Joint Trust Guideline for Inpatient Management of Hyponatremia

A Clinical Guideline

For use in:	All clinical areas
By:	All Health Care Professionals
For:	All adult patients (more than 16 years old) in Norfolk and Norwich Hospital
Division responsible for document:	Medical (NNUH)
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If Yes - does the strategy/policy deviate from the recommendations of NICE?	N/a

Contents

1. Treatment algorithm

2. Objectives

- To optimise and unify management of patients with hyponatremia 130mmol/L.
- To reduce in-patient hospital stays attributable to hyponatremia.
- To reduce risk of osmotic demyelination from rapid correction of hyponatremia.
- To reduce perioperative complications attributable to hyponatremia.

3. Rationale

- Hyponatremia (Serum sodium <135 mmol/L) is a common electrolyte disorder affecting 15- 30% of hospital admissions. It is common in older patients with multiple co-morbidities.
- Overall hyponatraemia is associated with increased morbidity and mortality (Odds ratio of death 1.47 during admission, 1.38 at 1 year and 1.25 at 5 years) as well as increased length of hospital stay irrespective of the cause of admission. It is also an important cause of delayed discharge.
- Inappropriately rapid correction of hyponatraemia can cause osmotic demyelination which can result in permanent neurological deficits and even death.

4. Broad recommendations

- Assessment of volume status and establishing the cause and duration of hyponatremia are essential to guide emergency management.
- In patients with asymptomatic, chronic mild hyponatremia 125-135mmol/L no further investigation or treatment may be required. These patients do not usually require admission and should be referred back to their GP +/- consider endocrine/renal referral.
- These guidelines refer to patients with symptoms and a serum sodium <130mmol/L, or asymptomatic patients with marked hyponatremia <125mmol/L.
- Patients with severe hyponatremia <120mmol/L, those with rapid onset hyponatreamia and those with neurological impairment are at very high risk and should be considered for HDU admission.
- Rehydration should be the mainstay of people with hypovolaemia and hyponatreamia.
- Fluid restriction should be the main stay of treatment for all other causes of hyponatremia.
- The rate of correction of hyponatremia should generally be a rise of 6-9mmol/L/24 hours but never exceed 12mmol/L/24 hours due to the risk of sudden osmotic shift and demyelination.

5. Assessment

5.1. History

Vomiting, diarrhoea, fever, polyuria, rigors, or other indicators of infection, as well as poor oral intake all make hypovolaemia likely as the cause of hyponatraemia. Thirst usually indicates hypovolaemia but needs to be distinguished from a dry mouth and habitual over drinking.

Recent surgery makes dehydration more likely, but recent use of IV fluids makes iatrogenic hypervolaemia more likely.

Diuretics, ACE inhibitors make renal sodium loss likely. These drugs should be stopped in most cases of hyponatremia. Carbamezapine and multiple other drugs (section 11, appendix 1) increase the possibility of SIADH and should also be stopped in most cases.

Gradual onset lethargy and mild confusion in a patient who has been drinking well and has no obvious cause of fluid loss make SIADH more likely.

5.2. High Risk patients

- Postoperative patients.
- Diuretic use.
- Alcohol excess.
- Malnourished patients.
- Psychogenic polydipsic patients.
    - Older patients or those with multiple comorbidities and multiple medications.
- Burns patients.

6. Examination

- No single examination finding is particularly sensitive or specific but it is vital to assess volume status to guide emergency management.
- Assess pulse, blood pressure, postural blood pressure, skin turgor, and for signs of peripheral oedema to help determine whether the patient is hypovolaemic or not, and take these signs in conjunction with the clinical history to establish whether the patient is likely to be hypovolaemic or not.

7. Management

Patients with a history strongly suggestive of dehydration with supportive clinical signs should receive fluid resuscitation with 0.9% sodium chloride (normal saline). The amount and rate of normal saline depends on haemodynamic status and degree of dehydration.

Where the clinical assessment is unclear, and the patient is not taking interfering drugs e.g., diuretics, urine sodium can be helpful. Urine sodium <30mmol/L strongly supports sodium and water depletion as the cause of hyponatremia. Urine sodium >30ml/l suggests excess body water: SIADH, or rarely cerebral salt wasting (typically affecting patients with acute brain injury or post neurosurgery only).

Repeat assessment of serum sodium and potassium will be necessary within 4 hours where large volumes of fluids have been administered, or 12-24 hourly in other cases and in case of development of hypokalaemia.

The sodium content of commonly used iv fluids is listed in appendix 2.

