Jos christmas eve bomb blast: confronting new challenges with old resources

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Abstract

Background: Jos, Nigeria has witnessed several mass casualty incidents from sectarian crises, with mechanisms of injury mainly from blunt forces and use of machetes and less from gunshots. In December 2010, for the first time, twin bomb blasts detonated at a market generating casualties and triggering another crisis. We sought to describe peculiarities of this novel mechanism of mass casualty.

Methods: A retrospective descriptive study of patients who presented to our hospital with injuries sustained following the Jos Christmas Eve bombing of 2010.

Results: Of the 90 patients that presented over 4 days, 81were males and 9 females. Age ranged from 2 to 76 years with a mean of 36.2 years, SD≤± 16. There were 31 (34.4%) blast injuries and 35 (38.9%) gunshot injuries. Majority of the wounds involved the lower limbs in 39(43.3%) patients, and upper limbs in 24(26.6%). Forty three (47.8%) patients required only debridement and 13(14.4%) needed only wound dressing. Definitive procedures done were open reduction and internal fixation in 7(7.7%) patients, laparotomy in 5(5.5%), amputation and local wound exploration in 3(3.3%) each, and chest tube insertion in 2(2.2%) patients. Duration of hospital stay ranged from 0-84 days. More than half of the 14(15.5%) complications were infective in origin. There were 7(7.7%) mortalities. The hospital cost was 14 times higher than that of previous crisis that did not involve bomb blast.

Conclusion: The bomb blasts generated predominantly limb injuries that required a lot of resources and prolonged hospital care..A disaster response protocol that envisages injuries arising from this mechanism is essential.

Key words: Bomb blast injuries, Terrorism, Mass casualty

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Introduction

Mass casualty situations typically generate patient loads that stretch or exceed the capacity of a health facility to cope.[1] Effective responses relies greatly on the ability to expand the surge capacity so as to convert what should have been a mass casualty situation into a multiple casualty incident.[2] Institutional mechanisms for expanding surge capacity need to be laid down in peace time and should provide for the most likely causes of such mass casualty events. Effective hospital preparedness therefore relies on the ability to predict such mechanisms of injury and forms the basis upon which institutional mass casualty response protocols may be designed.[3,4]

On the basis of previous experience in the management of mass casualties at this centre, a Mass Casualty and Disaster Management Protocol (The Jos Protocol)[5,6] was designed, to respond to mass casualties from multiple vehicular collisions; which was the predominant cause of mass casualties in our institution at the time. This was modified to provide for challenges posed by civilian conflicts, and modified again to provide for prolonged conflicts that disrupt normal societal activity for prolonged durations.[7-9] The protocol essentially entails a cascade call out system, hospital mobilization, hospital triage, team work, effective maneuvers and treatment, using the Advance Trauma Life Support (ATLS) protocol. The Jos protocol did not envisage injuries from bomb blasts and we were thus taken by surprise when on the 24th of December 2010, a twin blast erupted in a crowded market place while people were going about their last minute Christmas shopping, generating complex and extensive injuries among victims that survived the blast. Against a background societal tension from previous and frequent civilian violence which pervaded Jos city at the time, the multiple blasts triggered a sectarian crisis which further complicated response and increased the casualty figures.

Globally, bomb blasts are an increasing tool in the hands of terrorists seeking to attract attention to their cause or to achieve political or ideological goals.[10] These injuries are immediately lethal for those in close proximity to the site of the blast. Among survivors, it generates complex and extensive wounds that require special skills, resources and approaches to manage.[11] The purpose of this study therefore was to determine the success or otherwise, of confronting a new challenge of bomb blast as a cause of mass casualty situation, using old/existing resources, at Jos University Teaching Hospital, Jos, Nigeria. Response time, adequacy of resources, complications and time taken to return to pre-mass casualty settings have been used as a rubric to determine success.[12] We present the hospital response to

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the management of this incident, highlighting the peculiarities of the injuries arising from this novel mechanism in our institution.

Materials and Methods

Study Setting

The Jos University Teaching Hospital, located in Jos, Plateau state in north central Nigeria, developed a mass casualty management protocol in response to previous experience with the management of several mass casualty incidents.

