Electrolyte Disturbance in hemorrghic and non hemorrghic Stroke Patients in AL_Diwaniyh Teaching Hospital

Abstract

Among all neurologic diseases of adult, stroke graded first. Although there are many studies on stroke, but few studies on electrolytes disturbance have been done in our country, even on the outside. Electrolyte disturbances are frequently observed in hemorrhagic and non hemorrghic stroke and may potentially worsen outcome and prognosis. Our aim in this study is to estimate the level of serum potassium and sodium in acute stroke patients with comparison to patients of control group and their effect on the severity of stroke and the outcome. Our study is comparative cross-sectional study done to patients on the neurological center suffer from stroke and others in medicine department admitted for any disease other than CVA they consider the control group. All in AL_Diwaniyh Teaching Hospital from April to July 2018. The level of potassium and sodium from all patients is estimated. Patients with ischemic stroke were classified into 9 (15.8%), 34 (59.6%) and 14 (24.6%) having Glasgow coma scores of 3-8, 9-12 and 13-15, respectively. Patients with hemorrhagic stroke were classified into 5 (38.5%), 7 (53.8%) and 1 (7.7%) having Glasgow coma scores of 3-8, 9-12 and 13-15, respectively. Patients with TIA were classified into 0 (0.0%), 5 (41.7%) and 7 (58.3%) having Glasgow coma scores of 3-8, 9-12 and 13-15, respectively. Significant difference was seen in distribution of patients according to GCS levels (P = 0.014). Mean serum sodium was significantly lowest in hemorrhagic stroke, then ischemic stroke, followed by TIA and the highest sodium level was seen in control group (P<0.001). Mean serum potassium was significantly lowest in hemorrhagic stroke, then ischemic stroke, followed by TIA and the highest sodium level was seen in control group (P<0.001). Mean serum to potassium ratio was significantly highest in hemorrhagic stroke, then TIA, followed by ischemic stroke and lastly by control group (P<0.001). The rate of hyponatremia was 2 (2.2), 20 (35.1), 5 (38.5) and 2 (16.7), in control, ischemic, hemorrhagic and TIA groups, respectively. The rate of hypokalemia was 1 (1.1), 4 (7.0), 2 (15.4) and 0 (0.0) in control, ischemic, hemorrhagic and TIA groups, respectively.This study reveals that in haemorrhagic stroke, the incidence of electrolytes imbalance was more than ischaemic and which was mostly Hyponatraemia and Hypokalaemia . In our study we found that electrolyte disturbance could effects on the severity of stroke

according to Glassgow com scale result. Thus Electrolyte imbalance may adversely affect outcome and prognosis of stroke.
Keyword:

stroke, electrolyte disturbance, sodium, potassium.

INTRODUCTION

Cerebro-vascular accidents (CVA) are a main public health problem. It is well-distributed in the whole world and is assorted to be the second top cause of death in the world. Stroke cause significant impairments particularly in the older age group and are amongst the major health matters in several countries.[1]

"Stroke causes a great influence on disability rate. Stroke also has huge contribution to economic and social load for patients and their family.
In almost all neurological disorders, electrolyte disturbances are prominent. Electrolyte disturbance are commonly found in acute stroke events.
Recently research with electrolyte disturbances focusing on risk factors of stroke, its prevalence and association with other medical condition, not only on the neuroendocrine mechanism. Many Stroke patients die either because of the primary disease or due to its consequences .Management of stroke patient aimed not only on the treatment of the primary disease but also on the avoidance of severe consequences of stroke including dyselectrolytemia, aspiration pneumonia, malnutrition, pulmonary embolism , DVT, bowel or bladder dysfunction,UTI , contractures, skin breakdown and joint abnormalities . An early and accurate forecasting of stroke outcome in the emergency department is pivotal for decision-making, as well as in assessing patient's prognosis.

The reports on the association between electrolyte imbalance and severity of acute stroke are still in limited number, although there are some data about large number of electrolyte disturbances in acute stroke events. There is a deficiency of data about this association especially from the developing countries. Electrolyte disturbances are usually present in acute stroke setting as hypokalemia or hyponatraemia which is the commonest type of disturbance. Electrolyte disturbances such as hyponatremia resulting from either the syndrome of inappropriate antidiuretic hormone secretion (SIADH), inappropriate fluid intake and loss or high level of Brain Natriuretic Peptides (BNP) these can result in consequences such as seizures or death.

