CHANGES IN SERUM ADH CONCENTRATIONS IN SEVERE TRAUMATIC BRAIN INJURY PATIENTS

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Abstract

Objective: The study investigates the changes in serum ADH concentration and finds out the relationship between prognosis factors in brain trauma injury, such as sodium treatment time at Emergency Department and patients' lives. **Materials and methods:** The study subjects include brain trauma patients, Glasgow Coma Scale ≤ 8, hospitalized for fewer than 72 hours at Hue Central Hospital with CT scans of the brain and diagnosis of brain trauma injury. After being tested, these patients are treated at Emergency Department. Their treatment time is counted from the first day in Emergency Department to the day their health conditions are stable and they are moved to other departments. Serious cases in which patients ask for discharge are considered as dead cases. **Results:** By studying the change in serum ADH concentration among 59 brain trauma patients, including 51 males (86.44%) and 8 females (13.56%), the result is as below: serum ADH concentrations at 2 times of study head trauma are different and meaningful ($p<0.05$). The correlation between serum ADH1 concentration and days of treatment at Emergency Department ($r = 0.359$, $p= 0.002$, $y= 0.0449x + 8.6897$). **Conclusion:** ADH1 concentrations > ADH2 has a statistically significant ($p < 0.05$). The correlation between serum ADH1 concentration and days of treatment at Emergency Department ($r = 0.359$, $p= 0.002$, $y= 0.0449x + 8.6897$). The area under ROC curve of ADH2 is 75.7%, higher than that of Na+2 (73.9%).Cut-off value to predict the turn of ADH2 and Na2 was 28.61 pg/ml, 146mmol/l.

Key words: *Traumatic brain, serum ADH, traumatic.*

1. INTRODUCTION

Endocrine disorders after traumatic brain injury is one of the main reasons for the increase of death rates. In recent years, ADH hormone disorder has been mentioned and considered as the key factor in prognosis and treatment, which helps to save a number of lives. In acute brain trauma, water-electrolyte imbalance often occurs, in which blood sodium is the main factor affecting serum hormone ADH. If hyponatremia decreases, ADH will increase, causing cerebral edema. This happens when water moves into cells and erebral vasoconstriction as the mechanism of brain damage secondary to clinical. If ADH in blood decreases, it will cause central diabete insipidus. This is one crucial prognosis factor in brain trauma injury [1], [2], [5], [6], [12].

For early prognosis and treatment, this research on "Changes in serum ADH concentration in severe brain trauma injury patients" has been carried out. The study investigates the changes in serum ADH concentration and finds out the relationship between prognosis factors in brain trauma injury, such as sodium treatment time at Emergency Department and patients' lives.

2. MATERIALS AND METHODS

2.1. Subjects of the study

The study subjects include brain trauma patients, Glasgow Coma Scale ≤ 8, hospitalized for fewer than 72 hours at Hue Central Hospital with CT scans of the brain and diagnosis of brain trauma injury. After being tested, these patients are treated at Emergency Department. Their treatment time is counted from the first day in Emergency Department to the day their health conditions are stable and they are moved to other departments. Serious cases in which patients ask for discharge are considered as dead cases.

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2.2. Data collecting process

- Brain trauma patients are hospitalized and diagnosed through CT scan.

- Prior to infusion, these patients have blood test of Blood counts, electrolytes, urea, creatinine.

- 2ml venous blood is kept for record at Biochemistry Department according to the process and for test of serum ADH concentration, sodium at 2 times: day 2 and day 3.

- At the time of blood test, the clinical parameters are recorded: temperature, blood pressure, CVP, urine amount per 24 hours, Glasgow coma scale.

- The parameters in the research:

- Serum ADH concentration according to testing machine: 4-12pg/ml.

- Serum sodium concentration: 135 - 145 mmol/l

- Age division: Group 1. 18-40 years old

Group 2. >40 years old

- Level of severity according to Glasgow coma scale:

Serious ≤ 8; Average 9-12, Minor: 13-15

Excel and SPSS 18.0 are occupied to analyse the data.

