



GUIDELINES AND AUDIT  
IMPLEMENTATION NETWORK

# HYPONATRAEMIA IN ADULTS (ON OR AFTER 16TH BIRTHDAY)

February 2010



## FOREWORD

Hyponatraemia in adults (on or after 16th birthday).

These guidelines have been published by the Guidelines & Audit Implementation Network (GAIN), which is a team of health care professionals established under the auspices of the Department of Health, Social Services & Public Safety in 2008. The aim of GAIN is to promote quality in the Health Service in Northern Ireland, through audit and guidelines, while ensuring the highest possible standard of clinical practice is maintained.



This guideline was produced by a sub-group of health care professionals from varied backgrounds and was chaired by Professor Ian Young, Consultant in the Belfast HSC Trust.

GAIN wishes to thank all those who contributed in any way to the development of these guidelines.

A handwritten signature in black ink that reads "Tom Trinick". The signature is written in a cursive, flowing style.

**Dr T Trinick**

Chairman of GAIN





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## INTRODUCTION

Hyponatraemia is a disorder of sodium and water metabolism and is the most common electrolyte abnormality in hospitalised patients.

It is defined as a serum sodium concentration below 135mmol/L. Water balance is regulated by antidiuretic hormone (ADH), renal medullary concentrating ability and thirst.

Hyponatraemia usually results from retention of water secondary to impairment in free water excretion, although it may also result from sodium loss in excess to water loss.

It can cause morbidity and mortality and incorrect treatment can lead to additional complications.

## CLINICAL FEATURES

Symptoms associated with hyponatraemia range from lethargy and anorexia to agitation, disorientation, seizures and coma. The symptoms are often initially nonspecific.

Symptoms depend critically on both the rapidity of onset and severity of hyponatraemia.

Acute onset of hyponatraemia may cause cerebral oedema and requires prompt diagnosis and correction.

An osmotic demyelination syndrome may occur with inappropriate fluid correction resulting in rapid change in serum sodium concentration in persons with either acute or chronic hyponatraemia.



## PATIENTS AT GREATER RISK

- Postoperative patients
- Alcoholics
- Malnourished patients
- Psychiatric polydipsic patients
- The elderly
- Hypovolaemic patients
- Burns patients

The risk of hyponatraemia among elderly people is compounded by chronic disease and the concurrent use of certain medications.



## PREVENTION OF HYPONATRAEMIA

A strategy for prevention of hyponatraemia in hospital practice should include consideration of the following fluid management principles.

1. Any parenteral fluid therapy plan should proceed systematically on the basis of a:-
  - haemodynamic check for the presence of shock followed by treatment if necessary.
  - correction of any fluid deficit.
  - maintenance fluid regimen.
2. Using an oral or enteral fluid therapy regimen should be considered prior to instituting intravenous treatment. Intravenous fluid therapy should be discontinued as soon as possible and practical.
3. Prescription of fluid (oral, enteral or parenteral) should take into account the age, weight and physical condition of a patient. If necessary, and especially when conditions exist that might favour the development of hyponatraemia, consideration should be given to prescribing fluids on a mls/hour or even mls/kg/hour basis. The decision of when to use these techniques should be made pragmatically.
4. Care should always be taken when prescribing hypotonic fluids with a sodium content of less than 135mmol/L e.g. glucose 5%, sodium 0.18% with glucose 4%, sodium chloride 0.45%.
5. Monitoring of patients when receiving parenteral fluids should include clinical assessments and glucose, electrolytes and urea measurements at least daily. Patients at risk of hyponatraemia (or any electrolyte disturbance) may need closer and more frequent monitoring. Ill patients might require closer monitoring with measurements every 2 – 4 hours, especially after the administration of hypertonic saline.

6. Input/output fluid balance charts should be designed in such a way that they enable the prescription, administration and monitoring of fluid therapy to ill patients at risk of hyponatraemia as well as the healthy patient e.g. including guidelines for infusion fluid selection; methods for calculating infusion fluid requirements; and a record of essential monitoring data such as a patient's weight and blood electrolyte levels.

## SIGNS & SYMPTOMS

Signs and symptoms of hyponatraemia are primarily related to dysfunction of the central nervous system. Cerebral oedema can occur and early manifestations of hyponatraemia include:

- Anorexia
- Nausea
- Lethargy
- Apathy

More advanced signs and symptoms include:

- Disorientation
- Agitation
- Seizures
- Depressed reflexes
- Focal neurological deficits
- Cheyne-Stokes respiration
- Coma

Clinical manifestations of hyponatraemia correlate with the serum sodium concentration and more importantly with **how rapidly the condition develops**.

Symptoms depend critically on rapidity of onset and the severity of hyponatraemia.

Acute symptomatic hyponatraemia can cause cerebral oedema and usually requires rapid correction.

Chronic hyponatraemia, if corrected too quickly, may cause osmotic demyelination.



## DIAGNOSIS

A comprehensive history, examination and laboratory investigations are necessary to determine the cause and guide therapy.

The history should focus on medicines, recently prescribed intravenous fluids, vomiting, diarrhoea and associated disease states.

