Emergency management of Hyponatraemia (Na^+ <133 mmol/L) in adults

University Hospitals of Leicester NHS
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1. Introduction

- Hyponatraemia is present in 30% of inpatients and indicates the severity of underlying disease pathology. Treatment should be disease-specific if patient is stable.
- It's primarily a disorder of water balance, therefore fluid management is pivotal.
- The aetiology can be multi-factorial so consider each individual cause in parallel.
- **Classification** of hyponatraemia:

Based on severity of symptoms:

Moderately symptomatic

- **Nausea without vomiting**
- **Confusion**
- **Headache**

Severely symptomatic

- **Vomiting**
- **Cardio-respiratory distress**
- **Deep somnolence**
- **Seizures**
- **Coma (GCS <9)**

Based on biochemical degree (mmol/L)

Mild: Na^+ 130-133
Moderate: Na^+ 125-129
Profound: Na^+ <125

Based on duration of onset

Acute: ≤ 48 hours
Chronic: >48 hours

Based on Se Osmolality (mmol/L)

Hypotonic: <275 – Most common (>98%)
Isotonic : 275 - 295
Hypertonic: >295

- Majority of hyponatraemia is **Chronic** and usually asymptomatic.
- Asymptomatic hyponatraemia at admission should be considered as **Chronic.**
- Symptoms are determined by the biochemical degree, rate of onset & co-morbidities.
- It is critical to undertake **SAFE FLUID MANAGEMENT** to prevent potentially fatal **Cerebral oedema** and **Osmotic demyelination syndrome**.
- Rapid onset hyponatraemia may cause brain swelling (cerebral oedema).
- Rapid correction may cause sudden brain shrinkage and osmotic demyelination.
- Never give hypertonic saline without senior input or in an inappropriate setting.

Cerebral Oedema	vs	Osmotic Demyelination Syndrome
A sudden solute drop in sodium can result in water moving into brain cells causing cerebral oedema & increased intracranial pressure. This can cause seizures, loss of consciousness & death.		Over-correction of Na (>10 mmol in 24 hrs) can potentially cause rapid brain shrinkage & breakdown of myelin sheaths, leading to osmotic demyelination. This can cause irreversible neurological deficit.

2. Scope

This guideline is intended for all UHL clinicians managing adult patients with hyponatraemia (including Emergency Department Clinicians)

3. Management of Hyponatraemia: Flow charts1 (acute) & 2 (chronic)

Management of Acute Severe Hyponatraemia in adults *(Flow chart 1)*

To be managed with involvement of SpR grade or above

Hyponatraemia (Serum Na^+ <133 mmol/L)

Acute ≤ 48h in onset, Chronic ≥ 48h; Mild:130-133, Moderate:125-129, Profound:<125

Investigations:
- Serum Osmolality
- Urine Osmolality & Urine Na^+
- U&E, LFT, Glucose, TFTs, Cortisol

Exclude non-hypotonic hyponatraemia (diluted sample, hyperglycaemia, hyperlipidaemia, Mannitol, post-TURP)

Confirm Hypotonic Hyponatraemia (Serum Osm <275 mmol/L)

Presence of Severe symptoms?

- Vomiting
- Cardio-respiratory distress
- Deep somnolence
- Seizures
- Coma (GCS <9)

Yes

No → **Refer to Chronic Hyponatraemia pathway (Flow chart 2)**

- Involve SpR grade or above & Critical Care
- **Consider 150ml 2.7% Hypertonic Saline (HTS) bolus (preferably via syringe driver) over 20 min** via large vein **irrespective of aetiology**
- **Consider Level 2/3 care setting** (Resus/HDU/ACB) **with established escalation plan/ceiling of care**

Relative Contraindications for HTS
- Excess alcohol use
- Hypokalaemia (K<2.8 mmol/L)
- Malnutrition & BMI <18
- Liver disease
- Thiazide use

Check VBG Na/Se Na^+: 2nd HTS bolus is rarely required; consider only if severe symptoms persist (e.g. seizures) after Senior input

Involve ITU/Endocrinology if no response or persistently symptomatic despite Na^+5 mmol/L increase

Follow-up management after 5 mmol/L rise in Na^+
- **Stop HTS & give IV 0.9% normal saline at minimum rate**
- **Start diagnosis specific treatment & involve Physicians**
- **Limit Na^+ rise to 10 mmol in 24h,18 mmol in 48h**
- **Check Na^+ 6 & 12 hourly; CT head if severe symptoms persist**

Management of over correction of Na^+

Rise of >10 mmol/L in 24h or >18 in 48h
- **Stop HTS or other IV fluids**
- **Involve experienced Clinician or Endocrine team**

- Most hyponatraemia patients **DO NOT** need emergency correction with HTS.
- If hypotensive, fluid resuscitation overrides any risk of worsening of hyponatraemia.
- If still symptomatic after Na+ rise, consider CT head & rule out other causes.
- Severe risk of Osmotic demyelination: Alcoholism, Hypokalaemia, BMI<18, thiazide use etc

Management of Chronic Hyponatraemia in adults *(Flow chart 2)*

Hyponatraemia (Se Na^+ <133 mmol/L)

Acute <48h in onset, Chronic >48h; Mild:130-133, Moderate:125-129, Profound:<125

↓

Confirm Hypotonic Hyponatraemia (Se Osm <275 mmol/L)

↓

Presence of Severe symptoms?

