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Sodium Disturbances in Neurocritically Ill Patients

Essay Submitted in Partial Fulfillment for Master Degree
in General Intensive Care

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Abstract

Introduction: Sodium is the predominant cation in the extracellular fluid (ECF) and helps control of blood pressure and regulates the function of muscles and nerves. The normal serum sodium concentration is between 135 to 145 mEq/L. Sodium disturbances are frequent and serious complications in neurocritically ill patients. Hyponatremia is commonly defined as plasma sodium concentration less sthan 135 mEq/L . It typically develops in the context of an underlying disruption of free water elimination, usually as a result of syndrome of inappropriate anti-diuretic hormone secretion (SIADH), cerebral salt wasting syndrome (CSWS) or renal failure.

Aim of the work: This work is aiming to spot a light on sodium disorders in neurocriticaly ill patients and its impact on mortality and morbidity in these patients.

Summary: Disorders of sodium and water homeostasis are common in critically ill neurologic patients. A high index of suspicion should therefore be maintained in this patient group. Proper management necessitates an accurate diagnosis of the type of dysnatremia. Multiple combined mechanisms are common and must be identified. Reduction of P-[Na+]/plasma tonicity in hypernatraemia is important, but should not exceed 10 mmol/l/day to reduce the risk of rebounding brain oedema.

Keywords: Sodium, Neurocritically, CSWS, SIADH

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Contents

List of Abbreviations

ADH	Anti Diuretic hormone
AIDS	Acquired Immuno-defficiency Syndrome
ANP	Atrial Natriuretic peptide
AVP	Arginine Vasopressin
Bun	Blood urea nitrogen
CBC	Complete blood count
CDI	Central Diabetes Incipidus
CNS	Central Nervous System
COPD	Chronic Obstructive Pulmpnary disease
CSWS	Cerebral salt wasting syndrome
CT	Computed Tomography
DI	Diabetes insipidus
ECG	Electrocardiogram
ECV	Extracellular fluid volume
GCS	Glusgow coma score
GFR	Glomerular Filtration Rate
ICV	Intracellular Fluid Volume
ISV	Interstitial fluid Volume
K	Potassium
MRI	Magnetic Resonance Imaging
Na	Sodium

NICU	Neuro-intensive care unit
NNICU	Neurologic/Neurosurgical intensive care unit
ODS	Osmotic Demyelination Syndrome
Posm	Plasma Osmolality
SAH	Subarchnoid haemorrhage.
SG	Specific Gravity
SIADH	Syndrome of inappropriate ADH secretion
TBI	Traumatic brain injury
TBW	Total Body Water
TLC	Total leucocytic count
Uosm	Urine Osmolality

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Introduction

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Sodium is the predominant cation in the extracellular fluid (ECF) and helps control of blood pressure and regulates the function of muscles and nerves. The normal serum sodium concentration is between 135 to 145 mEq/L **(Goldman et al. , 2011)**

Sodium disturbances are frequent and serious complications in neurocritically ill patients **(Spatenkova et al., 2013).**

Neurocriticaly ill patients are patients with life-threatening neurological illness that require urgent medical and/or surgical intervention(s) such as postoperative patients, cerebrovascular stroke, traumatic brain/spinal cord injuries, epilepsy, ruptured aneurysms and neurological infections **(Rimawi, 2013)**.

Sodium homeostasis is done by various physiological mechanisms regulate sodium intake and output. These processes achieve acute and chronic sodium regulation by simultaneous or sequential changes which take place by activity of salt appetite center and kidneys **(Patel, 2009).**

Hyponatremia is commonly defined as plasma sodium concentration less than 135 mEq/L . It typically develops in the context of an underlying disruption of free water elimination, usually as a result of syndrome of inappropriate anti-diuretic hormone

secretion (SIADH) , cerebral salt wasting syndrome (CSWS) or renal failure **(Rudolph et al., 2009).**

Hypernatremia is defined as plasma sodium concentration more than 150 mEq/L and common occurrence in elderly patients **(Michelis, 2009)**.

Hypernatremia may delveop either due to an excess fluid loss, inadequate fluid intake or sodium excess. Sodium excess is usually caused by renal failure or drug therapy. Other causes of hypernatremia include: diarrhea, vomiting, burns, sweating, diabetes insipidus, osmotic diuresis and primary hyperaldosteronism**(Spatenkova et al., 2013)**.

Hypernatremia was shown to be a significant predictor of neurological intensive care unit mortality compared to hyponatremia but not a predictor of bad outcome upon discharge **(Spatenkova et al., 2013)**.

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This work is aiming to spot a light on sodium disorders in neurocriticaly ill patients and its impact on mortality and morbidity in these patients.

Chapter I

Normal Sodium Homeostasis