7.1. Euvolaemic hyponatremia

- **Stop interfering drugs** in most cases e.g. diuretics, ACE inhibitors and proton pump inhibitors. Consider stopping other drugs that may be associated with SIADH though this is often not appropriate or possible e.g. anti-epileptics (see appendix 1 for list of drugs implicated in hyponatremia).
- If the patient is not taking diuretics (or ACE inhibitors), **send a urine sodium**. Levels <30ml/l suggest that the patient is in fact hypovolaemic. Reassess the patient and consider whether they in fact require fluid replacement.
- **Send paired urine and serum osmolalities** to confirm SIADH if this is suspected.
- **Send blood tests to confirm the diagnosis: thyroid function, cortisol, glucose and lipids.** TSH should be tested in all cases, as well as TSH and free thyroxine if pituitary disease or the sick euthyroid syndrome is suspected. Send a random cortisol on admission in the very unwell patient, a 9am cortisol the next morning or a Synacthen test in the stable patient. Check blood glucose on admission in all patients (finger prick on admission) and lipids and liver function the next morning. This is to rule out factitious hyponatremia caused by hyperglycaemia. Every 5.5mmol/L increase in serum glucose will drop the serum sodium by 1.6mmol/L. Treatment of the hyperglycaemia will correct the sodium and no specific treatment for the hyponatremia is required.
- If the patient is clinically assessed to be euvolaemic, start **fluid restriction to 1 litre.** Tighter restrictions to 750mL/24 hours will be appropriate at presentation in some cases, particularly when chronic fluid intake is thought to be low, if the urine osmolality is already higher, and with patients of low body mass.
- **Reassess the serum sodium AND the patient's fluid charts AND the patient's clinical fluid status at 4 hours** if the presenting sodium level was <120mmol/L, or at 12 hours for levels 120-125 or at 24hours 125-130 or sooner if the patient is unwell.
- **Continue to monitor sodium** 2-4 hourly in the unwell patient or those with neurological sequelae, and at least 12 hourly in all other patients until they are obviously improving.
- **If the clinical response is very slow, reassess the patient and their fluid charts, and repeat urinary sodium**. If there is any possibility that the patient is in fact hypovolemic, a trial of 250mL 0.9% sodium chloride solution over 4 hours with a repeat serum and urine sodium may be helpful. A rise in serum sodium indicates that this treatment should continue. A fall in serum sodium and a rise in urine sodium indicates that the patient is retaining the free water and does indeed have SIADH. Continue fluid restriction in this case. If unsuccessful, demeclocycline at a dose of 150mg qds can be tried for short-term use. Renal function should be monitored and it is suggested to wait 3-4 days before dose changes. Patient may need to be considered a single use of selective vasopressin receptor antagonist, Tolvaptan (Non formulary drug) under close monitoring of serum sodium in 2 and 6 hours post dose, in severe cases who do not respond (Na^+ <125 mmol/L) after 48 hours. The dose should be either 15mg or a reduced dose 7.5 mg for patients at risk of overly rapid serum sodium concentration correction.

7.2. Acute onset (<48 hrs), life threatening hyponatraemia with fitting or other neurological deficits

This is a medical emergency. Consider admitting to HDU/ITU.

If patient has seizures or a decrease in their consciousness level attributable to hyponatremia,

- Administer an intravenous bolus of 150mLs of hypertonic sodium chloride solution (2.7%), through an infusion pump over 20 mins. Administration via central venous line recommended to prevent risk of extravasation*
- Check the serum sodium after 20 mins
- Then repeat another infusion of 150mL 2.7% sodium chloride for the next 20 mins.
- Repeat above recommendations twice or until a target of 5 mmol/l increase in serum sodium concentration is achieved.
- This will need frequent sodium monitoring and only in an HDU setting. Initiation of treatment upon urgency in high intensity patient care areas, such as A&E resuscitation bay, AMU acute care bay, should be continued under HDU setting.

Limit the rise of serum sodium concentration to a total of 10 mmol/l during the first 24 hours and an additional 8 mmol/l during every 24 hours thereafter until the target.

Higher concentrations and volumes are occasionally used by specialists under near continuous monitoring but are associated with an increased risk of permanent neurological damage and death.

* Consider peripheral administration through a large bore cannula when timely administration is necessary or central access isn't clinically appropriate. Observe carefully for signs of extravasation.

7.3. Hypervolaemic hyponatremia

Patients with clear signs of fluid overload for example raised JVP, peripheral oedema and pulmonary oedema will have hypervolaemic hyponatremia. In these cases, the underlying disease e.g. congestive cardiac failure or nephrotic syndrome must be identified and treated.

Drugs contributing to hyponatremia may be important in the treatment of the underlying condition e.g. diuretics in heart failure, and so must be assessed on an individual patient basis.

