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Original Research Article

Profile of bomb blast injuries

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ABSTRACT

Introduction : Bomb blast injuries in India have unfortunately been a recurring and tragic reality, stemming from acts of terrorism and insurgency that have targeted various regions of the country. These incidents have resulted in significant loss of life, severe injuries, and lasting trauma for those affected. The impact of bomb blast injuries in India is not only physical but also psychological, affecting individuals, families, and communities at large.

The injuries sustained in bomb blasts can vary in severity and type, depending on factors such as the type of explosive device used, the location of the blast, and the proximity of individuals to the explosion. Common injuries include shrapnel wounds, burns, fractures, traumatic amputations, and head injuries. The force of the blast can cause extensive damage to internal organs, leading to conditions such as blast lung injury, abdominal trauma, and hearing loss.

Aims and Objectives: The pattern of injuries due to bomb blast on the victims. Identification of the dead body of the deceased victims. To ascertain the distance of the victim from the blast from nature of injuries. Eardrum injuries sustained and mental trauma to live victims. To ascertain the presence of foreign bodies, primary and secondary missiles and there by assisting in investigations.

Materials and Methods

The present study “The Profile of Bomb Blast Injuries” has been carried out in the one of the Major Medical College and Hospital in Maharashtra State. The present study has been carried out during the period of January 2003 to July 2004, During this study total cases studied were sixty nine (69), they are grouped as A & B. A : - 32 cases died due to bomb blast has been meticulously studied. B : - 37 injured persons (clinical cases) due to bomb blast has been studied in the different wards of hospital.

Result: In the present work total 69 cases were studied by group A & B i.e group A: 32 cases brought dead in the hospital, while group B:37 cases admitted in the hospital and following conclusion are derived :-

1. Maximum affected persons from group A: deaths as well as from group B : clinical cases injured in bomb blast, were in the age group of 11 to 40 years.
2. Maximum cases from group A (brought dead to the hospital) as well as clinical cases from group B admitted in the hospital are much higher in males as compared to females.
3. The persons died, group A and injured cases (clinical) group B, during bomb blast in present study was mainly belong to Hindu religion as compared to other religions.
4. It was found in the present study that the persons died in bomb blast were mostly the residents of Mumbai city in comparison with those who are residing outside of Mumbai.

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1. Introduction

Bomb blast injuries in India have unfortunately been a recurring and tragic reality, stemming from acts of

terrorism and insurgency that have targeted various regions of the country. These incidents have resulted in significant loss of life, severe injuries, and lasting trauma for those affected. The impact of bomb blast injuries in India is not only physical but also psychological, affecting individuals, families, and communities at large.¹⁻⁵

The injuries sustained in bomb blasts can vary in severity and type, depending on factors such as the type of explosive device used, the location of the blast, and the proximity of individuals to the explosion. Common injuries include shrapnel wounds, burns, fractures, traumatic amputations, and head injuries. The force of the blast can cause extensive damage to internal organs, leading to conditions such as blast lung injury, abdominal trauma, and hearing loss.

Immediate medical attention is crucial in treating bomb blast injuries, as timely intervention can help save lives and prevent further complications. Emergency responders and healthcare professionals play a vital role in providing triage, stabilization.

Specialized care to those injured in bomb blasts. The coordination of resources, including medical supplies, personnel, and transportation, is essential in managing mass casualty incidents resulting from bomb blasts.⁶⁻⁹

In addition to the physical injuries, bomb blast survivors may also experience long-term psychological effects, such as post-traumatic stress disorder (PTSD), anxiety, and depression. Mental health support and counseling services are crucial in helping individuals cope with the emotional aftermath of such traumatic events and rebuild their lives.

Preventive measures are key in addressing the threat of bomb blasts in India, including enhancing security measures, intelligence gathering, and public awareness campaigns. Collaboration between government agencies, law enforcement, and the community is essential in preventing and responding to acts of terrorism and minimizing the impact of bomb blast injuries.