Disaster response

The hospital response to the incident following arrival of the first wave of patients followed the existing Jos Protocol, as described in previous publications.[5,6]

Study Design

Hospital records of all the patients that were brought to the Accident & Emergency Unit of Jos University Teaching Hospital following the mass casualty after the twin bomb blasts of December 2010 were reviewed retrospectively. Following triage, management of patients followed the ATLS protocol; specific injuries were treated accordingly.

Data Analysis

The patients' demographics, clinical features, management and outcome were collected on a trauma data sheet, and analyzed using the EpiInfo 3.4.1 statistical software (Centers for disease control and prevention, Atlanta Georgia USA). Results are presented in percentages, tables, frequencies and means with standard deviations.

Results

A total of 90 patients presented to the hospital within four days of the twin bomb blast in the market place. Thirty five (38.9%) of the injuries were due to gunshots while 31(34.4%) were due to the blasts. Others were machete wounds 13(14.4%), knife stabs 10(11.1%), burns 4(4.4%), and 1 (1.1%) victim was run over by a vehicle, as shown in Table 1 and Figure 1.Of the 31 blast victims, 28 (90%) presented within 2 hours of the blast and the remaining 3(10%) presented subsequently. There were 81 males and 9 females with male/female ratio of 9:1. The ages ranged from 2 to 76 years old, with a mean of 36.2±16 years and the peak in the 21 - 30 age range.

Injuries involved the lower limbs in 39(43.3%) patients, upper limbs in 24(26.6%), and other parts of the body as shown in Table2. Forty-two patients (46.7%) had injuries to multiple body regions. Care of the patients followed the ATLS protocol, after activation of our mass casualty management protocol. Specific interventions included intravenous resuscitation in 67(74.4%), antibiotics 78(86.6%), analgesia 65(72.2%), and tetanus prophylaxis 82(91.1%), while 43(47.8%) patients required debridement, wound dressing 13(14.4%) and suturing 5(5.6%).

Table 1: Aetiology of injuries sustained

Aetiology	Number	Percentage (%)
Gunshots	35	38.9
Blast	31	34.4
Machete	13	14.4
Knife	10	11.1
Burns	4	4.4
RTA	1	1.1

Table 2: Body parts affected

Body part	Number	Percentage (%)
Lower limbs	39	43.3
Upper limbs	24	26.6
Trunk	23	25.5
Abdomen	7	7.7
Chest	4	4.4
Eye	2	2.2
External genitalia	1	1.1

Table 3: Procedures/surgeries performed

Procedure	Number	Percentage (%)
ORIF	7	7.7
Laparotomy	5	5.5
Amputation	3	3.3
Local wound exploration	3	3.3
Chest tube insertion	2	2.2