The commenst presenting symptoms of patients with hemorrhagic stroke is headache and vomiting.Vomiting also an important factor of electrolyte disturbance[2]. Published reports about stroke suggest that CVD occurs with increasing frequency at all ages and in both sexes. Prospective studies on acute stroke found that hypertension, diabetes mellitus, dyslipidemia, obesity, smoking and family history are important risk factors (RFs)[3,4,5]. The objectives of this study reported here is to identify the common electrolyte disturbance in acute phase of multiple types of stroke patients & there relation with some usual clinical presentation & outcome.

Methods:

It is comparative cross-sectional study done on patients admitted to neurological center from April to July 2018 in comparison to patients admitted to medicine department for any cause other than CVA in the same hospital and at the same period.

Inclusion criteria:

Patients of either sex above 40 years of age with acute stroke admitted within 48 hours of onset & fulfilling WHO definition of stroke and confirmation of stroke with CT scan of brain. No history of endocrine or kidney diseases, Patient was not in resuscitation phase and Patients are not in diuretic therapy.

Exclusion criteria:

Any patients have complication that could affect electrolyte level excluded from the study also if Patients have any neurological deficit secondary to head injuries, Intracerebral Hemorrhage (ICH) , Subdural Hemorrhage (SDH) , Epidural Hemorrhage , or an infarction which is caused by an infection/tumor (SOL) etc. also any patients have preexisting severe physical or cognitive disabilities.

Results:

Diabetes mellitus was seen in 10 (17.5%), 3 (23.1%) and 4 (33.3) patients with ischemic stroke, hemorrhagic stroke and TIA patients, respectively and the difference statistically was not significant (*P*= 0.459). Hypertension was seen in 31 (54.4%), 6 (46.2%) and 7 (58.3%) patients with ischemic stroke, hemorrhagic stroke and TIA patients, respectively and the difference statistically was not significant (*P*= 0.814). Smoking was seen in 33 (57.9%), 8 (61.5%) and 7 (58.3%) patients with ischemic stroke, hemorrhagic stroke and TIA patients, respectively and the difference statistically was not significant (*P*= 0.971). Dyslipidemia was seen in 34 (59.6%), 7 (53.8%) and 7 (58.3%) patients with ischemic stroke, hemorrhagic stroke and TIA patients, respectively and the difference statistically was not significant (*P*= 0.929). Overweight or obesity was seen in 19 (33.3%), 5 (38.5%) and 4 (33.3%) patients with ischemic stroke, hemorrhagic stroke and TIA patients, respectively and the difference statistically was not significant (*P*= 0.938). Family history was seen in 20 (35.1%), 4 (30.8%) and 5 (41.7%) patients with ischemic stroke, hemorrhagic stroke and TIA patients, respectively and the difference statistically was not significant (*P*= 0.848). Patients with ischemic stroke were classified into 9 (15.8%), 34 (59.6%) and 14 (24.6%) having Glasgow coma scores of 3-8, 9-12 and 13-15, respectively. Patients with hemorrhagic stroke were classified into 5 (38.5%), 7 (53.8%) and 1 (7.7%) having Glasgow coma scores of 3-8, 9-12 and 13-15, respectively. Patients with TIA were classified into 0 (0.0%), 5 (41.7%) and 7 (58.3%) having Glasgow coma scores of 3-8, 9-12 and 13-15, respectively. Significant difference was seen in distribution of patients according to GCS levels (P = 0.014). Mean serum sodium was significantly lowest in hemorrhagic stroke, then ischemic stroke, followed by TIA and the highest sodium level was seen in control group (P<0.001). The Mean of serum potassium was significantly lowest in hemorrhagic stroke, then ischemic stroke, followed by TIA and the highest sodium level was seen in control group (P<0.001). Mean serum sodium to potassium ratio was significantly highest in hemorrhagic stroke, then TIA, followed by ischemic stroke and lastly by control group (P<0.001). The rate of hyponatremia was 2 (2.2), 20 (35.1), 5 (38.5) and 2 (16.7), in control, ischemic, hemorrhagic and TIA groups, respectively. The rate of hypokalemia was 1 (1.1), 4 (7.0), 2 (15.4) and 0 (0.0) in control, ischemic, hemorrhagic and TIA groups, respectively.

