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A STUDY OF SERUM ELECTROLYTES WITH PARTICULAR REFERENCE TO MAGNESIUM IN HEAD INJURY PATIENTS ADMITTED IN TERTIARY CARE HOSPITAL, KOLKATA

Biochemistry

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ABSTRACT

Introduction: Injured brains have significant biochemical alteration in the form of dyselectrolytemia. Electrolytes have correlation with response of treatment.

Methods: Forty one head injury patients were included. Serum electrolytes Sodium, Potassium, Calcium and Magnesium were measured in patient of traumatic brain injury on 1st day and 3rd day of injury. Traumatic Brain Injury (TBI) patients were assessed by using Glasgow Coma Score (GCS).

Result: Serum Sodium, Potassium, Calcium level were found significantly low on day of injury, which improved on day 3. Serum Magnesium concentration was found to be markedly decreased on day 1, but not normalized on 3rd day of TBI. Level of consciousness following head injury is the most important factor in the management of patient of TBI and can be assessed fairly by using GCS.

Conclusion: There is correlation between serum Magnesium level and GCS score, suggesting serum Magnesium may be used as a marker of severity of head injury.

KEYWORDS

Traumatic Brain Injury, Magnesium, Glasgow Coma Score.

INTRODUCTION:

Traumatic brain injury (TBI) is an injury from forces transmitted to the brain from an impact on the skull. Globally it is a leading cause of morbidity and mortality. It is estimated that nearly 1.5 to 2 million persons suffer from the traumatic brain injury per year in India and 1 million succumb to death [1]. The pathology of head injury is complex and modern researches show that different neuropeptides are released from injured brain which causes significant biochemical alteration [2] Electrolyte imbalance, namely sodium, potassium, calcium, chloride and bicarbonate is an important reflection of this alteration. This imbalance is corrected by administration of intravenous fluid but a number of patients do not show expected improvement even after correction of the imbalance. Researches show that another electrolyte, magnesium is also altered in TBI patients.

Intravenous fluid preparations used to treat the patients are devoid of magnesium. Supplementary use of Magnesium causes improvement of survivor's mental psychological function. The neuro - protective role of magnesium is well documented.

At this background, this study was undertaken to find out the changes in serum electrolytes (sodium potassium, calcium & magnesium) on day 1and day 3 of patients with TBI. Also it was aimed to find out whether the reduction of serum electrolytes have any relation with Glasgow Coma Scale (GCS) Score which is a well-accepted clinical parameter used to assess the severity of the condition of the patient immediately after TBI & also for the purpose of prognosis.

MATERIAL AND METHODS:

A prospective study was made on randomized chosen 41 head injury patients (32 male & 9 female) admitted in Institute of Post Graduate Medical Education & Research (IPGMER) SSKM Hospital from the period of 1st February, 2014 to 31st January, 2015. Patients of all ages and both sexes, who were admitted in Neurology Department of the said Institute within 24 hrs of injury were included in this study. Patients reporting after 24 hrs of injury or with compromised renal function were not included in this study.

The level of consciousness of the patients was evaluated clinically by Glasgow Coma Score within 24 hrs of head injury & repeated after 72 hrs (day 3). Blood sample was collected on day 1 and day 3 & estimated for serum sodium, potassium, calcium and magnesium. Serum sodium and potassium were estimated by flame photometer. Calcium and magnesium were measured colorimetrically using metal complexing dye cresolphthalein for calcium [4] and calmagite for magnesium [5]

Twenty four (24) hour urine was collected on day 1 and day 3 in 25 ml of 6 molar HCL. The sample was diluted in DDW (1:1) just before estimation of urinary magnesium concentration. The same parameters were done in same number of age and sex matched healthy subjects taken as control group. All values were expressed in mean ± standard deviation. The significance of difference between mean values was done by student's t test. The values were considered to be significant when values was obtained below 0.05. Patients were then classified according to GCS score into mild (GCS 13-15), moderate (GCS 8-12) and severe (GCS 3-7) [3] Mean ± Standard deviation of serum magnesium level was calculated for each group. Individual values of serum magnesium level were also correlated with individual GCS in each group to find out the correlation coefficient.