Despite the challenges posed by bomb blast injuries in India, resilience, solidarity, and a commitment to peace and security can help communities heal and rebuild in the aftermath of such tragic events. By working together to address the root causes of terrorism, strengthen emergency response capabilities, and provide comprehensive support to survivors, we can strive towards a safer and more secure future for all.^{10,11}

1.1. Types of injuries

The injuries sustained in bomb blasts can be categorized into primary, secondary, tertiary, and quaternary injuries.⁷ Primary injuries are caused by the direct effects of the blast wave on the body, leading to injuries such as blast lung, eardrum rupture, and internal organ damage. Secondary injuries result from flying debris and shrapnel, causing penetrating wounds and lacerations. Tertiary injuries occur when individuals are thrown by the blast force, leading

to fractures, head injuries, and blunt trauma. Quaternary injuries encompass all other injuries; including burns, crush injuries, and psychological trauma.

1.2. Patterns of injuries

The patterns of injuries in bomb blasts often follow distinct trends based on the type of explosion, the distance from the blast site, and the surrounding environment. For example, individuals closer to the epicentre of the blast are more likely to sustain primary injuries, while those further away may experience secondary and tertiary injuries from debris and structural collapse. The presence of protective barriers or structures can also influence the distribution of injuries, with individuals behind cover being shielded from the direct effects of the blast wave.

1.3. Medical response

In responding to bomb blast incidents, medical professionals must be prepared to address a wide range of injuries and prioritize care based on the severity and type of injuries sustained. Immediate interventions may include airway management, haemorrhage control, and stabilization of critical injuries.¹²⁻¹⁷ Trauma centres and hospitals must be equipped to handle mass casualty incidents and provide comprehensive care to a large number of patients in a short period of time.

Table 1: Bomb blasts in Mumbai⁷

Year	Date	Place	Vehicle Used	Death	Injured
1993	12 th March	Nariman Point To Bandra	Scooter	257	700
1993	29 th October	Matunga Road	Train	Nil	11
1998	27 th February	Santacruz, Kandivalli, Virar	Train	04	Nil
2002	2 nd December	Ghatkopar rly. station	Best bus	02	38
2002	06 th December	McDonald hotel	AC duct	nil	25
2003	27 th January	Ville parle	bicycle	01	30
2003	13 th march	Muland station	Local train	11	66
2003	28 th July	Ghatkopar	Best bus	04	35
2003	25 th August	Gate way of india and new Zaveri Bazzar	Taxi	25	178
2004	3 rd March	Virar	Not Known	01	03

The following study is carried out with keeping in mind following aims and objectives:-The pattern of injuries due to

bomb blast on the victim. Identification of the dead body of the deceased victims. To ascertain the distance of the victims from the device/blast from nature of injuries. Eardrum injuries sustained and mental trauma to live victims. To ascertain the presence of foreign bodies, primary and secondary missiles and thereby assisting in investigations. To know the cause of deaths of such cases. To facilitate the collection of evidentiary materials for chemical analysis and identity purpose. To pinpoint, highlight the lacunas in existing crisis management system to improve further management system and immediate steps to be taken for blast victims and mass casualties in casualty and mortuary services in public hospitals.

2. Material and Methods

The present study “The Profile of Bomb Blast Injuries” has been carried out in the one of the Major Medical College and Hospital in Maharashtra State. The present study has been carried out during the period of January 2003 to July 2004,

During this study total cases studied were sixty nine (69), they are grouped as A & B.

A: - 32 cases died due to bomb blast has been meticulously studied.

B: - 37 injured persons (clinical cases) due to bomb blast has been studied in the different wards of hospital.

Two proforma used to carry out the present study the deaths in bomb blast cases and injured in bomb blast cases. Analysis was done from tables used to study for approximate distance from blast site in feets, action of the victim at the time of blast, position of the victim related to blast site, level of consciousness following blast, Perforation of ear, Mental condition of the victim during admission, follow up after every 24 hrs and at the time of discharge, Condition at the time of discharge.