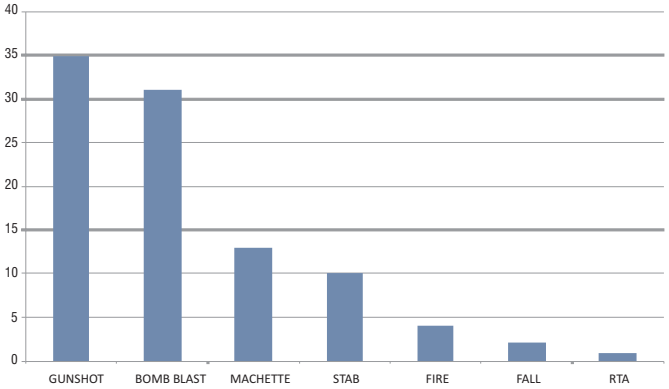

Fig. 1: Mechanism of injury

Sixty nine (76.6%) patients did not require formal

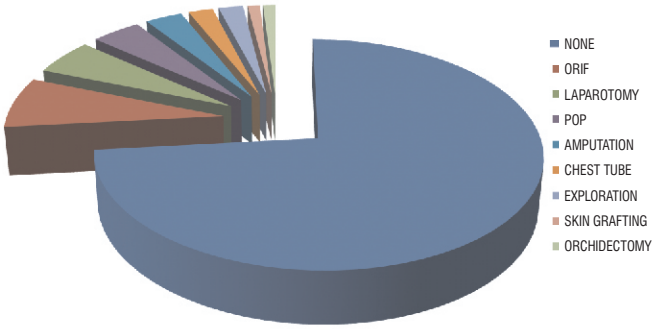

Fig. 2: Definitive treatment given to patients

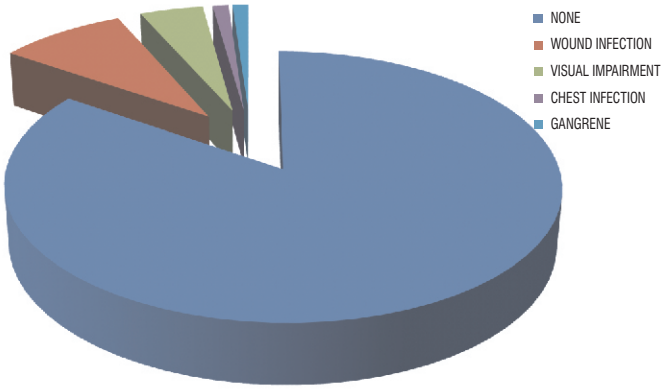

Fig. 3: Complications developed by victims/patients

Figure 4 : Total body burns from bomb blast triage category 4

operative treatment. Of the formal surgeries, open reduction and internal fixation was done in 7(7.7%) patients, laparotomy in 5(5.5%), amputation in 3(3.3%), local wound exploration in 3(3.3%) and chest tube insertion in 2(2.2%) as shown in Figure 2. There were 14 patients with complications (Figure 3), the most common of which were wound infections in 7(7.7%) patients. There were 7(7.7%) mortalities. Two of these, both from the blasts, occurred during resuscitation in the accident and emergency unit. One had total body burns (Figure 4) while the other had bilateral traumatic mid-thigh amputations, both from blast injuries. The others died subsequently, mainly from sepsis and multiple organ failure. The duration of hospital stay ranged from 0 to 84 days with an average of 22.8 $\pm$ 3.4 days. The direct hospital cost of care was N30, 304,100.45($67,342.45), an average of N336, 712.01($748.25) per patient.

Discussion

The presentation of 35 injured patients from the Christmas Eve bomb blast in Jos in 2010 within two hours posed a mass casualty situation, with unique challenges in both medical management and logistics. For a 14 couch capacity accident and emergency unit, available resources were easily overwhelmed and it triggered the activation of our mass casualty management protocol.

The blast also triggered off a sectarian crisis along ethnic and religious lines which lingered for about four days leading to the further presentation of additional 55patients over 4 days with injuries sustained from gunshots, machetes and clubs. The total figure is lower than that from previous mass casualty incidents, but the types of injuries especially from the blasts were unique and novel to our environment. There were extensive tissue destruction, involving both soft tissues and bones especially in the lower limbs, as well as traumatic amputations, which were not common place occurrence in our practice. It is generally reported that compared to other forms of trauma, bomb blasts produce injuries of greater severity and complexity, and involves more anatomical regions, consuming more hospital resources and producing more mortality.[11,12]

Based on the mechanisms of injury, 99%of the injuries were open, necessitating that most patients received tetanus toxoid, analgesics and antibiotics. Beyond this, majority (69%) of the patients did not require formal operative procedures. This is in keeping with the experience of others, who have reported that majority of the patients presenting following a mass casualty incident do not in fact have any life threatening injuries (Triage category green or delayed, also known as the walking wounded).[10] It has been reported that in a mass casualty event, irrespective of the origin, less than 15% of the patients have life threatening injuries, and are salvageable (Triage category red or immediate).[14] In this incident 2(2.2%) patients required the passage of a chest tube to evacuate intra-pleural collections and 5(5.5%) required exploratory laparotomy for persistent haemodynamic instability in abdominal injury, giving a total of 7.7% of the patients who required immediate lifesaving interventions (Triage category red). A major pillar of an effective hospital response is a triage system

that rapidly identifies these critical but salvageable patients so that trauma care assets can be prioritized in their favor in order to reduce mortality.[14]

Since the most frequently performed procedure for these patients was debridement and wound dressings, a facility anticipating mass casualty of a similar nature should therefore stock up on debridement sets as well as sterile supplies for the procedure. Unlike wounds resulting from machetes and clubs which may be sutured primarily, the wound resulting from the debridement of bomb blast injuries, like that for gunshot injuries, are not amenable to immediate closure. These wounds require much fluid for irrigation and consume much dressing materials. Failure to make provision for large numbers of such wounds leading to early exhaustion of consumables could result in interruption of the hospital response to the mass casualty incident.[7] Although 79.9% were soft tissue injuries, anticipation should make provision for assorted slings and splints as part of the initial response. The accompanying bony injury may require complex orthopaedic procedures, which can usually be carried out subsequently.