3. RESULTS

3.1. Overview

By studying the change in serum ADH concentration among 59 brain trauma patients, including 51 males (86.44%) and 8 females (13.56%), the result is as below:

Table 1. Parameter changes based on gender

Parameter		N	$\overline{XX} \pm SD$	P
ADH1 (pg/ml)	Female	8	60.08 ± 74.84	>0.05
	male	51	41.76 ± 52.48	
ADH2 (pg/ml)	Female	8	30.26 ± 16.74	>0.05
	male	51	23.32 ± 17.81	
Na^+1 (mmol/l)	Female	8	145.95 ± 12.83	<0.05
	male	51	134.94 ± 8.73	
Na^+2 (mmol/l)	Female	8	141.50 ± 16.08	> 0.05
	male	51	135.59 ±9.69	
ICU (day)	Female	8	9.25 ± 4.36	> 0.05
	male	51	10.90 ± **6,67**	
Age (year)	Female	8	39.87 ± 16.23	> 0.05
	male	51	38.23 ± 14.79	
Glasgow	Female	8	7.00 ± 2.61	> 0.05
	male	51	8.03 ± 2.52	

The rate of brain trauma male patients makes up 86.44%, and ADH concentration in female patients is higher but it does not have any meaning ($p>0.05$), Na^+1 concentration in female patients is higher than that of male patients ($p<0.05$).

Table 2. Parameter changes based on age

Parameter	Age group	N	$\overline{XX} \pm SD$	p
ADH1	18-40	30	44.81 ± 62.95	>0.05
	> 40	29	43.66 ± 47.91	
ADH2	18-40	30	23.39 ± 18.23	>0.05
	> 40	29	25.16 ± 17.39	
Na^+ 1	18-40	30	136.77 ± 11.99	>0.05
	> 40	29	136.08 ± 7.63	
Na^+ 2	18-40	30	136.70 ± 10.75	>0.05
	> 40	29	136.07 ± 11.00	
ICU	18-40	30	10.86 ± 7.10	>0.05
	> 40	29	10.48 ± 5.71	
Age(year)	18-40	30	26.10 ± 6.43	>0.05
	> 40	29	51.24 ± 9.05	

ADH concentration, Na+, days of treatment are not different between 2 age groups, $p>0.05$.

3.2. Characteristics of serum ADH concentration

Table 3. Changes of serum ADH concentration at 2 times

ADH (pg/ml)	Changes of serum ADH concentration at 2 times		
	N	$\overline{XX} \pm SD$	p
ADH1	59	44.25 ± 55.59	< 0.05
ADH2	59	24.26 ± 17.69	

Serum ADH concentrations at 2 times of study head trauma are different and meaningful (p<0.05).

Table 4. Changes of serum ADH concentration compared between living and dead groups

Parameter		N	$\overline{XX} \pm SD$	p
ADH1 (pg/ml)	Living	47	47.97 ± 61.02	> 0.05
	Dead	12	29.66 ± 20.76	
ADH2 (pg/ml)	Living	47	20.28 ± 12.98	< 0.05
	Dead	12	39.86 ± 24.73	
Na^+1 (mmol/l)	Living	47	134.25 ± 6.96	< 0.05
	Dead	12	144.96 ± 15.01	
Na^+2 (mmol/l)	Living	47	133.61 ± 7.07	< 0.05
	Dead	12	147.29 ± 15.54	
AGE	Living	47	39.19 ± 15.48	> 0.05
	Dead	12	35.58 ±12.31	
Glasgow	Living	47	8.14 ± 2.45	> 0.05
	Dead	12	6.91 ± 2.71	

ADH2 concentration, Na1, Na^+ 2 between the dead and living groups are different and meaningful (p< 0.05).

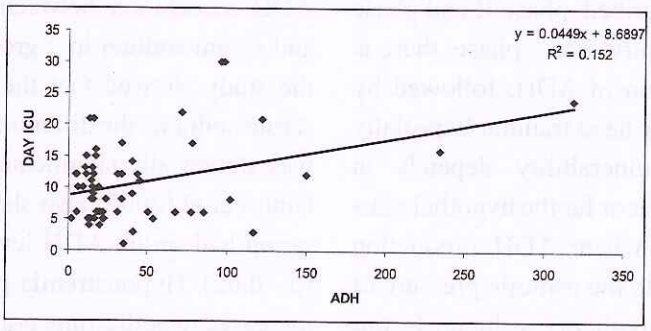

Chart 1. The correlation between serum ADH concentration and days of treatment at Emergency Department (r = 0.359, p= 0.002, y= 0.0449x + 8.6897)

