Original Article

Diurnal Variation of Leukocytosis and its Prognostic Significance in Head Trauma in Local Population

Variation of Leukocytosis in Head Trauma

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ABSTRACT

Objective: To study the Predictive value of leukocytosis in minor, moderate and severe head trauma.
Study Design: Prospective and analytical study.
Place and Duration of Study: This study was conducted at the Department of Physiology, B.M.S.I in Accident and Emergency, ICU of Neurosurgery Department (ward -16) JMPC Karachi Pakistan from January 2009 to January 2011.
Materials and Methods: 90 patients of head trauma were included, after taking complete history from the conscious patients and from the attendants of unconscious patients. Glass Coma Score were observed immediately with Glass Coma Score and blood sample was taken for white cell count with hemocytometer (Neubaur chamber), peripheral smear were prepared at the spot for differential leukocyte count within the time.
Results: 90 patients of head trauma of age 16 to 70 years were included of either sex. Statistically the mean leukocyte count revealed that significantly higher as compared to minor and moderate ($p < 0.001$)
Conclusion: On admission, white blood cells (WBC) count exceeding 19000/ mm ^{3} has a predictive as well as value for poor Glasgow coma scale (GCS) and serves as a significant parameter of severity of injury and predicator neurological out coma in patients with moderate and severe head injury in localpopulation.
Key Words: White Blood Corpuscles, Glasgow coma score, Head trauma

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INTRODUCTION

In multisystem trauma, the head is the most frequently injured part of the body. The incidence of closed head injury is estimated to be 200 per 100,000, totaling more than half a million patients annually. About 80% of head injured patients are classified as mild, approximately 10% have moderate to severe, head injury that requires significant resources for management. Traumatic brain injury (TBI) is a major public health problem both in the United States and abroad, with over one and half million American sustaining a TBI annually (Valadka,2000)[1],with a lethal outcome in 56,000 cases (McArthur et al., 2005; Schmidt et al., 2005)[2] and is the most frequent cause of deaths in young adults (Shlosberg et al., 2011)[3]. As developing countries become increasingly motorized, this is only set to increase (Kossmann et al., 2007)[4].

The majority of traumatic brain injuries are considered mild and primarily the result of motor vehicle crashes and falls (Jager et al., 2000; Finfer and Cohen 2001; Bazarian et al., 2005; Myburgh et al., 2008; Wu et al., 2008)[5,6,7,8]. The World Health Organization (2004)[9] reports on road traffic injury prevention, found that by 2020, road traffic accidents would be within the top three leading causes of the global burden of disease, ahead of HIV and tuberculosis. The aims of current research are to apply scientific discoveries in basic science into the clinical level hoping to provide measures that predict outcome and to decrease the mortality rate in human(Keramaris et al., 2008)[10]. TBI (Traumatic brain injury) can now be considered a neuro inflammatory condition of CNS. Trauma to the brain results in rupture of the blood brain barrier (BBB), effect on vascular permeability leading to accumulation of leukocytes from the systemic circulation, which themselves release pro-inflammatory cytokines, cytotoxic proteases and reactive oxygen species, edema is limited by the cranium, but have devastating effects. Brain swelling occurring in turn initiating the immune functions of native glia (Lucas et al., 2006[11]; Juurlink,

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2000; Lenzlinger et al., 2001; Morganti-Kossmann et al., 2001 & 2002; Morganti et al., 2002; Hurley et al., 2002; Fee et al., 2003; Dietrich et al., 2004[12]; Morganti-Kossmann et al., 2005; Streit, 2005)[13,14]. The acute phase response is also characterized by a leukocytosis upon admission. Therefore, it is possible that an increase in the white blood cell (WBC) count might serve as an additional diagnostic and prognostic indicator in head injury.(Rovalis and Kotsou ;2001)[15] Chemokines represent a class of cytokine-like Immunemodulators that are gaining attention as potential therapeutic targets for various inflammatory diseases (Jin et al., 2008; Viola and Luster, 2008)[16]. The severity of head injury is most commonly classified by the initial postresusciation GCS Score, which generates a numerical summed score for eye, motor and verbal abilities. Traditionally, a score of 13 -15 indicates mild injury, a score of 9-12 indicates moderate injury and score of 8 or les indicates severe injury.(Ghajar 2000; stein, 2001; finfer and cohen 2001)[17,18] .The present study was designed to assess the predictive value of leukocytosis in minor, moderate and severe head trauma.