3. Results

The observations are described in the following tables and graphs.

Table 2: A; showing age wise distribution of the victim died due to bomb blast. (Gr. A)

Sr. no.	Age group in years	No. Of cases	Percentage of cases
1	0 TO 10	0	0
2	11 TO 20	9	24.32
3	21 TO 30	14	37.83
4	31 TO 40	7	18.9
5	41 TO 50	4	10.8
6	51 TO 60	2	5.45
7	Above 60	1	2.7
	Total	37	100

Table 3: Showing the sex wise distribution of the victims died in bomb blast (Gr A)

Sex	No. Of cases	Percentage of cases
Male	32	86.48
Female	5	13.52
Total	37	100

Table 4: Showing the number of deaths in regard to religion. (Gr. A)

Religion	No.of cases	Percentage of cases
Hindu	30	81.09
Muslim	7	18.91
Total	37	100

Table 5: Showing the residential jurisdiction of victim died in bomb blast. (Gr. A)

Residential jurisdiction	No. of cases	Percentage
Within mumbai city	25	78.13
Outside mumbai but within state	3	9.37
Outside the state	3	9.37
Noy known	1	3.13
Total	32	100

Table 6: Showing distribution of nature of injuries found over the bodies

Nature of injuries	No. of cases in area of hnf	No. of cases in area of upper limbs	No. of cases in area of lower limbs	No. of cases in area of chest	No. of cases in area of abdomen	No. of cases in area of back
Burns	23	23	18	14	11	15
Lacerations	21	20	24	4	9	6
Contusions	24	25	31	12	14	13
Abrasion	25	25	31	14	17	13
Punctures	15	20	18	14	13	7
Degloving	4	6	12	1	0	5
Fractures	14	10	12	4	Nil	3
Perforations	Nil	Nil	Nil	Nil	5	Nil
Amputations	1	1	1(left leg)	1	Nil	1
No injuries	1	2	10	10	7	12

B: 1 Showing age wise distribution of injured persons due to bomb blast. (Gr. B)

1	0 TO 10	0	0
2	11 TO 20	9	24.32
3	21 TO 30	14	37.83
4	31 TO 40	7	18.9
5	41 TO 50	4	10.8
6	51 TO 60	2	5.45
7	ABOVE 60	1	2.7
	Total	37	100

Table B 2: Showing sex wise distribution of the injured patients. (Gr. B).

Sex	No. of cases	Percentage of cases
Male	32	86.48
Female	5	13.52
Total	37	100

B 3: Showing religion wise distribution of the injured of bomb blast. (Gr. B)

Religion	No. of cases	Percentage of cases
Hindu	30	81.09
Muslim	7	18.91
Total	37	100

B 4: Showing the approximate distance of 115 persons from the blast site. (Gr. B).

Continued on next page

Table 6 continued

Distance in feet	No. Of cases injured	Percentage of cases			
5	4	10.81			
10	7	18.9			
15	4	10.81			
20	5	13.5			
25	3	8.1			
30	4	10.81			
40	4	10.81			
50	2	5.45			
B 5: Showing the incidences of ear perforation in total admitted bomb blast victims. (Gr.B)					
Perforation	No. Of cases	Percentage of cases			
Bilateral ear perforation	9	24.32			
Unilateral ear perforation	5	13.51			
Unilateral perforation with csom in other ear	3	8.12			
No perforation	20	54.05			
Total	37	100			
B 6: Showing action motion movement of the victim of bomb blast at the time of incidence. (Gr. B).					
Action of victims	No. Of cases	Percentage of cases			
Walking	19	51.35			
Sitting	4	10.81			
Standing	11	29.72			
Working	3	8.02			
Total	37	100			
B 7: showing the incidences of post traumatic stress disease (PTSD) in the persons injured from bomb blast. (Gr. B).					
Type of stress	No. Of cases	Percentage of cases			
Victims with ptsd	25	67.56			
Victims without ptsd	12	32.44			
Total	37	100			
B 8: showing the nature of external injuries found in the injured admitted cases (Gr. B).					
No. Of cases in area of hnf	No. Of cases in area of upper limbs	No. Of cases in area of lower limbs	No. Of cases in area of chest	No. Of cases in area of abdomen	No. Of cases in area of back
8	6	10	3	3	6

