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Fever as an independent prognostic factor in traumatic brain injury

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ABSTRACT

Traumatic Brain Injury (TBI) patients more often than not develop fever within the first few days of their hospitalization. Studies report that causes are variable and according to the pathogenesis, fever may be harmful or protective. The study was conducted to correlate the development of fever with clinical prognosis. Throughout the study spanning 6 months, a total of 98 patients of TBI were included. In the first 48 hours, 54 patients did not develop fever (temperature >37°C), 20 patients recorded temperatures between 37°C and 39°C; and 24 patients developed high fever (39°C). On regular temperature monitoring and follow up, it was found that patients developing fever relatively early during hospitalization were more likely to end up with a poor outcome (Glasgow outcome scale 4 to 5). Therefore, fever is independently a predictor of poor prognosis in TBI patients and should be managed diligently in the first few days.

Keywords
fever,
prognostic factor,
traumatic brain injury

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INTRODUCTION

A major proportion of neurosurgical patients are victims of traumatic brain injury (TBI). TBIs are a leading cause of morbidity, mortality, disability and socioeconomic losses in India and other developing countries. Road traffic accidents are the leading cause of TBIs followed by falls and violence.[1] According to indianheadinjuryfoundation.org India has the unfortunate distinction of having highest rate of head injury in the world.[2]

A large proportion of patients with any type of acute brain injury will develop fever within the first few days of their ICU or hospital stay. The causes are variable. Often the patient gets non-infectious fever which is a direct consequence of brain injury itself in addition to the high risk of infections in brain-injured patients.[3]

We aim at studying the effect of hyperthermia in patients admitted with moderate to severe head injury and try to correlate the outcome of these patients with hyperthermia.

MATERIALS AND METHODS

This study was conducted at a tertiary health care centre (IPGMER and Bangur Institute of neurosciences, Kolkata, India) between July 2019 to December 2019.

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All patients with Glasgow Coma Scale of 12 or below admitted with history of head injury were included.
Exclusion criteria:

- All patients with normal radiological findings (CT scan or MRI)
- All patients requiring surgical intervention (except minor procedures like repair of open wound, tracheostomy etc). The study was limited to patients managed conservatively.

All patients fulfilling the above criteria were included in the study. The temperature was recorded 6 hourly. According to the reading, the patients were divided into three groups upto 37℃, temperature 37℃-39℃ and temp >39℃. All patients were managed for head injury appropriately and patients requiring surgical intervention at a further stage (due to failure of conservative management) were dropped from the study.

The outcome of the patients was divided into two: good outcome (Glasgow outcome scale score 4 to 5) and poor outcome (Glasgow outcome scale score 1 to 3).[4]

Results

A total of 98 patients were included in the study. The most common mode of injury was road traffic accidents (66 patients), fall from height (18 patients) and assault (10 patients). (Table 1) Of these, 62 patients were males and 36 patients were females. The average age of male patients was 39.4 years and that of females was 42.2 years.

All these patients were regularly monitored for hyperthermia. As hyperthermia within 48 hours of TBI is more significant, so the patients were divided into three groups at the end of 48 hours. The result are tabulated in Table 2.

The patients who did not develop hyperthermia within the first 48 hours were followed up for any subsequent development of hyperthermia and were again categorized into three groups. The data obtained was tabulated in Table 3. The patients who developed temperature >39℃ in any time period were treated vigorously with antipyretics, sponging and suitable antibiotics. The patient who developed fever >37℃ but less than 39℃ were managed with sponging and antibiotics but no antipyretics.

Mode of injury	Male	Female
RTA	40	26
Fall from height	12	6
Assault	7	3
Others	3	1

Table 1. Mode of injury and gender wise distribution.

Temperature within 48 hours	Good outcome	Poor outcome	Death
Upto 37℃	36	12	6
37-39℃	8	6	6
>39℃	2	3	19

Table 2. Proportion of patients developing hyperthermia within first 48 hours and outcome ratio.

Temperature after first 48 hours	Good outcome	Poor outcome	Death
Upto 37℃	18	4	1
37-39℃	14	7	3
>39℃	4	1	2

Table 3. Proportion of patients developing hyperthermia after first 48 hours and outcome ratio.

Discussion

Fever occurs with an incidence of up to 70% in neurologically injured patients and typically is not an isolated event but rather a sustained response seen for as long as 2 weeks following injury. Only half of the febrile patients are attributable to infection. In one fifth to one third of cases, fever remains unexplained despite extensive diagnostic workup.[5]

Early fever (within 24 hour) has been associated with an increased relative risk of a poor outcome by 2.2 fold with every 1℃ increase and even a 0.5℃ increase may lead to a series of secondary injuries and neuron death.[4,6]

What adds to the already complicated situation is that after major brain injury, brain temperature is higher than and can vary independently of systemic temperature. In such scenario, the brain is extremely sensitive and vulnerable to small variations in temperature.[7] There is growing evidence that elevated body temperature may be detrimental in patients with acute neurological disorder. Many work done till date shows that elevated body temperature is associated with increased mortality rate and poor functional outcome.[3,8]

The epidemiological and etiological spectrum of traumatic brain injury revealed in our study agrees with the already available data.[2]

Our study reveals that temperature >39℃ within first 48 hours of traumatic brain injury after

admission is significantly associated with higher death rate which concurs with other studies like that of Bao L et al.[4] The net effect of fever is reduction in internal perfusion pressure with diminished oxygenation of brain tissue resulting in cerebral oedema. The association of early development of fever with poor outcome is probably because already compromised brain tissue is more susceptible to oxygenation deficit.[9] In addition, fever causes a generalized increase in metabolic rate (7-10% increase per ℃ increase in core temperature), with corresponding increase in minute ventilation and oxygen consumption which can be detrimental.[3]

Our study does not establish a significance to delayed development of hyperthermia and poor outcome. This needs to be evaluated further.

According to some studies, the hospital stay is likely to be increased in patients who develop hyperthermia.[10] It remains to be studied and should be evaluated further in the backdrop of a developing country like India where resources are limited.

Targeted temperature management like therapeutic hypothermia has been touted as a valid candidate of neuroprotective treatment but the same has not been proven in larger randomized controlled trials. While overwhelming majority of TBI injury patients may benefit from fever control, the patients with severe infection who need an inflammatory response might not benefit and may even suffer adverse consequences. Additionally, in a small subset of patients both conditions may coexist.[11]

Conclusively, fever acts as an independent prognostic factor in patients of TBI in first few hours of admission and is associated with a poor outcome. It should be carefully watched for and vigorously treated. Further studies are required to assess the relation between delayed fever development and its impact on outcome. The pathophysiology of hyperthermia (infective or non-infective) also plays an important role in making a clinical decision.

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