AN INSIGHT ON HYPONATREMIA: A REVIEW

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ABSTRACT

Hyponatremia is an electrolyte imbalance mainly seen in geriatric patients, in which serum sodium concentration is less than 135mEq/L. Based upon the serum sodium concentration hyponatremia is classified as mild, moderate & severe. Main causes of hyponatremia include: SIADH, excess fluid intake, concomitant diseases & drugs. Management depends on its severity, volume status, clinical symptoms & etiology. Usually 3% sodium chloride & vaptans are used for the treatment of hyponatremia. This article is focused to review the causes and management of hyponatremia.

Key words: hyponatremia, geriatric patients, vaptans.

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INTRODUCTION

Hyponatremia is defined as a serum sodium less than 135mEq/l [1]. Higher incidence of hyponatremia is seen in geriatric patients with comorbidities, impaired response of water and electrolytic balance, changes in the GFR rates and polypharmacy. Hyponatremia usually results from the intake and subsequent retention of electrolyte free water in response to true hypovolemia due to gastrointestinal solute loss or malnutrition: decreased effective circulating volume due to heart failure or liver cirrhosis or non-osmotic vasopressin activity due to malignancies, infections, medications, pain or stress [2].

CLASSIFICATION OF HYPONATREMIA

Hyponatremia is mainly classified based on:

- Volume status
- Serum sodium concentration
- Duration of symptoms

Based on volume status:

Hypovolemic Hyponatremia

Its associated with low plasma volume. In this type of hyponatremia there is a decrease in both body water and sodium level but more depletion occurs to the sodium which results in hypovolemic hyponatremia. Hypovolemic hyponatremia mainly occurs due to non-renal fluid loss and renal fluid loss. Non-renal fluid loss is due to vomiting, diarrhoea, skin burns etc. Renal sodium loss is due to diuretic therapy such as thiazide diuretics, osmotic diuretics and adrenocorticoid failure. It is also caused by cerebral salt wasting mainly seen in patients having CNS disease.

Euvolemic Hyponatremia

In Euvolemic(dilution) hyponatremia total body sodium and thus extra cellular fluid volume are normal or near normal, however total body water is increased [4]. It is mainly caused by SIADH (syndrome of inappropriate anti-diuretic hormone), hypothyroidism, primary polydipsia, excessive electrolyte-free water infusion, Addison's disease, intoxication with MDMA (methylenedioxymethamphetamine) and certain drugs such as cyclophosphamide, NSAIDS, chlorpropamide. All these conditions result in water retention.

Hypervolemic Hyponatremia

Hypervolemic hyponatremia is characterized by an increase in both total body sodium (and thus ECF volume) and total body water with a relatively greater increase in TBW [5]. It is seen in various disease conditions such as: congestive heart failure, chronic kidney disease, liver cirrhosis, nephrotic syndrome. Vasopressin and angiotensin II are released due to decreased circulating volume which is caused by above mention disorders

[5] The following factors contribute to hyponatremia:

- The antidiuretic effect of vasopressin on the kidneys
- Direct impairment of renal water excretion by angiotensin II
- Decreased GFR

- Stimulation of thirst by angiotensin II

Based on serum sodium concentration

1.**Mild Hyponatremia(130-135mEq/l)**

Its mainly asymptomatic or associated with minor changes in physical and mental functions.

2.**Moderate Hyponatremia(125-129meq/L)**

It includes symptoms such as: nausea, delirium, headache

3.**Severe Hyponatremia(<124meq/L)**

It includes symptoms like vomiting, seizures, coma, somnolence, cardio respiratory arrest.

Based on duration of symptoms

Acute Hyponatremia (≤ 48 hrs.)

It leads to: seizures, delirium, increased mortality risk, cerebral edema with herniation, neurogenic pulmonary edema. Rapid correction well tolerated.

Chronic Hyponatremia (> 48 Hrs.)

It leads to nausea, vomiting, fatigue, neurological dysfunction, gastro-intestinal disturbances and seizures. Its sensitive to sodium correction rate. Aim to increase sodium by 10%

ETIOLOGY

Excess fluid intake
Excess fluid intakes lead to fluid over load, which in turn increases extra cellular fluid level and causes the dilution of sodium level result in hyponatremia.
GI fluid loss

GI fluid loss mainly occurs due to vomiting and diarrhoea . In this condition there will be depletion of sodium and water, were sodium deficit is more.
SIADH
In this condition an endogenous source of vasopressin promotes water retention by the kidney in the absence of an appropriate physiological stimulus[1]

Hypothyroidism

Diminished ability of a kidney to excrete free water fails to produce maximum urine dilution leading to water retention with consequent hyponatremia.