Table 6 continued

8	10	19	3	4	4
15	27	28	10	7	10
12	24	26	5	6	6
9	17	20	5	6	5
NIL	3	5	NIL	NIL	NIL
NIL	3	3	NIL	NIL	NIL
3	1	14	NIL	NIL	4
17	9	2	26	28	24

B 9: Showing the incidence of sudden unconsciousness in total admitted bomb blast victims (Gr. B).

Consciousness	No. of cases	Percentage of cases
Sudden unconsciousness	16	43.25
Normal	21	56.75
Total	37	100

4. Discussion

The present study "The Profile of Bomb Blast" has been carried out in one of the Major Medical College and Hospital in Maharashtra State. The present study has been carried out during the period of January 2003 to July 2004. In the present work total cases were studied were 69.

They are grouped as under:

A:- 32 cases brought dead in the hospital died due to bomb blast.

B:- 37 cases (clinical) injured due to Bomb blast admitted in the hospital.

Statistic was not applied, There is paucity of identical study data in the literature for comparison of our findings.

Age wise distribution of cases were studied and it was found that maximum number of cases i.e. 21 cases (65.62%) were found in the age group 11 to 40 years in group A. (Table A 1) In group B maximum number of cases i.e. 30 cases (81.06%) were in the age group 11 to 40 years (Table B1).

The probable reason for maximum cases in those particular age groups can be given as the persons in these age groups were the working and roaming population and are exposed more to exterior world as compared to the age groups below 10 yrs and after 41 yrs of life.

As shown in table A2 and B 2 the sex wise distribution, the percentage of males outnumbers the females in both groups, the brought dead and clinical cases i.e. 90.62 % and 86.48 % respectively. The reason of their higher distribution was due to prevailing culture of male dominance in productivity in the Indian society. Male were working members so they are more exposed to outside world whereas females are more engaged in household activities.

When the data was subjected to the religion wise distribution of the cases it was found that the percentage of Hindus were 84.37 % (as per table A-3) in the dead cases, and 81.06 % in the injured cases (as per Table B3) respectively. The probable reason behind this might be due to the reason as the population and density of Hindus in Mumbai and nearby vicinity was more as compared to Muslims.

When the data is critically analyzed for the persons died in bomb blast for their regional (residential) distribution. It was found that the person from within Mumbai were much more as compare to Outsiders 78.12%, (Table A-4). The probable reason was due to both incidences taken into study have been occurred in Mumbai and area where it is occurred , one of it is a crowded market place and other Place is a popular historical monument, where the local residents usually visits more in numbers than the outsiders.

When the data critically analyzed for the injuries sustained in both groups, dead bodies as well as injured clinical cases as in table A 5 and B-8 respectively, it was observed that the injuries like burns, abrasions, contusions, lacerations were abundant in numbers over the major area

of body. The perforation of cavities like abdomen seen in many cases in dead. The fractures and degloving injuries were found in decreasing order.

It was observed that the persons who are closed to the blast sites were sustained injuries like degloving and fractures and amputation and in some cases total distortion and fragmentation of body occurs. The abrasions, contusions, lacerations and Punctures were mainly due to the fragments generated during blast and the secondary missiles generated during blast. Burns were almost due the dual effect i.e. the heat generated during blast and secondary fire as the fire caught by inanimate objects and various vehicles and objects carrying inflammable material like taxi containing petrochemicals in the nearby vicinity.

In the present study the data related to identity was some meticulously collected and dispersed via different agencies like police, media and local booths formed at postmortem centers that all the dead bodies has been identified and claimed by relatives funeral purpose.

