being a challenge in management of bomb blast injuries.[15] This was what accounted for the patient who spent up to 90 days on admission because he had to undergo complex limb reconstruction procedures. Traumatic amputation following bomb

blast is could be associated as a poor prognosis especially when it occurs as a result of a primary blast wave as some authors have found [10,11]. The mechanism is usually due to combination of blast-wave-induced fracture, due predominantly to coaxial forces, followed by limb avulsion through the fracture site by dynamic forces (the blast wind) acting on the whole limb. [10]Sufficiently large fragments can cause direct limb amputation which is most likely the case in this study because not only was it associated with a good prognosis but the pattern of injury was isolated injuries and not associated with other injuries.

The mortality in the study was one patient and several factors where identifiable. The patient was an elderly patient poly traumatized with comorbidity. The patient was initially managed at a peripheral hospital with a very good field triage but was virtually lacking, such a patient would have being taken to the tertiary center.

Conclusion

Injuries are being seen with increasing frequency in the civilian setting as a result of an upsurge in terrorist bombings and the extremity is the commonest site of such injuries. A proportion of the patients will require complex orthopedic procedures, however majority of the patient still sustain non-life threatening injuries and the difficulty in identifying the severely injured patient can be addressed with an adequate field and hospital triage

References

1) Frykberg ER, Tepas JJ 3rd. Terrorist bombings. Lessons learned from Belfast to Beirut. Ann Surg. 1988; 208: 569-76.
2) Mellor SG, Cooper GJ. Analysis of 828 servicemen killed or injured by explosion in Northern Ireland 1970-84: the Hostile Action Casualty System. Br J Surg, 1989;76: 1006-10.
3) Bowyer GW. Management of small fragment wounds: experience from the Afghan border. J Trauma, 1996;40(3 Suppl): 170-2.
4) Hirscherg A, Stein M; Trauma Care in Mass Casualty Incidents. In trauma. 6th edition. Edited by Faliciano DV, Mattox KI, Moore EE. New York: McGraw-Hill; 2008:141-155
5) Hirscherg A, Holcomb JB, Mattox KI: Hospital Trauma Care in Multiple Casualty Incidents: A Critical Review. Ann Emerg Med 2001, 37:647
6) Ozoilo et al.: Challenges of Management of Mass Casualty: Lessons learned from the Jos Crisis of 2001. World journal of Emergency Surgery2013 8;44
7) Ozoilo et al.: Management of the Mass Casualty from the 2001 Jos Crisis. Niger J ClinPract2014:17:436-41
8) Leibovici D, Gofrit ON, Stein M, Shapira SC, Noga Y, Heruti RJ, Shemer J. Blast injuries: bus versus open-air bombings-a comparative study of injuries in survivors of open-air versus confined-space explosions. J Trauma. 1996;41: 1030-5
9) Stapczynski JS. Blast injuries. Ann Emerg Med, 1982;11: 687-94
10) Dabkana TM1, Bunu B, Na'aya HU, Tela UM, Adamu AS. Pattern of injuries seen during an insurgency: a 5-year review of 1339 cases from Nigeria. Ann Afr Med. 2015 Apr-Jun;14(2):114-7
11) Dana C. Covey. Blast and Fragment Injuries of the Musculoskeletal System. J Bone Joint Surg Am, 2002 Jul; 84 (7): 1221-1234.
12) Weil Y, Petrov K, Liebergall M, Mintz Y, Mosheiff R: Long bone fractures caused by penetrating injuries in terrorists attacks. J Trauma, in press
13) Yoram A. Weil, Rami Mosheiff, MeirLiebergall. Blast and Penetrating Fragment Injuries to the Extremities J Am Acad Orthop Surg September 2006 vol. 14 no. 10 S136-S139.
14) Hodalic Z, Svagelj M, Sebalj I, Sebalj D: Surgical treatment of 1,211 patients at the Vinkovci General Hospital, Vinkovci, Croatia, during the 1991-1992 Serbian offensive in east Slavonia. Mil Med 1999;164:803-808
15) Andrew N. P., COL James R. F. Extremity War Injuries: Challenges in Definitive Reconstruction. J Am Acad Orthop Surg; November2008:vol. 16 no. 11 628-634
16) Mellor SG, Cooper GJ. Analysis of 828 servicemen killed or injured by explosion in Northern Ireland 1970-84: the Hostile Action Casualty System. Br J Surg, 1989;76: 1006-10
17) Hull JB, Cooper GJ. Pattern and mechanism of traumatic amputation by explosive blast. J Trauma, 1996;40(3 Suppl): 198-205