Congestive cardiac failure

Here hyponatremia is mainly occurred due to an increase in activity of arginine vasopressin. It increases the renal free water reabsorption, increase in blood volume which led to dilution of plasma sodium

CKD

For patients with CKD there is more chance for fluid overload as kidneys fails to eliminate excess fluid from body which causes hyponatremia. Hyponatremia can also occurs due to reduced capacity of kidney to dilute or concentrate the urine

Cirrhosis

For cirrhosis patient there is an abnormality in body fluid homeostasis . In cirrhosis condition there will be an impairment in renal ability to eliminate solute free water.

Medications

Hyponatremia can occurs as a result of certain drugs,it includes: NSAIDS,PPI,SSRI,diuretics,antidepressants, antiepileptics, ACE Inhibitors, heparin, desmopressin, antipsychotics and antibiotics

MANAGEMENT OF HYPONATREMIA.

The management of hyponatremia depend upon its severity, etiological factors, presence of symptoms, rate of development &its duration.

It **includes management of acute hyponatremia/symptomatic hypotonic hyponatremia** (<48hrs); usually its seen in marathon runners, patients with primary polydipsia. There is a chance to increase the risk of brain herniation in acute hyponatremia. There are signs of cerebral edemas as convulsions or obtundation, sodium levels should be restored rapidly to normal by infusion of hypertonic (3%) sodium chloride. Latest treatment approach includes, giving a bolus of 100ml 3% Nacl IV over 10min& repeated up to 3 doses until acute symptoms and signs reduced. Raise the serum sodium by 4 to 6 mmol/L to prevent herniation.

CHRONIC HYPONATREMIA (>48hrs):it can be symptomatic and asymptomatic. If it is symptomatic such as seizures, confusion then it is treated with anti-convulsant medication &adequate ventilation. In case of severe (where serum sodium concentration is below 125mEq/l) then 3%Nacl is recommended.

Rapid correction of hyponatremia leads to demyelination, which means an abrupt increase in extracellular osmolality can lead to water shifting out of neurons, abruptly reducing their volume & causing them to detach from their myelin sheaths [1] results in osmotic demyelination syndrome (ODS). And it leads to structural &functional damage to midbrain structures. The rate of sodium correction should not exceed than 10mmol/L in 24 hrs. in case of chronic asymptomatic hyponatremia.

HYPOVOLEMIC HYPONATREMIA:

The sodium loss correction is by administration of 0.9% NaCl. usually 3% Nacl is not recommended. In patients with GI loss also involve this therapy.

In patients with CSWS (cerebral salt wasting syndrome-an endocrine condition in which there is decrease in blood sodium concentration &dehydration due to trauma or tumors ,0.9% Nacl is given & 3% Nacl is recommended.

In drug induced hyponatremia (thiazides)stop the medication.

Hypovolemic hyponatremia should not be treated with vaptans.

HYPERVOLEMIC HYPONATREMIA

This condition is usually formed in patients with CHF & cirrhosis.

Water restriction is the mainstay of therapy. cirrhosis may need severe water restriction (<750ml/day) which is difficult [3] .

Mostly loop diuretics are preferred.

The other therapies which gives for CHF patients are ACE inhibitors, beta adrenergic antagonists.

Vaptans are a better choice to treat hypervolemic hyponatremia.

The recommended doses are:

- Initial dose:15mg per oral.
- Maintenance dose: can increase up to 30 mg. should not exceed 60mg per day.

Vaptans (tolvaptan)are only given if the serum sodium is <125mEq/L. Not to exceed 30 days of treatment.

EUVOLEMIC HYPONATREMIA

Treatment is mainly for underlying causes.it includes stroke, hypertension, endocrine disorders.

Vaptans are recommended for euvolemic hyponatremia.

Starting dose of tolvaptan is 15mg as the 1st day & the dose can be titrated up to 30mg to 60mg at 24hr intervals. If serum sodium remains <135mmol/L or the increase in serum sodium is 25mmol/L in previous 24hr. [4] .

Patients with mild symptoms (e.g.; dizziness, forgetfulness, gait disturbances) be treated with less aggressive therapy [3].

Based on urine to serum electrolyte ratio:

If less than 0.5-fluid restriction

If greater than 1-along with fluid restriction salt tablets and loop diuretics can give.

Introduction of vasopressin antagonist and fluid restriction is not needed

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