RESULTS

Table 1: Levels of serum electrolytes and urinary magnesium conc on day 1 and day 3 in patients with traumatic brain injury along with healthy controls

Electrolytes	Healthy Control (n=41)	Patient on day 1 (n=41)	Patient on Day 3(n=41)
Serum Sodium (m Eq/l)	137±5.5	132 ±7.3	135±6.4
Serum Potassium (m Eq/l)	4.2±0.6	3.8±0.7	4.0±0.7
Serum Calcium(m d/dl)	9.4±0.9	8.9±0.8	9.0±0.8

Serum Magnesium (md/dl)	2.1 ± 0.4	1.6±0.7	1.8±0.7
Urinary Magnesium (md/dl)	14.8±4.1	16.2±3.6	16.0±3.3

All Values are expressed in mean ± standard deviation. Difference statistically significant at $p < 0.05$ and $p < 0.001$** when compared with healthy controls.

Table 2 : Inter-relation between Glasgow Coma Scale and serum magnesium level in study population on day 1 and day 3

Glasgow Coma Score	Day 1			Day 3		
	No. of Patients	Serum magnesium level (mg/dl)	Correlation coefficient	No. of Patients	Serum magnesium level (mg/dl)	Correlation coefficient
3-8	11	0.9± 0.3	0.59	12	0.9±0.3	0.63
9-12	16	1.8±0.6	0.55	12	1.9±0.4	0.54
13-15	14	2.1±0.7	0.57	17	2.3±0.5	0.64

DISCUSSION AND CONCLUSION:

The study reveals that on day 1 serum electrolytes namely, sodium potassium, calcium and magnesium are found to be decreased significantly when compared with age and sex matched healthy controls. The decrease can be explained by free water retention as a result of syndrome of inappropriate secretion of antidiuretic hormone (SIADH) in post-traumatic phase [2]. Administration of intravenous fluid rich in sodium, potassium and calcium helps in normalisation of serum electrolytes as seen in day 3. However, as far as serum magnesium is concerned the decrease in day 1 was found to be more significant which was not restored to normal level on day 3.

Not only SIADH, but some additional causes may have contributed to the decrease in serum magnesium level. Hyperactivity of adrenergic system which is quite common in post-traumatic phase has been reported as a contributory factor[6]. Harrigan (1996)[7] described cerebral salt wasting syndrome or excessive renal loss in post-traumatic phase due to alteration in neuroendocrine system. But our study does not support this explanation as no statistically significant increase in urinary magnesium concentration is observed either on day 1 or day 3. (Table 1) Normal intravenous fluids are devoid of magnesium. Hence on day 3, magnesium level could not be restored to normal. However, some improvement is possible due to shifting of magnesium from magnesium pool (bone & tissue) to serum during recovery of head injury [8]

Thus, the change in serum magnesium seems to be the true reflection of pathogenesis & progression of head injury. Hence, data were analysed to find out whether there is any correlation of this alteration with GCS. The result is shown in Table 2. In day 1, number of patients with mild, moderate severe TBI are 14, 16 & 11 respectively. On day 3, among the patients with moderate TBI, GCS of 3 patients. Improved to be within the range of mild TBI & that of 1 patient deteriorated to be within the range of severe TBI. There is no other change in distribution of patients as far as GCS is concerned. The mean ± standard deviation of serum magnesium level was calculated for each group on day 1 & 3. It was found that the magnitude of the serum magnesium level varies gradually with the severity of the TBI patients. When individual values of serum magnesium level was compared with individual GCS in each group to find out the correlation coefficient, a good positive correlation had been found to exist between GCS and serum magnesium level on day 1 day 3. This result is in accordance with the study of Polderman et al 2 and Kahramen et al [8] .However, further study regarding this is necessary which may help the prognosis and management of patient with TBI in future.

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