Research Paper

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Evaluation of Serum Level of Trace Elements at Day 5 and 10 After Enrollment and Its Association with Severity of Head Injury in Trauma Patients

Medical Science

KEYWORDS : Head injury, Trauma Patients, GCS Score, Copper, zinc, Magnesium, Chromium

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ABSTRACT

Introduction: Head injury is a recognized as a major public health problem that is a frequent cause of death and disability in young people and makes considerable demands on health services. Alteration of the trace elements such as Zinc and copper has great importance in head injury patients.

Objective: To evaluates serum level of Copper, Magnesium, Zinc and Chromium in trauma patients at day 5 and 10 after the enrollment and its association with head injury.

Methods: Special designed performa was used to collect data of Trauma patients. The data were expressed in percentage.

Results: The Total of 34 head injury patients were enrolled in the study. Majority of patients (41.2%) in present Study were aged between 21-30 years. Majority of patients (67.6%) were males. On day 5, only 2.9 % of patients had GCS scores between 12 to 15 which is corresponds with the mild category of head injury. Majority of patients had GCS Scores <8 which corresponds with the severe category of head injury. 41.2% patients had GCS Scores between 8 to 11 which corresponded with the moderate category of head injury.At Day 5, the mean serum copper level were 0.066 mg/dl, mean Zinc, magnesium and chromium levels were 0.224,0.643mg/dl and 0.249 ug/ml respect.Mean level of all the trace elements were found to be lower in moderate group as compared to severe group, however, the difference between two group was found to be statistically significant for copper and zinc levels.On day 10, Mean serum copper, Zinc, magnesium and chromium were found to be 0.093, 0.302, 1.439 mg/dl and 0.27 ug/ml respectively.At day 10, Mean copper levels were found to be minimum among patients who had day 10 GCS scores in severe category (0.034mg/dl). Mean copper levels were found to be maximum among patients who had day 5 GCS scores in mild category (0.126 mg/dl).

Conclusion:. The Present study conclude that, at day 10, copper and zinc showed a significant association with the status severity of head injury however. magnesium was not significant.

Introduction:

The American trauma Society defines trauma as an injury caused by a physical force. More often, trauma is the consequences of motor vehicle crashes, falls, drowning, gunshots, fires and burns, stabbings or blunt assaults.

The traumatic event is an event which threatens injury, death or the physical body of a person while also causing shock, terror or helplessness. Trauma refers to both the experience of being harmed by an external agents as well as the response to that experience[1].

According to Gururaj[2] (2002), the traumatic head injuries accounted for 24% of total injuries among hospital registered in the city of Banglore. The only hospital-based epidemiologic study in Banglore revealed that the incidence and mortality from traumatic head injuries is 160 and 20 respectively per 100,000 population per year. Thus as per Gururaj study, it is estimated that every year near 1.6 million individuals sustain a traumatic head injury and seek medical care.

The mineral copper, zinc, iron, magnesium and chromium are directly involved in maintaining and regulating many of physiological process, especially those involved in normal carbohydrate, fat and protein metabolism and the ultimate formation of usable energy[3].

A head injury patients often spends a long duration of time in hospital where the chances of sepsis and other opportunitunistic infection are high. The decencies of trace elements and infectious disease often coexist and exhibit complex interaction. Several trace elements such as selenium, zinc, copper and manganese etc. have immunomodulatory function and thus influences the susceptibility to the course and the outcome of a variety of viral infections. Some trace elements act as antioxidant or help such function that not only regulate immune response of the host, but also may alter the genome of the viruses as discussed by Chaturvedi et al[4] . with this background , the present study was designed to assess the relationship of trace elements in head injury at discharge time.

Objective:

- To evaluates serum level of Copper, Magnesium, Zinc and Chromium in trauma patients at day 5 and 10 after the enrollement
- To find out an association between these trace elements (Cu, Mg, Zn and Cr) levels and severity of head injury in terms of GCS at day 5 and 10.

Material and Methods:

I. Necessary approval from the Institutional Ethics Committee was obtained before initiating the study.

II. **Study site**

The Study conducted at the departments of Surgery, King George's Medical University, Lucknow.

