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Letter to Editor

Biochemistry Section

Hyponatraemia in Head Injuries Caused by Road Traffic Accidents

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The WHO has estimated that by 2020, Road Traffic Accidents (RTAs) will be the third greatest cause of the disease burden and injuries globally [1]. A study has shown that in India, 11% of the deaths which are caused by non communicable diseases are due to injuries, and that 78% of the injuries are caused by RTAs. RTAs are also the leading causes of the mortality in young adults who are less than 45 years of age and more so, in males [2].

Electrolyte disturbances are common after neurologic injuries and the most common electrolyte abnormalities are sodium disturbances. Hyponatraemia is defined as serum sodium levels of < 135 mmol/l. It is more common after head injuries and in patients with neurological disorders than in the general hospital population [3]. This study was undertaken to estimate the number of subjects with hyponatraemia following head injuries after RTAs and to seek out a relationship if any, between hyponatraemia at admission and the Glasgow Coma Scale (GCS) score, between the serum sodium values and the Intensive Care Unit (ICU) stay and between the GCS score and the ICU stay.

This study was undertaken over a period of 3 months at ASRAM Medical College, Eluru. All the subjects who were in the age group between 20 and 60 years and who were admitted to the ICU after sustaining head injuries following RTAs, were included in the study. The institutional ethical committee clearance was obtained from the institution's head and informed consents were taken from the relatives of the patients. A total of 37 consecutive subjects who constituted the cohort and who belonged to both the sexes were included in the study. The serum electrolytes were estimated by using an electrolyte analyser (Transasia- ion selective electrode method) within 20 hours of sustaining the trauma.

The level of consciousness was assessed at the time of admission to the ICU by using the Glasgow coma scale and the ICU stay of the subjects was recorded. A serum sodium value of <135 mmol/l was considered as suggestive of hyponatraemia and values between 135 and 145 mmol/l were considered as suggestive of normonatraemia. Serum potassium values between 3.5-5mmol/l were considered as suggestive of normokalaemia and a value of < 3.5 mmol/l was considered as suggestive of hypokalaemia.

Descriptive statistics and Pearson's correlation were applied to express the results. A p value of <0.05 was considered as significant. The [Table/Fig-1] shows the descriptive data. The patients with hyponatraemia had serious head injuries. The [Table/Fig-2] shows a positive correlation between the sodium and potassium values (r=0.8), and between the sodium values and the GCS score in the cohort (r=0.5). There were no correlations between the initial serum sodium values and the ICU stay and between the GCS score and the ICU stay.

Sodium Level in Mmol/l	Diagnosis	% of Subjects (n)	% Males (n)	% Females (n)
< 135	1 –diffuse axonal injury 13 –intracerebral haemorrhage with skull fracture 3 – SAH 6 – SDH 2 – EDH	67(25)	72(18)	28(7)
135-145	9 – concussion 3 – traumatic paraplegia	33(12)	50(6)	50 (6)

[Table/Fig-1]: Shows the number of subjects having hyponatremia and normonatremia and the diagnosis. SAH- subarachnoid haemorrhage, SDH-subdural haemorrhage, EDH- extradural haemorrhage

Parameters	Pearson's correlation coefficient (r)	Statistical significance p value
Serum potassium	0.8	0.0001
GCS	0.5	0.02
ICU stay	-0.2	0.2
Relation between GCS and ICU stay	-0.2	0.2

[Table/Fig-2]: Showing correlation between initial serum sodium values and serum potassium values and between sodium values and Glasgow coma scale (GCS) score . There is no relation between initial serum sodium levels and intensive care unit (ICU) stay and also between GCS and ICU stay

Hyponatraemia is a common complication of TBI [3].The most commonly observed electrolyte abnormality at admission in the present study was hyponatraemia (in 67% of the patients). Paiva et al, in their study, showed that sodium disorders were more common after TBI and that the substantial rate of detection on the day of admission suggested severe brain lesions [4]. This finding correlated with that of the present study, where hyponatraemia was seen in the subjects with severe head injuries. Acute hyponatraemia is more dangerous as compared to chronic hyponatraemia and it has a mortality which ranges from 7%– 60% [3]. The causes of hyponatraemia could be an appropriate anti diuretic hormone release following osmo or baroreceptor stimulation after blood loss following head injuries, the Syndrome of Inappropriate Anti Diuretic Hormone (SIADH) or the Cerebral Salt Wasting Syndrome (CSWS) or they may be iatrogenic (due to hypotonic fluid administration) [5]. The serum sodium levels were related to the Glasgow coma scale (GCS) r=0.5. Lower serum sodium levels were associated with lower GCS values and these levels were also related to the serum potassium values r=0.8. Hyponatraemia was associated with

hypokalaemia. This finding differed from the finding of Adiga et al, where only 4% of the subjects had hypokalaemia [6]. This could be because the injuries in the present study were more serious and a majority of the subjects had a GCS score of 3.

According to Pomeranz et al., the catecholamine surge following severe head trauma results in activation of the transmembrane sodium potassium pump, which is mediated by the β_2 adrenergic receptors and a shift of potassium from the intravascular spaces into the cells, leading to hypokalaemia [7]. There was no correlation between the initial serum sodium values and the ICU stay r= -0.2. This could be due to the fact that the serum sodium levels at the time of admission to the ICU were correlated with the ICU stay but were not monitored daily, as was done in other studies [4,8]. There was no correlation between the initial GCS score and the length of the ICU stay (r=-2). This finding was similar to that of another study which was done by Matis and Birbilis, who found no correlation between the GCS score and the duration of the ICU stay [9]. Another study which was done by Wijdicks et al too proved the inability of GCS in accurately assessing the severity of the coma and they proposed another scale for accurately assessing the consciousness [10].

Out of the 37 patients, 12 patients had normal serum electrolyte statuses and these patients had milder head injuries like concussion. Of the 37 patients, 2 died after 5 days. One of the patients had severe hyponatraemia with a serum sodium level of <120mmol/l and the other died of multiple organ failure. Both the patients had intracerebral haemorrhages with skull fractures, with a GCS score of 3. This was a pilot study which was done to assess the prevalence of hyponatraemia in subjects who sustained head injuries following RTAs. It was found that hyponatraemia was the most common electrolyte imbalance, followed by hypokalaemia. The serum sodium levels at admission, correlated strongly with the GCS score and with the serum potassium values. The latter was caused by the severity of the head injuries. There were no correlations between the initial serum sodium values and the ICU stay and also between the GCS score and the duration of the ICU stay.

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