



## Otolaryngological Presentations in Times of Terror: Profile from a Tertiary Health Center in North-Central Nigeria

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### ► ABSTRACT

**Objectives:** To report the incidence, socio-demographic characteristics, otorhinolaryngological presentations and outcomes of management of patients at the Jos University Teaching Hospital following terror attacks.

**Methods:** A prospective descriptive hospital based study of consecutive patients presenting with ear, nose and throat injuries as a result of bomb blasts and ethno-religious crises within a six-year period and managed at the Jos University Teaching Hospital were studied for age, gender, ear, nose and throat presentations, injury mechanism, interventions and outcome of interventions. A designed proforma was used for data collection.

**Results:** There were 107 ear, nose and throat injuries from a total 468 terror-related injuries consisting of 66 (61.7%) males and 41 (38.3%) females (M:F ratio of 1.6:1), aged between 5 and 77 years (mean=36.7 years; SD= +/- 16.2). Two peak age incidences of injuries in the first and third decades were recorded. The commonest source of injuries was bomb blasts in 47 (44%) patients. Multiple facial fractures with soft tissue injuries were the commonest seen in 78 (72.9%) patients. The commonest associated injuries were head injuries (n=36). Ninety-four (87.9%) patients presented via the Accident and Emergency department, 16 (15%) received pre-hospital care. Patients with multiple injuries stayed longer in the hospital ( $p=0.028$ ). Complications were recorded in 19 (17.8%) patients. A case fatality rate of 5.6% was recorded.

**Conclusion:** Bomb blasts were the major form of terror attacks in our region. The presence of multiple injuries is a significant negative predictor of patient outcomes.

**Keywords:** Ear; Nose; Throat; Injuries; Terror; Jos-Nigeria.

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## Introduction

Terrorism is defined as a doctrine about the presumed effectiveness of a special form of fear generating, coercive political violence on the one hand, and on the other hand to a conspiratorial practice of calculated demonstrative, direct violent action without legal or moral restraints, targeting mainly civilians and non-combatants, performed for its propagandistic and psychological effects on various audiences and conflict parties [1]. These violent events can be in the form of single-phase acts such as bombings and armed assaults, dual-phased life threatening incidents such as kidnapping and hijacking and multi-phased sequences of torture, secret detention and murder [1].

Armed assaults in the form of ethnic and religious conflicts have been in existence in Nigeria from the pre-colonial era [2]. These conflicts are usually politically motivated. Bombings however have been non-existent until the last decade with the proliferation of a variety of terrorist groups. Jos, Plateau state, Nigeria has been the most affected region in the country suffering these terror acts with deleterious consequences of increasing incidences of injuries, fear, chaos, deaths and destruction of properties [3]. Improvised explosive devices (IED) are the usual weapon used by perpetrators.

The number of injured individuals as a result of these violent incidences triples the number of the dead leaving several millions displaced in the process [2].

Trauma from armed assaults as recorded in a previous study from our center could be in the form of penetrating high velocity injuries, fractures and lacerations from gunshots, machetes, knives etc [4]. There are four basic mechanisms of bodily trauma resulting from bomb blast injuries and are termed as primary, secondary, tertiary and quaternary. Primary blast injury occurs from the direct effect of high pressure waves on body tissues. Secondary injuries follow wind propulsion of shell fragments or debris into tissue. Tertiary injuries occur when the blast wind knocks individuals against a solid object. Quaternary injuries include other effects like burns, crush injuries and post-traumatic stress disorders [5].

These violent events have resulted in an unprecedented increase in the number of mass casualties presenting to health facilities and coupled with documented evidence of decreasing emergency care capacity would require preemptive action [6, 7].

Life threatening injuries like blast lung and abdominal injuries do occur, requiring prompt recognition and treatment [8] but injuries to the head and neck region can be lethal as a result of airway compromise and should not be ignored.

Due to violent blast exposure, neuro-otologic injuries are said to be the commonest otorhinolaryngological manifestation following bomb blast events [9].