MATERIALS AND METHODS

It was prospective and analytical study in Accident & Emergency, ICU of Neurosurgery Department (Ward-16), JPMC, Karachi from August 2009 to August 2010.
90 patients of Head trauma, of Age 16 to 70 years of either sex were included after taking complete history, from the conscious patients and from the attendants of unconscious patients. Glasgow Coma Score were observed immediately with the Glasgow coma scale, and blood sample was taken for laboratory analysis especially for white blood cells count with hemocytometer (Neubaur Chamber).
Lastly all the findings were recorded in the proforma specially designed for this purpose.
Glasgow Coma Scale (GCS) is a neurological scale which aims to give a reliable, objective way of recording the conscious state of a person, forinitial as well as subsequent assessment. A patient is assessed against the criteria of the scale, and the resulting points give a patient score between 3 (indicating deep unconsciousness) and either 14 (original scale) or 15 (the more widely used modified or revised scale).
The patients were grouped according to Glasgow coma score. Each group includes 30 patients.

Group I 14 to 15 GCS	**Group II 9 to 13 GCS**	**Group III 3 to 8 GCS**
Minor Head Trauma Patients	Moderate Head Trauma Patients	Severe Head Trauma Patients
n=30	n=30	n=30

Total Leukocyte Count (TLC) was done blood was sucked up into WBC pipette up to 0.5 mark from collected sample. This blood was diluted with Turk's solution up to mark of 11 (dilution 1:20). The pipette was allowed to stand for 5-10 minutes to hemolyze erythrocytes. First 3 to 4 drops were discarded and then the Neubaur's counting chamber was charged. Under the high power lens 1 x 40, 16 large squares at each corner of chamber were counted (total of 64squares).

Formula for total leukocyte count:

$$TLC = \frac{\text{Number of cells counted X 160 X dilution2}}{\text{No. of squares counted (64)}}$$

RESULTS

The results of this study showed the significant difference ($p<0.001$) in the mean value of total leukocyte count in severe head trauma immediately as compared to moderate and minor head trauma.
A significantly higher mean immediate soon after trauma total leukocyte count was observed in severe head trauma patients as compared to moderate and minor head trauma ($p<0.001$) results were observed.
Statistically, the mean total leukocyte count was significantly higher in moderate as compared to minor head trauma cases ($p<0.001$)
The mean total leukocyte count was also significant when comparing severe head trauma patient to minor head trauma patient ($p<0.001$.

Table No.1: Comparison of Mean Total Leukocytes Count in Patients of Severe and Moderate Head Trauma :

According to GCS score	Severe head trauma (3-8)	Moderate head trauma (9-13)
No. of patients	30	30
Mean TLC count	19030.70*	13230.00
S.D	2006.60	738.10
SEM	365.350	134. 750

Table No.2: Comparison of Mean Total Leukocytes Count in Patients of Moderate and Minor Head Trauma:

According to GCS score	Moderate head trauma (9-13)	Minor head trauma (14-15)
No. of patients	30	30
Mean TLC count	13230.00	12388.00
S.D	738.10	508.83
SEM	134. 750	93.00

Table No.3: Comparison of Mean Total Leukocytes Count in Patients of Severe and Minor Head Trauma:

According to GCS score	Severe head trauma (3-8)	Minor head trauma(14-15)
No. of patients	30	30
Mean TLC count	19030.70*	12388.00
S.D	2006.60	508.83
SEM	365.350	93.00

*****Significantly higher as compared to minor and moderate ($p<0.001$) **Significant Correlation ($P<0.001$)

DISCUSSION

Akkose et al (2003)[19] performed a retrospective study evaluating 713 blunt trauma patients and found a positive correlation between WBC count and severity of injury. The present study correlates with the above study in terms of severity of head trauma.