Correlation between serum electrolytes (serum sodium and potassium) and clinical characteristics

Characteristic	Serum sodium		Serum potassium		Na/K ratio	
	r	*P*	r	*P*	r	*P*
Stroke type	0.206	0.064	-0.055	0.625	0.150	0.180
Age	-0.197	0.077	-0.328	0.003 *	0.301	0.006 *
Gender	-0.144	0.196	-0.214	0.053	0.110	0.326
Diabetes	0.170	0.126	-0.045	0.688	0.099	0.377
Hypertension	0.234	0.035 *	0.215	0.053	-0.131	0.241
Smoking	-0.085	0.448	-0.026	0.818	-0.002	0.986
Dyslipidemia	-0.012	0.918	-0.087	0.435	0.067	0.548
Overweight or obesity	-0.150	0.180	-0.088	0.432	0.030	0.789
Family history	0.092	0.409	0.103	0.356	-0.064	0.570
Residency	0.010	0.929	0.016	0.885	-0.019	0.865
Occupation	-0.049	0.659	0.095	0.396	-0.104	0.352
Glasgow coma scale	0.148	0.186	0.236	0.033 *	-0.181	0.104

r: correlation coefficient; *: significant at $P \leq 0.05$.

Discussion:

In this present study and according to imaging studies there is 57 patients with ischaemic stroke, 13 with intracerebral hemorrhage and 12 with TIA in comparism to ninety patient in control group.

The current study showing that hemorrhagic Stroke is most commonly occurred at the older age patients (significant difference with the rest of patients and control subject P<0.001) while Ischemic and TIA mainly occur at middle age group and no significant difference in mean age with the control subject (P>0.05).

According to study in Manado General Hospital in indonesia they found that Stroke is more commonly occurred in the middle age group and above also more in male than female. In this study we found that there is no significant difference between male and female among control and study groups (P=0.952). In a community-based cross-sectional study in Bao'an district, Shenzhen, China [6,7],there is more predominance of stroke in males than between females. The same results have been found in Saudi Arabia[8], and other countries, like in German[9], the United Kingdom[10], the US[11], Italy[12], Spain[13].The multivariable studies indicated that sex was a significant factor in stroke,men have two times more risk to develop stroke than women.

Our study revealed that residency is not a risk factor for CVA because no significant difference was encountered among all stroke patients (p=0.588). Also in this study there is no significant difference according to distribution of patients regarding their occupation (*P*=0.588).

The risk factors of stroke in study group have the same effect for all types of stroke because the difference in distribution among ischemic, hemorrhagic and TIA was statistically not significant.

The level of consciousness assessment for patients included in the present study was performed according to Glasgow coma scale.

Our study showing a significant difference in the distribution of patients according to GCS levels (as mild, moderate and severe disturbances of consciousness) (P = 0.014) .We detect that patients presenting with hemorrhagic stroke had a conscious level (median was 9) in comparative with ischemic and TIA (median 11, 13) respectively. These findings may help in the determining the stroke's type because Subarachnoid hemorrhage is usually associated with significant increase in intracranial pressure and lowering in cerebral perfusion pressure this causing intermittent reduction of cerebral blood flow thus the main presenting symptoms of subarachnoid hemorrhage (SAH) is loss of consciousness (LOC) that mean sever GCS.

Distinguishing between ischemic and hemorrhagic stroke not depend on symptoms alone which are not enough specific. Any way generalized symptoms, like nausea, vomiting, and headache, in addition to altered level of consciousness, may give a hint to increasing intracranial pressure and usually found more in hemorrhagic strokes and large ischemic strokes.

Disturbance of the normal values of sodium and potassium will effect the fluid and electrolyte balance and may result in disturbing the normal physiological function and the neurotransmission of the brain in the form of collection of fluid and exchange of nutrients like lactic acid and arachidonic acid which have mean role in the development of neurological signs and symptoms.The damage that results due to these consequences will result either in decreased cerebral blood flow or rupture of small vessels due to pressure imbalance. Study by Alam M N et al6[14,] revealed that hyponatermia is the main electrolytes disturbances in cerebrovascular accidents, both in ischemic and hemorrhagic stroke.Other study by Kusuda K et al7[15,] also showed hyponatremia, hypernatremia, hypokalemia and hyperkalemia in CVA. Study also stated that hypernatremia is more common in hemorrhagic stroke and 57% of patients with hypernatremia in his study end by dead within one month of hospital admission indicating the importance of electrolyte disturbances in these patients.

In our study, we found that the hyponatremia and hypokalemia are more common in hemorrghic stroke followed by ischemic stroke then TIA and the highest level in control group. Low sodium level was mainly detected among patients with hemorrhagic stroke followed by ischaemic stroke patients and there is statistical significant association between hyponatremia and type of stroke. Many studies and researchers find that hyponatremia in acute CVA patient may affect the prognosis and severity of stroke negatively. Hypokalemia was more common within hemorrhagic stroke patients followed by ischaemic stroke patients.In the study of Qureshi *et al*,[16] it was detect that hyponatremia is most common than hypernatremia (30% vs. 19%) after aneurysmal SAH. Hypernatremia was significantly associated with the worse prognosis, and there is positive relationship between elevated serum sodium levels and poor GCS within three months following the ictus. Chandy *et al*,[17] showed that hyponatremia was associated with high risk of cerebral vasospasm after aneurysmal SAH. [15]

A retrospective study by Sherlock *et al*.,[18] 316 patients with aneurysmal SAH ,hyponatremia was a common electrolyte imbalance between those patients (56% overall prevalence) which result in longer hospital admission but without any effect on the mortality rate. They detect that in a major group of the hyponatremic patients (21.4–31.8%, according to the treatment modality), this may develop within seven days after SAH.