The distinction between viable and non-viable tissue in bomb blast injuries is not usually obvious at the initial debridement, therefore the patient may have to endure two or more sessions of the procedure and very often requires several operating theatre (OT) visits to render the wound fit for closure. The pressure on the hospital resources and trauma care assets such as OT space, personnel and consumables therefore remains long after the initial response has been concluded and may still conceivably interfere with the normal day to day running of the hospital, with a delay in time taken for the hospital to return to normalcy. In this crisis, the accident and emergency unit returned to pre-crisis level 48 hours after the last wave of victims were brought in, Operating theatre 1 week later, and the wards 4 weeks afterwards. How early the hospital returns to normal routine operations has been used as a measure of the severity of a mass casualty incident.[13]

Although most of the patients did not have any complications, 66.7% of the complications encountered were infective in origin. The 7.7% infection rate (7 wound infections and one chest infection) we saw in this event was slightly higher than our previous experience with mass casualty injuries produced by mechanisms other than bomb blast.[8,9] The trauma patient is considered immunocompromised due to the metabolic response that ensues as a result of a defective humoral and cell mediated immunity leading to a predisposition to infections.[15] In addition, asepsis and infection control practices are easily sacrificed in the chaotic environment of trauma resuscitation.[14] This is made worse in the background of a mass casualty incident. There is also a tendency to move from patient to patient without change of gloves, or to abbreviate the procedures of cleansing and draping and gowning, which all predispose to infection. Conscious effort must be made to maintain asepsis; this must be built into the mass casualty protocol and provisions made by way of supplies to achieve this. This is more so in wounds inflicted by blasts which are more prone to infection. Infective complications in trauma prolong length of hospital stay, increase hospital costs and could result in mortality, in addition to patient discomfort.[16]

The other important complications such as impaired vision (3.3%) and hearing loss occurred in people who were in close proximity to the detonations. Tympanic membrane injury has been used as a marker for proximity to a blast.[18–20] Patients should therefore be screened for blast ear injury, and the finding of a tympanic perforation should prompt suspicion for injuries in similar air filled cavities, such as the lungs and intestines.[19] This is because the pressure from the primary blast injury (or the "blast wave") induces changes in air filled cavities resulting in sudden over pressure and rupture of the walls of such cavities. Delayed perforation of a blast intestinal injury could pose a diagnostic dilemma while blast lung injury in particular could be lethal because of ARDS and respiratory failure.[20]

Although it was not possible to ascertain the field mortality from the blast, the hospital mortality of 7(7.7%) was higher than our previous experiences.[8,9] The two early mortalities which occurred on the day of presentation were from the blasts. These were both triage category 4 patients (the so called Living dead) in whom heroic attempts at salvage would have led to consumption of scarce resources at the expense of people with less critical but more salvageable injuries.[6–8] Even among this category, provision must be made for them in a quiet corner, where they are made comfortable with pain relief and basic care that accords them a dignified death (Figure 4).

We observed prolonged hospital stay of up to 84days with a mean of 22.8 $\pm$ 3.4 days. This is far greater than our previous experience of 4 - 11 days.[7,8] This is to be expected because the repeated sessions of debridement needed and the fact that repair of bony injury had to await soft tissue healing in addition to the high wound infection rates encountered. We also noted that the average cost of hospitalization per patient was N336, 000, a 14 fold increase from the N24, 000 in the preceding mass casualty incident. This is a huge burden in a trauma system where payment is largely out of pocket, with minimal government reimbursement for care leaving the institutions to bear the burden of cost of response to mass casualty incidents.