The primary objective of this study is to determine

the frequency and profile of ear, nose and throat injuries associated with terror attacks. The secondary objective is to create awareness of these injuries with the aim of implementing preventive measures.

## Materials and Methods

### *Study Design and Population*

In this prospective descriptive hospital based study, consecutive patients presenting with trauma as a result of bomb blasts and ethno-religious crises starting from the Christmas Eve bombing of 2010 in Jos (24/12/2010) to January 2016 and managed at the Jos University Teaching Hospital were studied.

The patients studied were victims of four bomb blast events within Jos Metropolis and those from several sporadic armed assaults at neighboring Local Government Areas (LGA) in Plateau state.

### *Study Protocol*

Clearance for this study was obtained from the ethical committee of the teaching hospital.

Patients presenting with isolated ear, nose and throat injuries were managed by otolaryngologists while multiple injured patients required multi-disciplinary management involving the trauma surgeons, otolaryngologists, ophthalmologists, reconstructive, cardiothoracic and neuro surgeons.

Patients were studied for age, gender, ear, nose and throat presentations, mechanism of injury, interventions and outcome of interventions.

Patients presenting via the Accident and Emergency department were evaluated and resuscitated by the application of the Advanced Trauma Life Support protocol. Those presenting at the outpatient clinic were reviewed and treated on outpatient basis.

Radiological and laboratory investigations were carried out as necessary. Further treatment such as blood transfusions (for hemo-dynamically unstable patients), tracheostomy (for airway compromise), thoracotomy and chest tube insertions, craniotomies, laparotomy, limb fracture reductions, fixations and immobilization were effected as necessary especially for multiply injured patients.

At surgery, under general anesthesia, facial lacerations were cleaned and where shrapnel were embedded in wounds they were removed, cleaned and closed primarily. In cases of extensive tissue loss, flaps were raised and defects were closed. Facial fractures were reduced, immobilized and fixed by the application of wires where necessary. Analgesia and antibiotics were given as required. Patients were admitted and managed in the Intensive Care Units and the open wards as the mass casualty cases were overwhelming.

Medical and surgical emergencies not attributable to trauma from these sources were excluded from the study. Patients brought in dead were also excluded from the study. A proforma was designed and all the data entered as required.

### Statistical Analysis

Data collected was entered into the Statistical Package for the Social Services (SPSS) software version 20 (SPSS Inc., Chicago, IL, USA). Descriptive analysis of mean and standard deviations were used to summarize the collected data. All tests of statistical significance were two-tailed. To determine the predictor variables associated with intervention outcomes, bivariate correlation analysis was used to calculate predictor variables that are associated with patient outcomes. A *p*-value of less than 0.05 was considered statistically significant. Results obtained are presented in tables and charts.

### Results

From the 24<sup>th</sup> of December 2010 to January 2016 there had been series of sporadic armed assaults and bomb blasts in Jos and its surrounding local government areas accounting for 468 (2.1%) injuries out of a total 22, 614 injuries managed at the Jos University Teaching Hospital in the study period.

Of the 468 injuries resulting from terror events, 107 (22.9%) had various ear, nose and throat manifestations meeting our inclusion criteria. Of these were 59 (55.1%) multiple injured patients and

48 (44.9%) with isolated ear, nose and throat injuries. The recorded injuries were from bomb blasts in 47 (44%) patients, gunshots in 16 (15%), machete injuries in 39 (36.4%) and inhalational burns in 5 (4.6%) patients (Figure 1).

The age range of patients studied was 5 to 77 years with a mean age of 36.7 years (Standard deviation +/-16.2) constituting 66 (61.7%) males and 41 (38.3%) females giving a male to female ratio of 1.6:1. There were two peak age incidences- the first and third decades of life (Table 1).

There were 43 (40.2%) patients with isolated soft tissue injuries in the form of penetrating gunshot injuries (n=11), avulsions (n=8) and head and neck lacerations (n=24).

Multiple facial fractures with soft tissue injuries were seen in 78 (72.9%) patients and cut throat in 1 (0.9%) patient (Table 2).

