

Central Nervous System Complications in Civilians' Blast – Induced Head Injuries

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ABSTRACT

Objective: To evaluate the frequency of central nervous system complications in civilians with explosive related head injuries.

Material and Methods: This observational study was conducted at Neurosurgery Department, Post Graduate Medical Institute, Lady Reading Hospital, Peshawar – Pakistan, from January 2009 to December 2011 (3 years). We included all the patients with explosive related head injuries who were hospitalized, of all age groups and both genders, and excluded those patients who died before hospitalization. We also excluded patients with head injuries having neurovascular complications or had neurological deficit.

Results: We had total of 191 patients with bomb blast head injuries treated in Lady Reading Hospital. One sixty six (86.9%) patients were male and 25 (13.1%) female with male / female ratio of 6.6:1. Their age ranged from 2 months to 71 years. Almost 65% of the patients were in their 2nd, 3rd and 4th decades of life. The common CNS complications in our patients were infections (12.04%), cerebrospinal fluid (CSF) leak (8.38%), epilepsy (5.2%) and post-traumatic hydrocephalous (3.7%). Mortality rate was 11%.

Conclusion: We conclude from this study that central nervous system infections are the common (12.04%) complication of civilian explosive related head injuries followed by cerebrospinal fluid leak, seizures and hydrocephalous respectively. Over all morbidity is 29.32% and mortality rate is 11% in those head injured patients who reach to hospital.

Key Words: Explosive injuries, Bomb blast injuries, penetrating brain injuries, Traumatic brain injury, warfare injuries.

INTRODUCTION

Blast – induced traumatic brain injury (bTBI) is a major medical concern and has been called the “signature wound” of the Afghan / Iraq Wars.¹⁻⁴ It is a significant military health issue and also a civilian threat. The civilian casualties’ have increased by the use of improvised explosive devices in the recent global terrorism.⁵⁻⁷ The neurological consequences of blast are different between civilian and military populations. This is because civilians do not wear protective equipment and are more heterogeneous population (includes children and elderly).^{8,9}

The characteristics of the blast waves are different in open field detonations than in confined spaces as armored vehicle.⁵ Primary blast injuries are caused by overpressure waves while secondary, tertiary, and quaternary blast injuries by the impact of fragments, abnormal movements, or heat. Traumatic brain injuries (TBI) are often complicated by secondary injury cascades.^{5,10} The propagation of blast waves through vessels affecting vascular perfusion and function of the blood – brain barrier is suggested to be an important mechanism for blast.¹¹

Explosive related head injuries are less common

types than other head injuries and are managed either conservatively or surgically. The aims of operative management are securing hemostasis, decompression of brain and water tight closure of the dural defects using natural (pericranium, temporalis fascia, fascia lata or allograft) or synthetic materials.¹²

Blast injuries are more complex and have high mortality.^{7,11,13} A number of complications can occur with explosive related head injuries. These are cerebrospinal fluid (CSF) leak, infections (wound infection, meningitis, and abscess), seizures, post-traumatic hydrocephalus and vascular complications (aneurysm, arterio-venous fistula, vasospasm and subarachnoid hemorrhage).⁷

As there is limited study on civilian explosive related head injuries, this study will help us to know about these complications and their prevention and management.

MATERIAL AND METHODS

This observational study was conducted in the Department of Neurosurgery, Lady Reading Hospital, Peshawar from January 2009 to December 2011. We included patients of both gender and all age groups who had bomb blast head injuries and were hospitalized. Those patients who died before hospitalization were excluded from the study. After taking history and thorough examination, all the patients were subjected to CT Brain with bone window. Approval for conducting this study was taken from the ethical committee of the hospital and Consent was taken from the patients or their relatives. The patients were observed for development of CNS infections, CSF leak, seizures and hydrocephalus for the period of one month. The demographic and clinical data of the patients was entered in a specifically designed Performa. This data was analyzed using SPSS version 11.

RESULTS

We included a total of 191 patients with bomb blast head injuries who were hospitalized in neurosurgery department LRH Peshawar.

Age Distribution

Age of the patients ranged from 2 months to 71 years with the mean age of 35.6 years. The patients with different age groups are given in Table 1.

Table 1: Age Distribution.

Age	No. of Patients	Percentage
0 – 10 Years	14	07.33
11 – 30 Years	41	21.46
21 – 30 Years	53	27.75
31 – 40 Years	31	16.23
41 – 50 Years	22	11.52
51 – 60 Years	19	09.95
61 – 71 Years	191	100

Gender of Patients

Out of 191 head injured patients 166 (86.9%) were male and 25 (13.1%) female with male / female ratio of 6.6:1.