Conclusion

The bomb blasts generated complex injuries predominantly in the lower limbs. Majority of patients did not have injuries requiring formal operative treatment and most did not have complications. Blast injuries however generate complex bony and soft tissue injuries that require a lot of resources and entail prolonged hospital care. The direct hospital cost is also enormous – a 14 fold increase when compared to our previous experiences with crisis that did not involve bomb blasts.

References

1. Levi L, Michaelson M, Admi H, Bregman D, Bar-Nahor R. National strategy for mass casualty situations and its effects on the hospital. Prehosp Disaster Med. 2002;17(1):12-6
2. Hirshberg A, Scott BG, Granchi T, Wall MJ Jr, Mattox KL, Stein M. How does casualty load affect trauma care in urban bombing incidents? A quantitative analysis. J Trauma. 2005;58(4):686-93
3. Frykberg ER. Medical management of disasters and mass casualties from terrorist bombings: how can we cope? J Trauma. 2002;53(2):201-12.
4. Steiner N. Medical management of disasters and mass casualties from terrorist bombings: how can we cope? Management in Health. 2017;21(3):6-15
5. Nwadiaro HC, Yiltok SJ, Kidmas AT. Immediate mass casualty management in Jos University Teaching Hospital: a successful trial of Jos protocol. West Afr J Med. 2000;19(3):230-4
6. Ozoilo KN, Pam IC, Yiltok SJ, Ramyil AV, Nwadiaro HC. Challenges of the management of mass casualty: lessons learned from the Jos crisis of 2001. World J Emerg Surg. 2013;8(1):44
7. Ozoilo KN, Kidmas AT, Nwadiaro HC, Iya D, Onche II, Misauno MA, Sule AZ, Yiltok SJ, Uba AF, Ramyil VM, Dakum NK, Ugwu BT. Management of the mass casualty from the 2001 Jos crisis. Niger J Clin Pract. 2014;17(4):436-41
8. Ozoilo KN, Amupitan I, Peter SD, Ojo EO, Ismaila BO, Ode M, Adoga AA, Adoga AS. Experience in the management of the mass casualty from the January 2010 Jos Crisis. Niger J Clin Pract. 2016;19(3):364-7
9. Frykberg ER. Principles of mass casualty management following terrorist disasters. Ann Surg. 2004;239(3):319-21
10. Kluger Y, Peleg K, Daniel-Aharonson L, Mayo A; Israeli Trauma Group. The special injury pattern in terrorist bombings. J Am Coll Surg. 2004;199 (6): 875-9
11. Hirshberg A, Frykberg ER, Mattox KL, Stein M. Triage and trauma workload in mass casualty: a computer model. J Trauma. 2010;69(5):1074-81
12. Owers C, Morgan JL, Garner JP. Abdominal trauma in primary blast injury. Br J Surg. 2011;98 (2):168-79
13. Trucco P, Nocetti C, Sannicandro R, Carlucci M, Weinstein ES, Faccincani R. Assessing Hospital Adaptive Resource Allocation Strategies in Responding to Mass Casualty Incidents. Disaster Med Public Health Prep. 2021:1-11
14. Nwadiaro HC, Iya D, Yiltok SJ, Kidmas AT. Mass casualty management: Jos University Teaching Hospital experience. West Afr J Med. 2003;22 (2):199-201
15. Napolitano LM, Faist E, Wichmann MW, Coimbra R. Immune dysfunction in trauma. Surg Clin North Am. 1999;79(6):1385-416
16. Ozoilo K, Peter S, Nwadiaro H. The burden of morbidity in polytrauma. Highland Medical Research Journal. 2014;14(1):9-11.
17. Wolf M, Kronenberg J, Ben-Shoshan J, Roth Y. Blast injury of the ear. Mil Med. 1991;156(12):651-3
18. Kronenberg J, Ben-Shoshan J, Wolf M. Perforated tympanic membrane after blast injury. Am J Otol. 1993;14(1):92-4
19. Cripps NP, Glover MA, Guy RJ. The pathophysiology of primary blast injury and its implications for treatment. Part II: The auditory structures and abdomen. J R Nav Med Serv. 1999;85(1):13-24.
20. DuBose J, Plurad DS, Rhee PM. Blast injuries. In: Penetrating Trauma. Springer, Berlin, Heidelberg. 2017:541-547