Twenty-eight (26.2%) had otologic presentations with 16 (15%) having tympanic membrane perforations- 9 (8.4%) patients with bilateral and 7 (6.5%) with unilateral perforations. There was spontaneous healing of the tympanic membrane with scar tissue formation in 13 (12.1%) patients. Tympanoplasty was required in 3 patients. The audiogram recording of 5 (4.7%) patients was

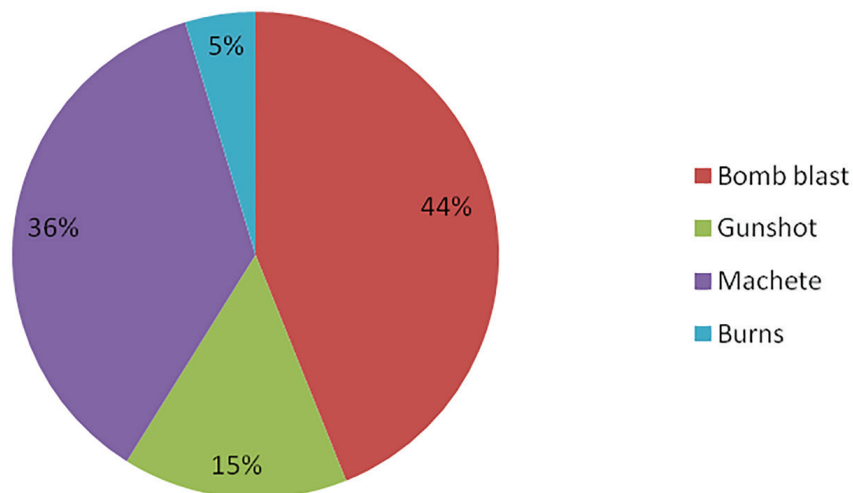


Fig. 1. Sources of Injuries

Table 1. Age and gender characteristics of patients

Age range (yrs)	(%)	Gender		Total
		Male	Female	
9	(27.1)	13	16	29
10-19	(13.1)	4	10	14
20-29	(30.0)	27	5	32
30-39	(9.3)	8	2	10
40-49	(6.5)	6	1	7
50-59	(6.5)	4	3	7
60-69	(1.9)	0	2	2
70-79	(5.6)	5	1	6
<b>Total</b>	(100)	66	41	107
Mean=35.74		Standard deviation=16.23		
Minimum=5		Maximum=77		

**Table 2.** Facial fractures sustained by patients studied

Fracture Type	Frequency	Percentage
Maxilla	29	37.2
Zygoma	5	6.4
Mandible	17	21.8
Ethmoid	7	9.0
Nose	11	14.1
Le-Fort	8	10.2
Orbit	1	1.3
<b>Total</b>	<b>78</b>	<b>100</b>

moderate to severe hearing loss and in 11 (10.3%) patients was mild to moderate hearing loss. Eleven (10.3%) patients reported tinnitus. Other otologic presentations were lacerations of pinnae in 11 (10.3%) patients and complete avulsion of pinna in 1(0.9%) patient.

The commonest associated injuries in patients with multiple injuries was head injuries (n=36). Others were eye injuries (n=11) of which 2 patients had complete unilateral visual loss, abdominal injuries (n= 5) and hemo-pneumothorax (n=7) (Table 3).

Ninety-four (87.9%) patients presented via the Accident and Emergency department of which 16 (15%) received pre-hospital care and 13 (12.1%) patients presented via the outpatient clinic all of whom had tympanic membrane perforations from bomb blast events. The interval between injury and time of presentation to the hospital was 1 hour to 12 days (mean=14.6 hours; SD= +/-15.4). Bivariate correlation analysis revealed no statistical correlation between length of hospital stay and intervention outcomes ( $p=0.71$ ). The length of hospital stay for in-patients ranged from 5 days to 31 days with a mean=11days. Patients with multiple injuries stayed longer in the hospital ( $p=0.028$ ).