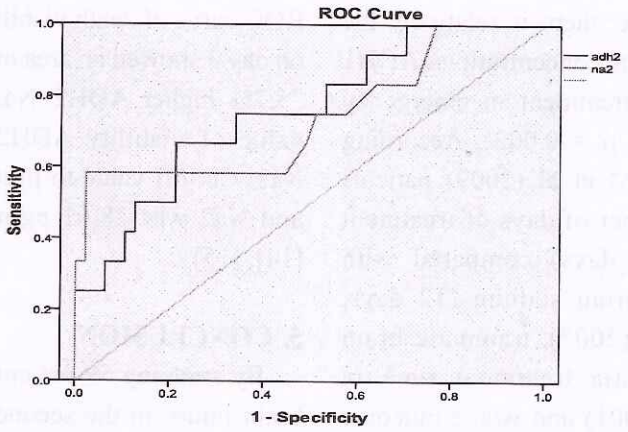

Chart 2. ROC curve of ADH2 and Na2+ based on the likelihood of dead

Table 5. Sensitivity, specificity of ADH2 and Na2

Characteristics	AUC	Reliablity 95%	Cut-off	Sensitivity	Specificity
ADH2(pg/l)	0.757	60.5- 90.9	28.61	66.7%	58.0%
Na2(mmol/l)	0.739	55.7- 92.2	146	58.0%	97.0%

The area under ROC curve of ADH2 is 75.7%, higher than that of Na+2 (73.9%).

4. DISCUSSION

4.1. Overview

In this research, the rate of brain trauma male patients makes up the majority (86.4%), in comparison with that of Nguyen Quoc Hung's study (male: 80%, female:20%), or Nguyen The Hao (47/3%).

4.2. Changes in serum ADH concentration

The relationship between serum ADH concentration and gender shows a higher rate in female patient than male patient, while the number of ADH concentration between different groups is not meaningful ($p>0.05$). In brain trauma injury, during the recent years, researchers have mentioned and described phase II and phase III after brain trauma injury. For 2 phase, there is often inhibit the secretion of ADH, followed by increased massively after head trauma. Especially the details of this vulnerability depends in traumatic brain injury near or far the hypothalamus and posterior pituitary where ADH production storage and less subject to the osmotic pressure of blood or a change of circulatory volume. In our study there is a positive correlation between the number of days ADH1 treatment in intensive care, due to increased ADH1 should hold more water and cause hyponatremia increases levels of brain edema in clinical practice, there is relatively the agreement between serum concentrations ADH1 the number of days of treatment in emergency resuscitation ($r = 0.359$, $p = 0.002$). According to the author Sherlock M et al (2009) patients with hyponatremia number of days of treatment in hospital longer (19 days) compared with patients with normal serum sodium (12 days, $p < 0.001$); Moro et al (2007), traumatic brain injury have hyponatremia treatment time in the ICU longer ($p < 0.001$) and worse outcome ($p = 0.02$) compared with the remaining patients. In the study ADH1 > ADH2 serum, a previous study we reverse this is also a perfect fit because previous studies have all 3 levels of severity of traumatic brain injury in points Glasgow, in research only severe traumatic brain injury and Petra CM under serum ADH levels highest on day 2. ADH concentrations in serum of brain injury than some of our other authors almost similar authors especially in sample sizes similar to our study as of Xu (2007) on 28 patients Nc human ADH concentrations average 66.61± 17.10 pg/ml; Yang 2002, 58.13 ± 16.78 pg/ml; Huang 2010, 48.30 ± 8.28 pg/ml [9], [13], [14], [15].

Serum concentrations of ADH, sodium and death ADH association between serum concentrations and serum sodium in 2 groups life and death over the study showed that the increase of ADH and serum sodium , the difference between the 2 groups was statistically significant ($p < 0.05$). In studies Cintra et al (2007) also showed that the mortality group had serum ADH levels increased on day 3 ($p <0.05$). Hyponatremia group of high mortality increased in both 2 time points ($p<0.05$), on clinical blood sodium increased, many diabetics, low urine density suggests a condition, diabetes insipidus is happening and this is also an independent predictor of patient mortality. Chart performances under the ROC curve of death viability of serum ADH levels on day 3 showed an area under the ROC curve was 75.7% higher ADH2 Na2 is 73.9%, predictive value of viability ADH2 of serum higher than Na2. Cut-off value to predict the turn of ADH2 and Na2 was 28.61 pg/ml, 146mmol/l [9], [10], [14], [15].

5. CONCLUSION

By studying 59 patients with severe traumatic brain injury in the second time we give some of the results follows:

Serum concentrations ADH1 Day 2: 44.25 ± 55.59 pg/ml

ADH2 serum concentrations on day 3: 24.26 ± 17.69 pg/ml

ADH1 concentrations > ADH2 has a statistically significant ($p < 0.05$).

The correlation between serum ADH1 concentration and days of treatment at Emergency Department ($r = 0.359$, $p = 0.002$, $y = 0.0449x + 8.6897$).

The area under ROC curve of ADH2 is 75.7%, higher than that of Na+2 (73.9%). Cut-off value to predict the turn of ADH2 and Na2 was 28.61 pg/ml, 146mmol/l.

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