ORIGINAL ARTICLE

PATTERN OF ABDOMINAL INJURIES IN BOMB BLAST PATIENTS

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ABSTRACT

Objective: To study the pattern of abdominal injuries in bomb blast patients.

Material and methods: This retrospective study was done in surgical department of Khyber teaching hospital from April 2012 to June 2015. Record of bomb blast injury patient was reviewed and details of abdominal injuries were sorted out. Bomb blast patients with abdominal injuries admitted in general surgery department were included in our study. Patients with no abdominal injuries or admitted in other specialty units were excluded from the study.

Results: Total 73 patients of bomb blast injuries presented to emergency department in the above mentioned period, from where 56 were referred to general surgery unit for admission. Out of 56 patients admitted, 47 patients had abdominal injuries. Abdominal wall injuries not breaching the peritoneum were found in 12 patients while 41 patients had abdominal wall injuries breaching the peritoneum. Three patients had no obvious abdominal wall injuries but got intra-abdominal visceral injuries.

Conclusion: A low threshold for operative intervention should be kept in mind because of the complex intra-abdominal injury produced by bomb blasts. Close observation and serial monitoring in important because of delayed rupture of gastrointestinal wall hematoma.

Key Words: Bomb blast injuries. Abdominal injuries, peritoneum, blast effect.

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INTRODUCTION

Once considered as a domain of military surgeons; treatment of bomb blast injuries is no more confined to military hospitals,[1] due to increased incidence of bomb blast and suicidal attacks after 9/11. Bomb blasts produce a unique pattern of injuriesthat is never seen beyond the combat.[2] The injuries produced may be blunt or penetrating and often involve multiple organs.[3] High pressure air wave rapidly spreading from detonation center also produces fatal occult injuries that may be easily missed.[4] In present era of unstable security situation where threats of terrorist attacks are prevalent in many parts of the world, understanding the pathophysiology and management of bomb blasts injuries is essential in civilian practice[5]. Current study is an attempt to know about the pattern of abdominal injuries produce due to bomb blasts and this may provide a roadmap for the management of such patients.

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MATERIALS AND METHODS

This retrospective study of bomb blast injuries patient was conducted in General Surgery Department of Khyber Teaching Hospital from April 2012 to June 2015. Records of all bomb blast injuries patients were retrieved and patients admitted in general surgery department were included in the study. Bomb blast injuries patient referred to other surgical specialties were excluded from the study. Patients who were in extremis on arrival to ED and died in A &E without any surgical intervention were also excluded from the study. Patient's demographics including age, gender, socioeconomical group and marital status were noted. Abdominal injuries on physical examination and operative findings were recorded.

Microsoft Excel was used for data interpretation. Continuous data was presented as mean, median and

standard deviation whereas categorical data was presented as frequency and percentage.

RESULTS

During this period total 73 patients of bomb blast injuries presented to emergency department of Khyber Teaching hospital. Fifty six (n=56) patients were admitted in General Surgery department comprising of 51(91%) male and 5(8.9%) females.Mean age of the patients was 28 with ± 8.3SD.The most common affected age group was25 to 35 years old having 21 (37.5%) cases. There were 15 (26.7%) patients in the age group of 15 to 25 years, followed by age group 36-45 years old, having 8 (14.2%) patients. Six (10.7%) patients were of the age group above 40 years,and 6 (10.7%) patients were <15 years age group.

Seventeen patients were referred to other surgical specialties. Of those admitted to general surgical unit 47 patients had abdominal injuries. Twelve (21.4%) patients had abdominal wall injuries that were not breaching the peritoneum. The most common intra-abdominal hollow viscus injured was ileum (52.7%), followed by colon (31.8%) and then stomach (25%) while in intra-abdominal solid organs liver was the most commonly injured organs (47.7%), followed by mesentery (43.1%) and then spleen (31.8%). Intra-abdominal vascular injuries were three times common for veins than arteries.Patient's demographic data is given in table 1 and injuries (on physical examination and operative findings) are given in Table 2.

Table 1: Patients' Demographic data

Patient's demographics	Number0	Percentage
Age Group		
<15 years	6	10.7%
15 to 25 years	15	26.7%
26 to 35 years	21	37.5%
36 to 45 years	8	14.2%
>45 years	6	10.7%
Gender		
Male	51	(91%)
Female	5	(8.9%)
Marital status		
Married	39	69.6%
Unmarried	17	30.3%
Monthly income		
<300 $	41	73.2%
300-500$	9	16%
>500 $	6	10.7%

Table 2: Patient's injuries (On Physical examination and operative findings)