Complications were recorded in 19 (17.8%) patients with the commonest being otologic complications (Table 4). Patients with multiple injuries were those who developed complications and stayed longer on admission ( $p=0.002$ ). Six (5.6%) patients died while on admission- 1 from severe head injury and 5 from sustained multiple injuries.

**Table 3.** Associated injuries

Injury Type	Frequency	Percentage
Head	36	61.0
Eye	11	18.6
Pneumothorax	6	10.2
Hemothorax	1	1.7
Abdomen	5	8.5
<b>Total</b>	<b>59</b>	<b>100</b>

**Table 4.** Complications of injuries

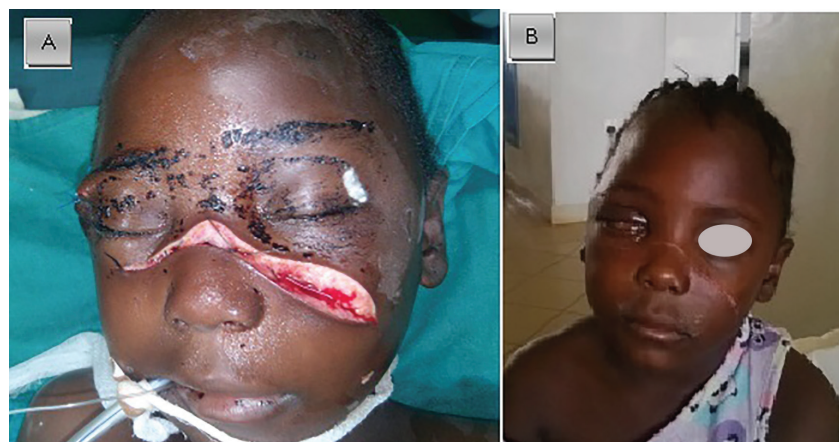
Type of complication	Frequency (%)
Facial nerve	3 (15.8)
Chronic suppurative otitis media	3 (15.8)
Loss of vision	2 (10.5)
Avulsion of pinna	1 (5.3)
CSF rhinorrhea	2 (10.5)
CSF otorrhea	3 (15.8)
Nasal synechiae	1 (5.3)
Tinnitus	4 (21.0)
<b>Total</b>	<b>19 (100)</b>

## Discussion

Communal clashes were once the most predominant form of terror events in Nigeria as human existence depicts a history of intergroup and/or intertribal conflicts. This has however changed to conform to the pattern of terrorism occurring worldwide as bomb blasts and insurgent attacks have become common events especially in the last decade. This is evident in our study as bomb blasts were responsible for the majority of ear, nose and throat injuries recorded with bimodal peak age incidences seen amongst individuals in the first and third decades of life.

Children have become a major group suffering the deleterious consequences of terror events by having firsthand experience as shown in our study (Figure 2). Alongside the physical trauma reported in this study, the psychological effects of these terror-related events on children are documented in literature to be inimical to proper development [10, 11].

Our study shows that individuals in the second



**Fig. 2. A.** An 8-year old female patient at presentation with facial lacerations and right eye injury, a victim of insurgent attacks; **B.** Same patient in Figure 2A following repair and evisceration of the right eye. Her left eye (concealed) is normal.



decade of life also constituted a significant majority of those affected and with those in their third decade reveals that the young in the reproductive and productive stages of life responsible for social and economic development of society are at the receiving end of these unfortunate events. This portends great danger as it negatively impacts on the socio-economic development of any country.

The male to female ratio recorded shows that women are significantly affected by these events especially insurgent attacks, signifying that all gender are equally at risk.

The commonest ear, nose and throat presentations in our study were multiple facial fractures of which fractures of the maxilla were in the majority with associated multiple soft tissue injuries in the form of facial lacerations and avulsions affecting the head and neck region. This is similar to the finding from a study in Iraq and Israel [12, 13]. Most maxillofacial injuries are due to the secondary and tertiary effects of bomb blasts [12] and they may also follow all four mechanisms of blast injuries. This may explain the wide variation of maxillofacial presentations in our study. Injuries to the face result in scars and produce functional and psychological disorders in affected patients, in this study mostly young individuals and it involves prolonged treatment and rehabilitation.