The examination should focus on volume status including assessment of postural changes in pulse and blood pressure, the level of the jugular venous pressure and the presence or absence of oedema or clinical signs of dehydration.

The laboratory evaluation should include serum and urine osmolality, urine sodium concentration, renal and liver function tests. Glucose, thyroid and adrenal function tests should be ordered if clinically indicated.

## TREATMENT PRINCIPLES

### **Asymptomatic Patients**

The focus of therapy should be directed to identifying and treating the cause of the hyponatraemia.

In HYPOVOLAEMIC states (see flow diagram) restoring fluid volume with normal saline will inhibit ADH secretion and facilitate correction of hyponatraemia.

In HYPERVOLAEMIC states (see flow diagram) attention is directed towards treatment of the underlying condition, along with restriction of fluid and sodium intake.

Some ISOVOLAEMIC patients have the syndrome of inappropriate antidiuretic hormone (SIADH), where hyponatraemia develops in the absence of renal, thyroid, adrenal, pituitary disease or diuretic use. SIADH patients often have low serum uric acid and urea. Laboratory evaluation shows a low serum osmolality ( $< 275$  mOsmol/Kg) with an inappropriately concentrated urine ( $> 100$  mOsmol/kg). Fluid intake should be restricted and the underlying cause should be addressed.



## TREATMENT STRATEGIES

### Symptomatic Patients with Isovolaemia

This group is divided into two depending on the perceived rapidity of onset of hyponatraemia.

#### Acute Onset (<48 hrs)

- Restrict fluid and stop offending drugs and hypotonic fluids.
- If the patient has significant clinical symptoms attributable to hyponatraemia (for instance, seizures or loss of consciousness), give an initial i.v. bolus of 200 mls HYPERTONIC saline (2.7%) over thirty minutes. Consider co-administration of 20mg i.v. furosemide if there is any evidence of fluid overload.
- Aim to raise the serum sodium by 1 to 2 mmol/L per hour in the first 2-3 hours until symptoms resolve. The serum sodium concentration should not increase by more than 12 mmol/L in a 24 hour period. The formulae on the following page may be used as a guide, although they are not a substitute for careful monitoring and adjustment of treatment on an individual basis.
- **It is mandatory to measure the serum sodium concentration at least every 2-4 hours following the administration of hypertonic saline to ensure compliance with the guidelines.**
- **Raising the sodium levels too rapidly may cause harm.**

## Chronic Onset (>48 hrs)

**If hyponatraemia is of chronic onset patients are unlikely to have significant clinical symptoms attributable to low sodium.**

- Restrict fluid and stop offending drugs and hypotonic fluids.
- In chronic hyponatraemia administration of hypertonic saline will only be required in exceptional circumstances and the decision should be made by an experienced clinician.
- Treat according to the treatment principles described and aim to raise the sodium levels slowly by 0.5 to 1.0 mmol/L per hour to a maximum of 12 mmol/L in a 24 hour period.
- **It is mandatory to measure the serum sodium concentration at least every 2-4 hours following the administration of hypertonic saline to ensure compliance with the guidelines.**
- **Raising the sodium levels too rapidly may cause harm.**



## INFUSION GUIDELINES

Formulae should only be viewed as a guide and should not be used as a replacement for clinical judgment. In clinical practice, the predictive accuracy of formulae is limited. Formula-based prescription of fluid has been associated with inadvertent overcorrection of serum sodium concentration.

### **Formulae (only apply to 1L infusate bags)**

$$\text{Change in serum [Na}^+ \text{]} = \frac{\text{Infusate [Na}^+ \text{]} - \text{Serum [Na}^+ \text{]}}{\text{Total body water} + 1}$$

### **Clinical Use**

To estimate effect of 1 litre of infusate on serum on serum [Na<sup>+</sup>]

$$\text{Change in serum [Na}^+ \text{]} = \frac{\text{Infusate [Na}^+ \text{]} + [\text{K}^+] - \text{Serum [Na}^+ \text{]}}{\text{Total body water} + 1}$$

To estimate effect of 1 litre of infusate containing Na and K on serum [Na<sup>+</sup>]

Total body water is 0.6 and 0.5 of body weight (kg) in non-elderly (<65 yrs) males and females, and 0.5 and 0.45 in elderly (>65 yrs) males and females respectively.

2.7% sodium chloride = 462mmol/L Na<sup>+</sup> (hypertonic)

1.8% sodium chloride = 308mmol/L Na<sup>+</sup> (hypertonic)

0.9% sodium chloride = 154mmol/L Na<sup>+</sup>

0.45% sodium chloride = 77mmol/L Na<sup>+</sup> (hypotonic)

5% dextrose = 0 mmol/L Na<sup>+</sup> (hypotonic)



## EMERGENCY ADMINISTRATION OF HYPERTONIC SALINE

In a patient with significant clinical symptoms believed to be due to hyponatraemia (for instance, seizures or loss of consciousness), 200 mls of 2.7% saline should be given immediately as an i.v. bolus over 30 minutes. Consider co-administration of 20mg i.v. furosemide if there is any evidence of fluid overload. This will raise serum sodium by approximately 2 – 4 mmol/L and will reduce cerebral oedema. The assistance of an experienced clinician should be sought to guide further treatment.