In the present study when the samples collected were analyzed for explosive material, chemical analysis reports reveals that Nitrite (post explosion residue) was present in all samples. Nitrite was the basic component of many of the explosives used recently. While collecting the data through history some interesting cases has been uncovered which explains the various effects and modes of actions of the explosives.

One injured victim narrated the history that he was around 5feet away from the site of explosion. At the time of explosion he experienced electrocution (sudden vibration and numbness) like Sensation. This may be due to the different energy waves and radiation generated during blast.

In other incidence one victim experienced a sudden fall at time of blast and after few seconds she pushed up to the distance of 5 feet towards the direction of blast. This explains the positive and negative pressure waves generated during blast.¹⁸⁻²¹

One injured seen that one person who is sitting with the wall behind him has been blown upwards up to the height of 10 feet's after explosion. This explains the resistance offered by wall to the positive pressure generated during blast and is transformed into the victim sitting close to it.

Many people who witnessed the blast experienced that they are immediately thrown away opposite to the direction of the blast while few others experienced that they were sucked towards blast site. This explains the positive and negative waves generated during blast.

During postmortem examination a spanner has been removed from one dead body. This spanner is blown as a secondary missile from the taxi found in the blast.

After blast local peoples, social workers, local vehicles, ambulance squads from different social and governmental organizations, police vehicles all rushed towards the incidence sites. All have contributed in the

fast transportation of victims and dead bodies towards various nearest hospitals and institutes. But there was no co-ordination between all these agencies which created hawking atmosphere resulting in the unnecessary delay in the treatment and Proper management of the situation medically. Mumbai peoples tolerate this panic very bravely and courageously without creating any problem to law and order of the city.

Compensation for victims kin: State (Government has announced financial assistance of Rs. 2 lakhs to next of kin of those who dies in blast. A spokesperson from Chief Minister's office said families of seriously injured will receive Rs. 50000/- (T.O.I 27th Aug. 2003).

This endeavor is not to summarize the horrible experiences experienced by victims and till continue by the family members who have lost their beloved for forever but to fill the gap of knowledge and its application, by which such panic should be avoided. The overall management to be reviewed to decrease death toll, and effective medical and medico-legal management should be provided by studying different type of injuries sustained. Social, mental and spiritual trauma to the victims reviewed and their further rehabilitations considered.^{22–29}

5. Conclusion

In the present work total 69 cases were studied by group A & B i.e group A: 32 cases brought dead in the hospital, while group B 17 cases admitted in the hospital and following conclusion are derived:-

Maximum affected persons from group A: deaths as well as from group B: clinical cases injured in bomb blast, were in the age group of 11 to 40 years. Maximum cases from group A (brought dead to the hospital) as well as clinical cases from group B admitted in the hospital are much higher in males as compared to females. The persons died, group A and injured cases (clinical) group B, during bomb blast in present study was mainly belong to Hindu religion as compared to other religions. It was found in the present study that the persons died in the bomb blast were mostly the residents of Mumbai city in comparison with those who are residing outside of Mumbai. The pattern of injuries found in brought dead (Group A) cases were mostly of burns, abrasions contusion, lacerations, while in few cases fractures, degloving injuries, amputations and total disruption of body was observed. The pattern of injuries found in injured (clinical) cases (Group B), were mostly of Abrasion, Contusion, Laceration & Burns. Maximum numbers of cases found injured (clinical) group B were within the range of 30 feet from the blast site. Bilateral perforation of ear was in more cases than the unilateral perforation of ear in the present study. (Group B). Mental trauma (post traumatic stress disease) was seen in majority injured cases. (Group B). Sudden unconsciousness was experienced by many injured victims of bomb blast in the

present study. (43.24%) (Group B) Shock and Hemorrhage due to polytrauma was the cause of death in majority of cases. While in few cases it was associated with extensive burns, fatal head injury and burst abdomen. "Nitrite" was the basic chemical compound of explosive material traced in the chemical analysis in the present study.

6. Source of Funding

None.

7. Conflict of Interest

None.

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