ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 01 | January - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

S. PROCALCITONIN: A BIOCHEMICAL MARKER TO PROGNOSTICATE OUTCOME IN SEVERE HEAD INJURY.

Neurosurgery

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ABSTRACT

Background: Severe head injury is associated with majority of trauma deaths. The use of a biomarker like procalcitonin (PCT) in severe TBI may allow for prognostication and correlation with mortality and outcome.
Aims: The primary objective is to determine the correlation between PCT concentrations with TBI outcomes (mainly in terms of mortality).
Methods: In total, 45 severe TBI patients aged > 18 years with minimum survival for at least 24 h admitted to the ICU were prospectively included in the study. All admitted patients were treated according to the standard institutional protocol. The PCT levels were obtained on admission (with in 24 hrs). Clinical, laboratory, diagnostic, and therapeutic data were also collected. Outcome (Mortality) on 28 days were compared with PCT level on admission.
Result: Among 45 patients, 30 patients had high S.PCT level on admission. 28 days mortality was found significantly higher in this group compared to the group who had normal S.PCT level.
Conclusion: PCT appears promising as a surrogate biomarker for severe TBI. Initial high PCT level may be used as an early predictor of mortality in severe head injury patients.

KEYWORDS

Procalcitonin, Prognosis, Traumatic brain injury.

INTRODUCTION:

Severe head injury is associated with the majority of trauma deaths[1]. The mortality rate is about 35% - 50% from Severe Head Injury.[2] Traumatic brain injury (TBI) patients are at risk of secondary complications such as aspiration pneumonitis, ventilator-associated pneumonia (VAP), and sepsis. Prompt diagnosis and management are necessary to reduce morbidity and mortality[3]. In healthy individuals, procalcitonin (PCT) is produced in thyroid cells. Virtually all PCT is converted to calcitonin in healthy subjects so that the circulating level of PCT is < 0.05 ng/ml.[4] PCT levels are found to be raised in patients with bacterial sepsis, systemic inflammatory response syndrome (SIRS), and also after traumatic injury[5]. Major trauma provokes a strong systemic inflammatory response syndrome (SIRS) early after traumatic injury as a result of tissue damage, hypotension, hypoxia, cytokine release, and inflammation [6]. The prognosis depends on the balance between pro- and anti-inflammatory responses[7]. So, this study was planned to determine outcome (mortality) in severe head injury patients based on their S.PCT level.

Objective:

Primary objective is to determine the correlation between PCT concentrations with 28 days mortality in severe head injury patients.

MATERIALS AND METHODS

This study was conducted in Mittal hospital and research centre, Ajmer from November 2020 to February 2021. After approval from institutional ethics committee, all patients with severe TBI admitted to the ICU were prospectively included in the study. The inclusion criteria were patients with severe head injury aged between18 – 60 years, and survival for at least 24 h after admission and patients with positive head injury findings on CT scan. Severe head injury was determined based on GCS score (GCS<9). Exclusion criteria included patients with preexisting sepsis or with chronic kidney disease, patients with history of drug abuse or any anaphylaxis, pt on any immunosuppressive drugs, pts on antibiotics, pt with any chronic medical disease. Patients who required surgical intervention were also excluded from the study. Patients were treated according to the institutional protocol and accepted standards of care. PCT, all laboratory, microbiological, and clinical data with duration of treatment in the hospital were noted. PCT values were obtained on day 1 (with in 24 hrs. of trauma). The PCT level more than 0.5 ng/ml was taken as positive (high level). Outcome (mortality) was assessed on 28 th day.

RESULTS:

Total 45 patients were included in this study (based on inclusion and exclusion criteria). All patients had severe head injury (GCS <9).All patients were admitted in ICU and treated with standard protocol. S.PCT level was measured in every patients (with in 24 hrs of admission).30 patients had high S.PCT level (>0.5 ng/ml). Rest 15 patients had normal S.PCT level. All patients were treated conservatively and according to standard institutional protocol. 28 days mortality was assessed. 18 patients had died who had high S.PCT level. While only 2 patients had died with normal S.PCT level. Statistic analysis was done using chi square test which suggest mortality rate in high S.PCT group was statistically significant ($p < 0.05$).

	High S.PCT(>0.05)	Normal S.PCT(<0.05)
No of patients	30	15
Mean age	40 years	38 years
Male	17	9
Female	13	6
Mortality	18	2

DISCUSSION:

Trauma is the leading cause of death. Severe head injury is associated with the majority of trauma deaths[1]. Major trauma provokes a strong systemic inflammatory response syndrome (SIRS) early after traumatic injury as a result of tissue damage, hypotension, hypoxia, cytokine release, and inflammation [6]. The prognosis is strongly related to the posttraumatic balance between pro- and anti inflammatory respons[7]. Following this induction of the inflammatory cascade there is an increase in counter regulatory anti-inflammatory cytokines, which results in immune suppression and increased susceptibility to infection and subsequent complications such as sepsis. Together, the consequence of initial injury and inflammation, subsequent immune suppression and infection, subsequently results in multiple organ dysfunction (MOD)[7]. MODS remains the leading cause of late death following trauma[8]. Early identification of patients at risk of developing MODS is crucial to allow the provision of early and appropriate therapy and prognosticate them. PCT is a 116-amino acid polypeptide precursor of calcitonin which is produced by the C cells of the thyroid gland. Healthy individuals have serum PCT levels less than 0.05ng/ml. [4] PCT levels are found to be raised in patients with bacterial sepsis, systemic inflammatory response syndrome (SIRS), and also after traumatic injury[5]. Serum levels of PCT linearly correlate with bacterial infection/sepsis in patients[9]. Patients with raised plasma PCT concentration on admission were variably associated with various complications, including the length of ICU stay and poor or fatal outcome.[10] In our study, we measure S.PCT level on admission and found that high PCT level is associated with higher mortality during first 4 weeks. Aziza N. AlRawahi et al also concluded that initial peak PCT level may be used as an early predictor of severity of injury, development of sepsis and MOD, and mortality in trauma population[11]. Elevated PCT level could be used as a predictor for SIRS in moderate and severe head injury patients.[12]In study conducted by E O'Connor, B Venkatesh et al, serum PCT appeared to correlate with severity of

traumatic brain injury and mortality. However, it could not reliably distinguish between SIRS and sepsis[13]. Our study also predicted mortality based on initial PCT level.

CONCLUSION:

High PCT level early after injury may be used as an early predictor of severity of injury, development of sepsis and MOD, and mortality in severe head trauma population.

Source of Support: None.

Conflict Of Interest:

The authors declare that they have no conflict of interest

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