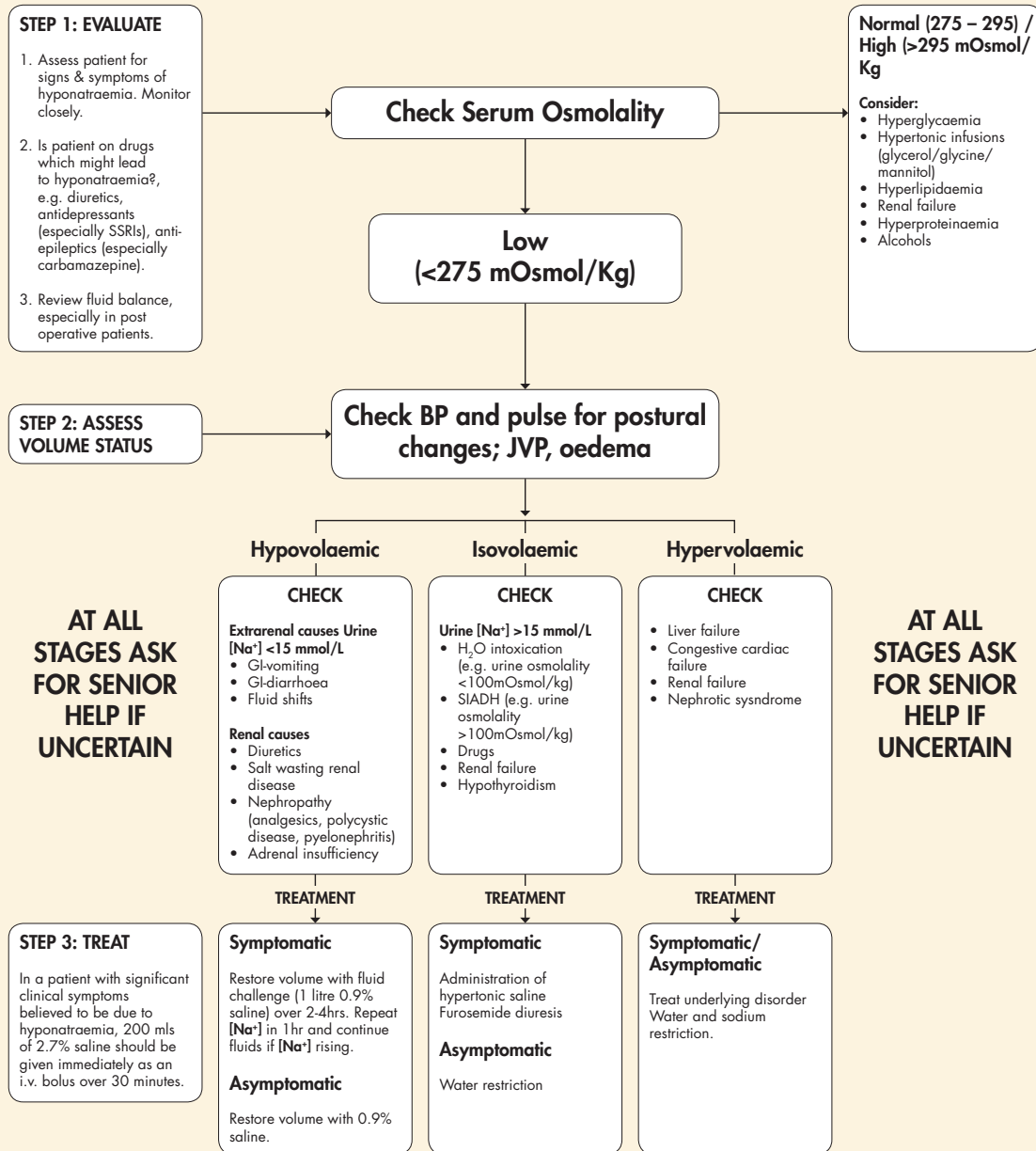
## MONITORING

During treatment monitor:

- Clinical state, such as pulse, blood pressure, anorexia, nausea, lethargy, apathy
- Central nervous system observations
- Fluid balance (this should be reviewed at least daily by an experienced member of medical staff)
- In symptomatic patients or following administering of hypertonic saline, monitoring should be more frequent, i.e. every 2-4 hours.

**When treating hyponatraemia always seek advice from an experienced member of medical staff.**

## HYPONATRAEMIA IN ADULTS (ON OR AFTER 16TH BIRTHDAY) – A DISORDER OF WATER BALANCE WHICH IS POTENTIALLY FATAL



[Na<sup>+</sup>] should not increase by > 12mmol/L in 24 hours

## APPENDICES

### Appendix 1

Membership of the GAIN Sub-Group developing consensus guidelines for Hyponatraemia in Adults (on or after 16th birthday)

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NOTES



## NOTES





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