McGirt *et al*,[19] reveal that an increase in the serum levels of cerebral natriuretic peptide (BNP) was independently associated with hyponatremia, and the occurrence of hyponatremia rising significantly within 24 h after the onset of delayed ischemic neurologic deficits.· Hypokalemia occurring in haemorrhagic stroke patients more than ischaemic stroke patients in comparison to control group.

Electrolyte disturbance have an effect on clinical characteristic revealed that there is negative relationship between age and serum potassium, when age increase serum potassium decrease, this may be the result of multiple causes. The normal physiological changes related to the aging affect the potassium normal values in the body. Also when the function of kidneys decrease, this will effect on the urine output and cause disturbance in the mechanisms that maintain reabsorption and excretion of nutrients. Thus high level of potassium will be execreated in urine. While at the level of gastrointestinal system, vomiting and diarrhea can affect the proper absorption of dietary potassium. Other medical problems such as Crohn's or Cushing's disease, leukemia or magnesium deficiency cause large loss of potassium. Some drugs like the diuretics, insulin, steroid, laxatives, antibiotics also theophyllines may change the normal absorption of potassium.

Notably, when there is increase in the levels of body sodium, blood pressure will increase. Renin-angiotensin system is affected by high salt diet. Damage to endothelial had a significant role in the effect of high sodium intake on blood pressure, although the exact mechanisms remain unknown. High blood pressure represents the major factor in the cardiovascular disease (such as stroke, cardiac failure, and coronary artery disease).

Glassgow coma scale increase when there is an increase in serum potassium. Many studies detect that when there is serum potassium increase there is significant improvement in Glasgow coma scale.

Potassium concentration through membrane of cell has a significant effect in the membrane potential, so that when there is abnormal potassium level this may affect membrane potential in neuronal, cardiac and vascular tissues. A study from Cheng et al.[20] study show low potassium level can reduce the conductance hyperpolarization in potassium channel of skeletal muscle tissue. Severe muscle dysfunction, palpitations, cardiac dysrhythmias, and abnormality in neurological function may occur if there are few disturbances in potassium level. Potassium intake can lower the stroke risk and this is showed by multiple meta-analyses studies and the suggested mechanism could be that K^+ decreases the formation of free radicals and increase endothelial dysfunction . Gariballa et al.[21] showed that low potassium level at admission may result in a three-month mortality rate of acute ischemic stroke while study from Fofi et al,[22] revealed that the relationship between mortality and the serum potassium level not significant . These differences may be due to discrepancy between the two studies in the population features. The study by Fofi et al. was focusing on AIS patients with an OTT of less than 6 h while Gariballa et al. included patients with multiple types of stroke. Other groups revealed that K^+ can suppress vascular smooth muscle cell proliferation . A study performed at the First Affiliated Hospital of Xi'an Jiaotong University Department of Neurology reveal that serum potassium level less than 3.7 mmol/l on admission is an indicator of poor outcome for 3 months after stroke following acute ischemic stroke event.Thus hypokalemia is a significant factor for the worse outcome. So acute ischemic stroke patients should be monitored because they are at higher risk of a poor prognosis by the effect of the serum potassium level at time of admission.These findings will help physicians who usually monitor serum potassium with acute ischemic stroke and assess its level above 3.7 mmol/l. Because Mg^{2+} can improve the Na^+/K^+ pump function so any disturbance in the serum Mg^2levels in patients with severe low potassium level should replace with Mg^{2+} inspite of the serum Mg^{2+} being normal.[19]

LIMITATION OF THE STUDY:

There are several limitations of this study:

1. The sample size of this study was relatively small.

2. There was no long-term follow-up of patient.

Conclusion:

Our study showed that electrolyte imbalances are usual problem. Hyponatremia & hypokalemia are the main electrolyte disturbances in both ischemic &haemorrhagic stroke. patients with normal electrolyte balance had best outcome &it was statistically significant thus serum electrolyte assessment should be performed for all stroke patients. The early diagnosis and perfect control and treatment can end with very good outcome of stroke patients.

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