Patients' abdominal injuries	Number	Percentage
Not breaching the peritoneum	12	21.4%
Breaching the peritoneum	41	73.2%
Intra-abdominal injuries without abdominal wall injury	3	5.3%
Hollow viscus injuries		
Stomach	11	25%
Duodenum	3	6.8%
Jejunum	8	18.1%
Ileum	23	52.7%
Colon	14	31.8%
Rectum	2	4.5%
Bladder	3	6.8%
Ureter	1	2.2%
Gastrointestinal hematoma NOS	8	18.1%
Solid Organs Injuries		
Liver	21	47.7%
Spleen	14	31.8%
Pancreas	3	6.8%
Mesentery	19	43.1%
Kidney	6	13.6%
Testis	2	4.5%
Intra-abdominal vascular injuries		
Arterial injury excluding Aorta	3	6.8%
Venous injury excluding IVC	8	18.1%

DISCUSSION

Bomb blast injuries are not uncommon in North West of Pakistan. The management of bomb blast injuries is challenging because of the complexity of injuries it produces and the unfamiliarity of most clinicians with such injuries. Despite the first report of primary blast injuries in a submarine explosion in 1917,[6] it was largely forgotten till World War II when blasts in both air

Table 3: Zuckerman's classification of bomb blast injuries

Type of blast injury	Mechanism of injury
Primary	Interaction of the blast wave with the body
Secondary	Energized fragments from the bomb itself or environmental debris accelerated by the blast wind
Tertiary	Physical displacement of the body by the blast wind including tumbling and impact with stationary objects; crush from building collapse caused by blast wind.
Quaternary	All other miscellaneous effects including psychological effect from blast, burns and inhalational injuries.

and water were common and a resurgence of interest in bomb blast effects and management took place[7,8,9]. However this interest in research on bomb blast injuries was declining till the global peace was threatened again with 9/11 accident and then a wave of terrorist attacks spread across the world.

Bomb blast produces injury by one of the four mechanisms[10]. Table 3 Primary bomb blast injuries are due to the overpressure effect produced in first few milliseconds of detonation. This generates a stress and shear waves causing tissue injuries by spalling and implosion and tearing of restraining tissues due to differential deceleration.[11]

In survivors of bomb blast injuries secondary and tertiary injuries outnumber than the primary[12] and both auditory and pulmonary injuries are commoner than abdominal injuries[13]. However submarine explosions[14] and blasts in enclosed space can particularly causes severe abdominal injuries.[15] The severity and fatality of bomb blast depends on the type of explosive used.[16] Nitroglycerine, dynamite plastic ammonium nitrate/fuel oil, trinitrotoluene and triacetone triperoxide are used in high order explosive bombs.[17]

In our study most of the bomb blasts were suicidal attacks at overcrowded public places targeting civilian population causing death of mostly poor and working class young people. Females were less victimized because of the cultural and social norms to avoid going into bazaars and overcrowded places. Two bomb blasts were targeted planted bombs. All were air blasts in open space with no close space or sub-marine explosion.

Abdominal injuries produced by bomb blast are quite difficult to assess and manage owing to the multiplicity and complexity of injuries produced. In total 73 patients presented to A&E 64% patients had significant abdominal injuries that warrant admission to surgical unit. Five percent (5%) patient had no obvious abdominal wall injuries but they had visceral perforation. Two of them had caecal perforation while one had stomach perforation.

In our study the most common intra-abdominal hollow viscera injured were ileum (52.1%) followed by colon(31.8%) and then stomach(25%).This is in accordance with the size of organ and the chances of injuries from penetrating objects are simply more for larger organs, however in bomb blasts air containing structure are more at risk and that is the reason gas filled organs are the main victims. Gastrointestinal hematoma was found in 18% patients. Management of gastrointestinal hematoma in bomb blast patients is quite challenging as delayed perforation is common. Serial observation, monitoring the patient and timely intervention is the key to successful outcome.

In solid intra-abdominal organs liver was the most commonly injured organ (47.7%), followed by mesentery (43.1%) and then the spleen(31.8%). Mesenteric tears and avulsion is common due to the blast effect and shearing forces acting on the mesentery during rapid deceleration. Renal injuries were found in 13.6% patients as kidneys are well protected in fat pad and resistant to the blast effect. Venous injuries were more common than arterial injuries because of the mesenteric avulsion mostly tearing the veins.

Most of the results were in accordance with the systemic review of 61 articles conducted by Owers et al, in 2010[1]. However in our study we found mesenteric injuries to be more common and renal injuries were-comparatively less. The changing pattern of warfare technologies and attack strategies may change the pattern of injuries produced and continuous update of medical community is important in this aspect to tailor the management strategies accordingly.

CONCLUSION

Bomb blasts produces complex abdominal injuries and much vigilance is needed in treating such cases. Patients should be retained in hospital where suspicion of intra-abdominal injury is there, irrespective of obvious abdominal wall injury. Serial observation and monitoring is needed as delayed rupture of gut wall hematoma is common and may lead to sepsis. The

changing pattern of warfare strategies may change the pattern of injuries it produces and continuous research is essential for improved care provision.

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Khan MA: Concept, Data Collection and writing

Muslim M: Review

Ahmed M: Review

Ahmed N: Data analysis

Aurangzeb M: Supervision

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Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.