Sixteen patients in our series had tympanic membrane perforation. This is similar to a study by Shah et al in which they recorded 18 tympanic membrane perforations amongst 110 returning blast-injured Middle-east deployed service members they studied [9]. We also recorded bilateral tympanic membrane perforations in 8.4% similar to their record of 8%.

The ear is the commonest organ affected by blast injuries as it is the most sensitive pressure transducer in primary blast injuries [14] with tympanic membrane perforation being the commonest resultant injury [15]. Detonation of an explosive device causes the release of high pressure gases which expands away from the point of explosion compressing the surrounding air, producing both a blast wave and a blast wind that propagates away from the explosion in a spherical pattern [16]. This high energy produces rupture of the tympanic membrane and cochlear damage.

Spontaneous tympanic membrane healing occurred in a large number of patients in our series following perforation. Studies have shown that spontaneous healing of the tympanic membrane occurs and early surgical intervention with its attendant complications can be avoided as a result [17]. This fact is further buttressed by a study in Enugu, Nigeria in which 94% of patients with post-traumatic tympanic membrane perforations experienced spontaneous healing [18]. Those requiring surgical interventions in our study were few and were as a result of repeated infections of the middle ear which prevented spontaneous healing. The commonest associated injury recorded

in this study was head injuries (open and closed) followed closely by eye injuries. These were as a result of direct blows to the head from machetes, clubs and shrapnel from the improvised explosive devices used in these attacks and explains the varied injury types recorded in our study. The presence of associated injuries is a determinant of patient outcome by complicating the management of these patients [19]. This is shown in our study in which patients who had associated injuries recorded longer hospital stays and mortalities.

Research has shown that significant morbidity and mortality is attributable to lack of a functional Emergency Medical Service (EMS) especially Pre-hospital Transport and Care which is an important component of EMS [20]. The economic status of a nation has been linked to the availability and efficiency of this service [21]. The EMS in Nigeria remains extremely poor [7] and accounts for the poor record of this service accorded our patients. It is also known that EMS and Pre-hospital care also reduce critical mortality; therefore it is possible that some patients may have died in the field due to the absence of this service in our environment. Our study is hospital based, and may not account for all field mortalities or morbidities attributable to field delays.

Overall, we recorded satisfactory outcomes in our patients with complications recorded in 17.8% of patients following treatment especially otologic complications. We attribute this outcome to the prompt management instituted to our patients at presentation and the otologic complications such as chronic suppurative otitis media were due to late hospital presentation.

The development of functional injury surveillance systems at regional and national levels is important to preventing these injuries. This helps to characterize events leading to injuries and prioritizing effective interventions by allocating adequate funding and human commitment towards prevention.

Several documented factors are responsible for ethno-religious/communal conflicts ranging from poverty and ignorance to religious fanaticism and politics. It is government's role to improve human development capacity in order to reduce these conflicts by establishing a conflict management unit and improving the economy and job creation. It is also the role of government to ensure strict adherence to the United Nations' General Assembly resolution on Global Counter-Terrorism strategy [22].

Properly equipping hospitals and the development of a standardized EMS will ensure appropriate management of patients and further improving overall outcomes.

## Conclusion

The commonest ear, nose and throat presentation from terror attacks in our region, of which bomb blasts were the most common sources of injuries are

facial fractures with soft tissue injuries occurring mostly among males in the first and third decades of life. Having multiple injuries is a significant negative predictor of patient outcomes. Management of these injuries when promptly identified can result in favorable outcomes for patients.

These injuries are preventable and require

government improving the lives of the citizenry by provision of jobs, basic amenities and conflict resolution in order to stem the tide of terror attacks. The need for a proper and functioning EMS in order to improve outcomes cannot be overemphasized.

**Conflicts of Interest:** None declared.

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