III. Study design

Prospective Cohort study

IV. **Sample size:** Total 34 patients were recruited for the study

V. **Patient selection**

- **Inclusion criteria:**
  - Isolated Head Injury patients managed conservatively
  - BMI between 18.5 to 23.5 (Normal)
  - Injury within eight hours of admission

- **Exclusion criteria:**
  - Presence of Co-morbid disease like Diabetes, Hypertension, cardiovascular disease. Liver disorders
  - Alcoholics
  - Workers exposed to metal industry

VI. Study Methods

All the patients fulfilling the inclusion criteria were enrolled in the study. At the time of admission, after noting down the detail related with age, gender, occupation, place of living, mode of injury, time gap between injury and admission to hospital were noted. Severity of injury was measured in terms of scores on Glasgow coma scale. Blood sample were collected and sub-

jected to biochemical assessment for trace elements. Estimation of trace elements was done using atomic absorption spectrophotometer model Perkin Elmer analyst 600.

Results:

The Present study was carried out to study serum level of trace elements (Copper, magnesium, zinc and Chromium) levels.For this purpose, a total of 34 head injury patients were enrolled in the study. Majority of patients (41.2%) in present Study were aged between 21-30 years. Majority of patients (67.6%) were males. There were only 4 females. Male to female ratio of the study subjects was 5.75:1.

Table 1 Shows: Distribution of Patents according to GCS Scale at day 5

SN	GCS Score	Severity	Percentage
1	12-15	Mild	2.9%
2	8-11	Moderate	41.2%
	<8	Severe	55.9%

On day 5, only 2.9 % of patients had GCS scores between 12 to 15 which is corresponds with the mild category of head injury. Majority of patients had GCS Scores <8 which corresponds with the severe category of head injury. 41.2% patients had GCS Scores between 8 to 11 which corresponded with the moderate category of head injury. As only 2.9% patients had mild category at day 5, Hence for subsequent group comparison it had been clubbed with those having moderate category of GCS.

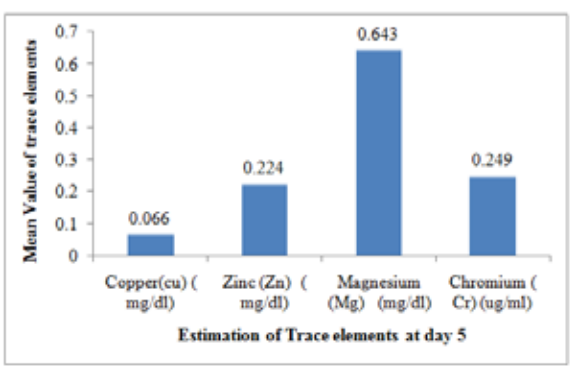

Fig 3 Shows: Estimation of serum levels of trace elements at day 5

At Day 5, the mean serum copper level were 0.066 mg/dl, mean Zinc, magnesium and chromium levels were 0.224,0.643mg/dl and 0.249 ug/ml respect.

Table 2 Shows: Association between serum trace element levels and Severity of head injury at day 5

SN	Element	Moderate (GCS 8-11)		Severe (GCS<8)		Significance of Difference (Mann-whitney U test)	
		Mean	SD	Mean	SD	Z	P
1	Copper(Cu) mg/dl	0.094	0.018	0.043	0.024	4.358	<0.001
2	Zinc (Zn) mg/dl	0.295	0.056	0.165	0.068	4.044	<0.001
3	Magnesium (Mg) mg/dl	0.645	0.361	0.634	0.551	0.692	0.506
4	Chromium (Cr) ug/ml	0.271	0.143	0.225	0.153	0.748	0.461

Mean level of all the trace elements were found to be lower in moderate group as compared to severe group, however, the difference between two group was found to be statistically significant for copper and zinc levels.

Table 3 Shows: Distribution of Patents according to GCS Scale at day 10

SN	GCS Score	Severity	Percentage
1	12-15	Mild	35.3%
2	8-11	Moderate	23.5%
3	<8	Severe	29.4%
4	Expiry		11.8%

On day 10 (At discharge level), 4% Patients expired.35.3% were in mild category, 23.5% had moderate and 29.4% had severe category of head injury.