No ↓

Mild symptoms or asymptomatic

↓

Urine Osmolality

<100 mOsm/kg ↓

- Primary Polydipsia
- Inappropriately excess IV fluid
- Low solute intake

Rx: Reduce excess fluid intake

> 100 mOsm/kg ↓

Check volume status

BP, pulse, mucous membranes, JVP, Oedema, ascites, Pulmonary congestion consider point of care ultrasound (POCUS).

↓

Hypovolaemic (ECF reduced) ↓

Ur Na < 30 ↓

- Diarrhoea & Vomiting (GI loss)
- Third space loss
- Previous diuretic use

Rx: IV fluids & stop diuretics

Ur Na > 30 ↓

- Hypoadrenalism-call Endocrine SpR
- Vomiting
- Renal salt wasting
- Cerebral salt wasting
- Diuretics

Rx: IV fluids & stop diuretics

Euvolaemic (ECF normal) ↓

Ur Na > 30* ↓

Diuretics or kidney disease?

No ↓

- SIAD – most common
- ACTH deficiency
- Diuretic use

SIAD: Never diagnose SIAD before excluding low cortisol level (see 4.)

Rx: <1 L Fluid restriction
Stop offending agents
Rule out cancer and intracranial lesion
Refer to Endocrine SpR if resistant hyponatraemia
Tolvaptan rarely used but must allow free fluids if given

Yes ↓

Consider all other causes

Hypervolaemic (ECF expanded) ↓

Ur Na >30 ↓

Diuretics AKI

Ur Na < 30 ↓

- Heart failure
- Liver failure/cirrhosis
- Nephrotic syndrome

Rx: Treat underlying organ failure cause in liaison with renal/liver/cardiology
Fluid restriction helps

Sodium correction interventions unhelpful as hyponatraemia likely a reflection of disease severity

Yes ↓

Refer to Acute Severe Hyponatraemia pathway in *page 2* (Flow chart 1)

- The primary responsibility remains under the admitting specialty as hyponatraemia management is cause specific.
- **Treat underlying cause in liaison with Renal / Liver/ Cardiology teams for organ failure hyponatraemia.**
- Remember that confusion is common in elderly & alcohol withdrawal patients, hyponatraemia may be incidental.

* If Euvolaemic & Urine Na <30, please explore causes of Hyper/Hypovolaemia.

4. Syndrome of Inappropriate Anti-Diuresis (SIAD)

- Clinically Euvolaemic hyponatraemia caused by an absolute increase of body water secondary to excess intake in presence of impaired free water excretion.
- Either due to inappropriate release of Arginine Vasopressin (AVP) or due to low intake of solutes.
- Can mimic Hypoadrenalism (Addison's, Adrenocorticotropic hormone {ACTH} deficiency)- exclusion is essential before diagnosis.
- It is important to investigate underlying aetiology of SIAD such as malignancy, intracranial lesion etc, & treat accordingly.

Diagnosis of SIAD

Essential criteria

- **Se Osm <275**
- **Ur Osm >100**
- **Ur Na >30**
- **Clinical Euvolaemia**
- **No recent diuretics**
- **Normal thyroid, adrenal, pituitary and renal function**

Supplemental criteria

- **Se Urea <3.6 mmol//L**
- **Failure to correct Na^+ after 0.9% Normal saline**
- **Correction of Na^+ upon fluid restriction**

Causes of SIAD

- **Cancer:** any malignancy but lung cancer is most common.
- **Pulmonary:** Pneumonia, TB, Abscess/Empyema, Respiratory failure etc.
- **CNS:** Subarachnoid haemorrhage, Subdural haematoma, brain tumour, head trauma, Meningitis etc
- **Drugs: Many drugs result in SIAD, so best to check on BNF on individual drug side effect**. Most commonly incriminated are anti-convulsants (Carbamazepine), anti-depressants (SSRIs, Amitriptyline etc), anti-psychotics, Desmopressin etc.
- **Others:** Hereditary(rare), exercise, stress, pain, general anaesthesia, Idiopathic, transient etc

5. FOOTNOTE

- **Pseudohyponatraemia (rare):** Hyperlipidaemia or hyperproteinaemia can interfere with Na measurement- will not cause cerebral oedema. Venous blood gas can reveal accurate Na^+ level, as true osmolality is usually normal.

6. Monitoring compliance

Adherence to the guidelines in patients with Hyponatraemia should be monitored every 3 years by an audit, with input from Endocrinology, Chemical Pathology and Emergency departments.

7. References & key web links

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8. Key words

Hyponatraemia, SIAD, Hypertonic saline, Adult patient, management.

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