Salt and water restriction, and serum sodium monitoring should also be implemented as for euvolaemic hyponatremia as above.

7.4. Pre and Perioperative Management of the hyponatremia

- Hyponatremia is also commonly seen in patients who require routine or emergency surgeries. The principle of assessment and management of hyponatremia on those patients should be the same as in general management outline. For specific guidance see algorithm (4.1). Depending on the degree of hyponatremia, assess individual patient (history and examination) with the aim of establishing their volume status.
- With sodium levels between 130 and 135 mmol/L: generally proceed with surgery safely.
- 125-129 mmol/L: Try and identify if the patient is symptomatic from the hyponatremia and whether the hyponatremia is of recent onset. It is the speed of onset of the hyponatremia which usually determines the likelihood of symptoms, with clinical sequelae more likely if the fall in plasma sodium concentration is rapid. Use WebICE or contact the GP who may be able to help with this. If symptomatic and/or onset of hyponatremia is acute, then such patients should be referred to the anaesthetist in pre-operative assessment clinic.
- If the hyponatremia is of a more chronic nature, consider the urgency of the surgery and whether the surgery can be postponed. Review patient's medications and consider advice from the endocrinology/renal team.
- Sodium level less than 125 mmol/L: such patients should be seen by an anaesthetist in pre-operative assessment. All patients with sodium levels of less than 125 mmol/L should be referred to the Endocrinology/renal team. One should be cautious when considering stopping suspected responsible medications and this should be undertaken by senior clinicians with follow-up arranged. Discuss with the consultant surgeon and anaesthetist whether surgery should be postponed.

7.5. Peri-operative management of hyponatremia (quick reference)

8. Clinical audit standards

1. Patients with hyponatremia should have a detailed drug history taken.
2. Patients with hyponatremia should have volume status assessed and documented.
3. Patients with hyponatremia should have a strict intake output check recorded.
4. Patients with a clinical diagnosis of SIADH should have urine and plasma osmolarity measured to confirm the diagnosis.
5. Patients with possible SIADH should have TSH and 9 am cortisol measured.
6. Patients with severe hyponatremia (<125 mmol/L) should have daily U&E.
7. Patients with hyponatremia should not have sodium level corrected by more than 9 mmol/24h.
8. Patients with severe hyponatremia with decreased conscious level, fits or confusion should be managed in HDU.

9. Summary of development and consultation process undertaken before registration and dissemination

The authors listed above drafted this guideline on behalf of Directorate of Endocrinology which has agreed the final content. During its development it was has been circulated for comment to the directorates of Diabetes and Endocrinology, renal medicine, intensive care, medicine for the elderly, department of anaethesia and pharmacy. This version has been endorsed by the Clinical Guideline Assessment Panel.

10. Distribution list/ dissemination method

All Nursing Policies and Guideline folders and Trust Intranet.

11. References

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Appendix 1: Causes of hyponatremia

<table>
<tr><th>Hypovolemic hyponatremia</th><th>Euvolemic hyponatremia</th><th>Hypervolemic hyponatremia</th></tr>
<tr><td>Renal loss
Diuretic therapy
Cerebral salt wasting
Adrenocortical insufficiency
Salt wasting nephropathy</td><td rowspan="8">SIADH*
Drugs: (not complete list)
SSRI
Carbamazepine
Desmopressin
Phenothiazines
Tricyclic antidepressants
Cyclophosphamide
Opioids
Vincristine
NSAIDS
Clofibrate
Proton pump inhibitor

Pulmonary causes:
Pneumonia
Pulmonary abscess
Tuberculosis

Neoplastic:
Small cell lung cancer
Lymphoma

CNS:
Meningitis
Stroke
Tumours

Post operative pain</td><td>Congestive Cardiac failure</td></tr>
<tr><td>Extra renal loss
Diarrhoea
Vomiting
Excessive sweating</td><td>Liver cirrhosis</td></tr>
<tr><td rowspan="6">Third space loss:
Small bowel obstruction
Pancreatitis
Burns</td><td rowspan="6">Nephrotic syndrome</td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
<tr><td>Adrenocortical insufficiency</td></tr>
<tr><td>Hypothyroidism</td></tr>
<tr><td>Primary polydipsia</td></tr>
</table>

*** SIADH: Syndrome of Inappropriate antidiuretic hormone**

Appendix 2: Commonly used IV fluids and sodium content

0.9% sodium chloride solution (normal saline)	154 mmol/L
5% glucose	0 mmol/L
Compound sodium lactate solution (Hartmann's solution)	131 mmol/L (+5mmol/L Potassium)
0.18% sodium chloride and 4% glucose	30 mmol/L