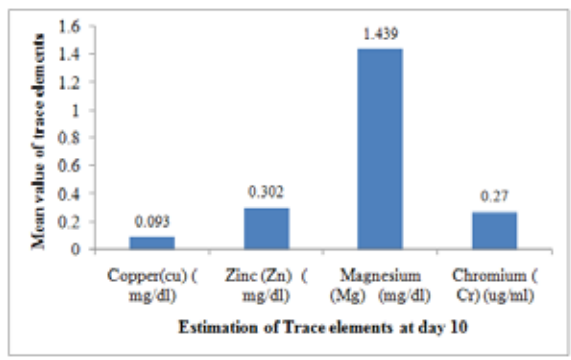

Fig 4 Shows: Estimation of serum levels of trace elements at day 10 (At Discharge)

On day 10, Mean serum copper, Zinc, magnesium and chromium were found to be 0.093, 0.302, 1.439 mg/dl and 0.27 ug/ml respectively.

Table 4 Shows: Association between serum trace elements levels and severity of head injury at day 10 (At Discharge)

SN	Element	Mild (GCS 12-15)		Moderate (GCS 8-11)		Severe (GCS<8)		Significance of Difference (Kruskallwalis test)	
		Mean	SD	Mean	SD	Mean	SD	X^2	P
1	Copper(Cu) mg/dl	0.126	0.022	0.116	0.014	0.034	0.028	18.667	<0.001
2	Zinc (Zn) mg/dl	0.414	0.052	0.353	0.054	0.128	0.049	22.387	<0.001
3	Magnesium (Mg) mg/dl	1.254	0.635	2.214	2.038	1.042	0.600	2.732	0.255
4	Chromium (Cr) ug/ml	0.236	0.128	0.330	0.146	0.262	0.176	2.253	0.324

At day 10, Mean copper levels were found to be minimum among patients who had day 10 GCS scores in severe category (0.034mg/dl). Mean copper levels were found to be maximum among patients who had day 5 GCS scores in mild category (0.126 mg/dl).

Discussion:

Head injury caused by trauma is one of the most important causes of hospital admission and mortality. It affects an individual both physically as well as psychologically by impairing the functional ability as well as cognitive ability of an individual. Head injury affects mainly the males who in productive years of their life stage.

Traumatic injury poses a significant psycologic and physiologic threat, challenging a victim's perception of control over their environment and life outcome. The multiple stressors presented by traumatic injury diminishes the patients perception of control, resulting in a subjective stress response. Increased stress response after traumatic injury has been associated with altered immune function and decreased immunity. The immune system is depressed overall as discussed by Schrader[5],1996. Some of these changes can be related to alterations in trace elements metabolism. Trace elements especially zinc and copper have im-

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portant role in human growth, development and immune function stated by walker and black[6] 2004. Trace elements are also required to maintain the activity of a number of enzymes that directly participate in important defense process stated by Prasad[7] 1998.

At enrollment, No significant association between serum magnesium and chromium levels with severity of injury could be elucidated. The intracellular magnesium has also been shown to decrease after experimental traumatic brain injury stated by (Mcintosh et al and shigemori et al)[8,9] yet to date there is no evidence showing association of serum magnesium levels with the severity of head injury, our finding are in accordance with observation of Hosseein et al[10].

The present study showed, On day 10, mean zinc levels were found to be minimum among patients who had day 10 GCS scores in severe category. Mean zinc levels were found to be maximum among patients who had day 10 GCS Scores in severe category. On comparing the data, the groups were found to be significant. At day 10, mean magnesium levels were found to be minimum among patients who had day 10 GCS scores in severe category. Mean magnesium level were found to be maximum among patients who had day 10 GCS scores in moderate category. At day 10, mean chromium levels were found to be minimum among patients who had day 10 GCS scores in mild category. Mean chromium levels were found to be maximum among patients who had day 10 GCS scores in severe category. The difference among groups were not found to be statistically significant. In present study, an association between GCS scores and serum copper and zinc levels was observed at day 5 and day 10 of the admission, thus reiterating our observation that serum and serum copper levels are affected by the severity of head injury and vice versa.

Conclusion

The Present study conclude that, at day 10, copper and zinc showed a significant association with the status severity of head injury, though magnesium levels also showed similar trends yet the association was not significant. However, chromium levels neither followed a trend nor showed a significant association with the status of severity of head injury.

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