Complications

The list of complications is given in Table 2.

Table 2: Complications.

Complications	No. of Patients	Percentage
Infection	23	12.04%
CSF leak	16	8.38%
Seizures	10	5.2%
Hydrocephalous	7	3.7%
Total morbidity	56	29.32%
Mortality	21	10.99%

DISCUSSION

Brain is a delicate organ of the body which is shielded by the hard bony skull. Explosive head injuries are comparatively rare but are more fatal. We had total of 191 patients who had blast related head injuries. The age of the patients was between 2 months to 71 years with the average age of 35.6%. The common age groups were between 2nd to 4th decades (65%) of life. In our study the male to female ratio was 6.6:1. In a study of series of explosions the mean age of the patients were 32 years and men (59%) were commonly affected group as compared to female.¹⁴ This is because men in young age, because of their outdoor activities,

are more prone to terrorist attacks than women and people of extreme ages.

Cerebrospinal fluid leakage (CSF) is a common complication (28%) of such injuries and is highly predictive of infectious complications.¹⁵ Chances of infection rise from 5% to 50% in the presence of cerebrospinal fluid leaks.¹⁶ We had CSF leak in 8.4% patients in our study. Almost comparable results were published in other studies as 6.7%¹⁷ and 8.6% cases.¹⁸ Bhattoe¹⁹ reported CSF leak from wound in 30.4% (7/23) cases that had anterior skull base head injuries due to missiles. This means that chances of CSF leak is more in patients who have explosive head injuries to the anterior skull base than other parts of the head.

Infectious complications are common after Penetrating type head injuries and are associated with higher morbidity and mortality rates. These complications are more frequent in the presence of cerebrospinal fluid (CSF) leaks, tract involving air sinus, trans-ventricular injuries or those crossing the midline. These are also more frequent after explosive related military head injuries (4% – 11%) than civilian (1% – 5%).²⁰ The common organism involved is *Staphylococcus aureus*. We observed infectious complications in almost 12% cases in our study. In one study suppurative meningitis rate reported was 13.04%.¹⁹ Secer and colleagues¹⁷ reported the rate of infection in 26.7% of patients in their studies. Some studies have reported infections in 9.1% and 11% patients.¹⁸ So the results are variable.

The risk of post-traumatic epilepsy after penetrating brain injuries is high probably due to direct traumatic injury to the cerebral cortex with subsequent cerebral scarring. It is reported that the more severe the injury to the brain, the higher the risk for the development of post-traumatic epilepsy.²¹ About 30% – 50% of patients suffering such injuries will develop seizures. It is estimated that up to 10% of them will appear early (first 7 days after the trauma), and the rest 90% after that.²² We had post-traumatic seizures in 5.2% patients in our study which is comparatively lower than other studies. The reason could be the short follow-up period (1 month) in our study. In another study 7.2% patients had seizures.²³

One of the important complications of blast related head injuries is hydrocephalous. In our study 3.7% (7/191) patients developed post-traumatic hydrocephalus. In a study of anterior skull base missiles and shrapnel injuries, hydrocephalous was observed in 13.04% patients who were treated with Ventriculoperitoneal shunts. The overall mortality in this study was

4.3%. This difference in the results could be either because of different sample sizes or because we were not more specific to anterior skull base injuries.

Mortality is more in patient with explosive head injury having low Glasgow Coma Scale (GCS), bi-hemispheric injury, tract passing through ventricles or those who develop complications.²⁴ The overall mortality in our study was 10.99%. Levi and colleagues²⁵ observed mortality of 19% (in 64 patients) in Lebanon war experience after explosive head injuries. In another study the mortality was 4.35%. Secer¹⁷ reported mortality of 13.3% in patients with land – mine head injuries. The difference in the results could be because of the different variables on which the prognosis of the patients depends as age, hypotension, hypoxia, coagulopathy, low Glasgow coma scale, poly trauma (associated lung injury), increase intracranial pressure and certain CT Brain findings as bihemispheric lesions, multilobar injuries, intraventricular hemorrhage, uncal herniation, and subarachnoid hemorrhage.⁷

CONCLUSION

We conclude from this study that central nervous system infections are the common (12.04%) complication of civilian explosive related head injuries followed by cerebrospinal fluid leak, seizures and hydrocephalus respectively. Over all morbidity is 29.32% and mortality rate is 11% in those head injured patients who reach to hospital.

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