Chang et al (2003)[22] prospectively studied 882 patients admitted to a Level 1 trauma center evaluating admission on the basis of race, injury mechanism, blood pressure, GCS, WBC and patients requiring early transfusion versus no early transfusion. He found that only ISS greater than 15, GCS ≤8, and white race were associated with an increase in white blood cell count. The results of the present study are in agreement with the results of above said study. However, the main difference is of the population.

Rovlias and Kotsou (2004)[23] has used a Classification and Regression Tree (CART) Technique and employed it in the analysis of data from 345 patients with isolated severe brain injury and a total of 16 prognostic indicators were examined to predict neurological outcome. The results indicated that the GCS was the best predictor of the outcome with regard to the other data, not only most widely examined variables such as, pupillary reactivity or computer tomographic findings proved to be strong predictors, but less commonly applied parameters, indirectly associated with brain damage, such as leukocytosis were also found tocorrelatesignificant.

The results of above study also supported the results of present study. Gurkanlar et al. (2009)[24] conducted a retrospective study of WBC count in

59 patients with severe, moderate and minor craniocerebral injury in emergency department. They compared WBC count with GCS scores, in which GCS scores highly correlated with WBC count. There were also statistically significant differences between severe and moderate, severe and minor and moderate and minor patients (P<0.01). The results of present study are in agreement with the above said findings.

The results of present study are also in agreement with the study conducted by Bhatia et al. (2004), who in their prospective study observed 116 patients (77 male and 39 female) of stroke (within 72 hours of onset). After clinical evaluation, neuroimaging and blood investigation, high total leukocyte count and ESR at admission correlated significantly with an undesirable outcome during the initial 30 days and logistic regression analysis demonstrated that a low GCS score and total leukocyte count correlated with death. Matis and Birbilis (2009)[25] observed in their retrospective study, 60 patients with head trauma who had been admitted to a ICU of tertiary care hospital and undertaken to explore the possible correlation between the GCS and outcome. Their results suggested that GCS is limited to predict the outcome in head injured patients particularly when it is used as sole predictor in mild or moderately severe head injury. The results of present study in terms of GCS are totally in accordance with the results of above study.

Santucci et al. (2007)[26] studied two groups of head injured patients by comparing the initial WBC in significant injury and without significant injury in Emergency Department, they correlate the findings with the degree of injury using 'Injury Severity Score' (ISS) in both groups and found that WBC count could be used as a predictor of serious injury. Further, they reported difference in mean WBC count between the two groups and found that the difference was statistically significant (P<0.001). A positive relationship between ISS and WBC also was found, although, the association was weak, while the WBC had moderate discriminatory capability for serious injury. However WBC count could not in isolation, rule in or rule out serious injury, but remarking the WBC on presentation to the Emergency Department could be used as an adjunct for making disposition decisions. The results of present study are partially in agreement with the above said study.

Asadollahi et al. (2010)[27] evaluated the significance of leukocytosis, as a best predictor of mortality and morbidity not only in head trauma patients, but also in various other diseases. White Cell Count (WCC) exceeding $11x10^9/l$ is widely considered to be an indicator of infection or inflammation and other clinical situations such as, trauma and exercise. The above findings also collaborates the results of present study.

CONCLUSION

It is therefore, concluded that on admission, white blood cell (WBC) count exceeding $19000/mm^3$ has a predictive value for poor Glasgow Coma Scale (GCS) score and could serve as a significant parameter of severity of injury, and as an additional predictor of neurological outcome in patients with severe head injury. WBC count could be uses in patients with moderate and severe head injury to predict outcome in our local population**.**

Author's Contribution:

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Final Approval of version:	Muhammad Muqeem Mangi

Conflict of Interest: The study has no conflict of interest to declare by any author.

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