

Management of Severe Hyponatraemia in a Large Teaching Hospital

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Rationale / Background

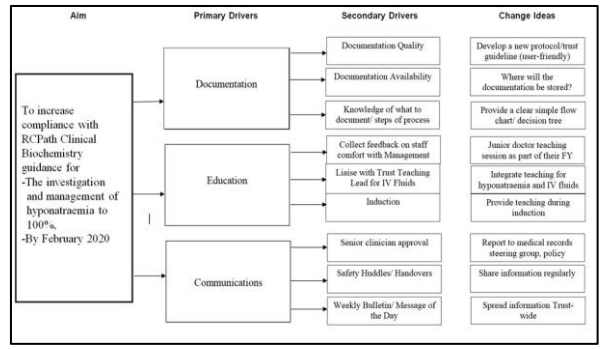
- Hyponatraemia contributes to 15-20% of emergency hospital admissions, and is an independent predictor of all-cause inpatient mortality¹.
- In the context of Covid-19, increasing severity of hyponatraemia is associated with encephalopathy, mechanical ventilation, and decreased probability of discharge home (all p < 0.001)^{2,3}.

Following local governmental body recommendation, a closed loop audit using the Royal College of Pathologists proforma⁴ on hyponatraemia management was completed, as well as a post project questionnaire for feedback on the trust protocol. Cases of suspected Covid-19 infection were sampled in the re-audit.

Measurement Plan⁴

Data collection proforma for the investigation of patients presenting with hyponatraemia					
Hyponatraemia Investigation	Audit standard	Yes	No	Comment	Other comment
Admission sodium clearly documented	100%				
Clinical assessment of volume status clearly documented	100%				
Plan of action on Hyponatraemia documented	100%				
Comments on urine output documented	100% of patients with significant pathology				
When investigations made prior to the commencing	100% for ideal practice; 80% for acceptable practice				
Plasma osmolality measured and urine osmolality measured	100% if pathology uncertain				
Urine sodium measured and sodium measured when hyponatraemia still present	100% if pathology uncertain				
Plasma cortisol measured random when sodium < 125 mmol/L	100% if pathology uncertain				
Thyroid function	Should only be undertaken if three or more signs of abnormality exist. It is the primary cause of hyponatraemia				
Renal pathology correctly assigned	80%				
Increase in sodium concentration	100% - less than 10 mmol per day				
Timing of Urine and Serum Creatinine measurement	100% within an one hour (if more than one hour record time)				

Diver Diagram



Test of Change 1

Collaborate in a multidisciplinary/multispecialty way to design protocol, followed by re-audit

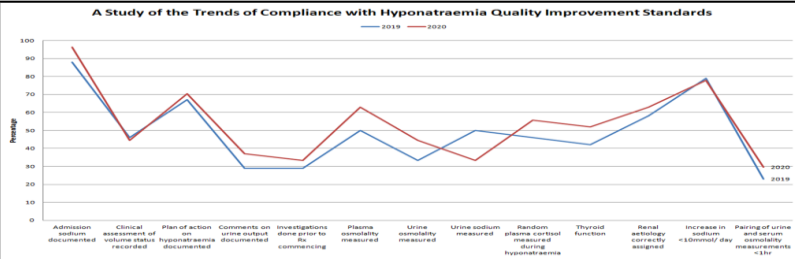
-Use RCPaht proforma
-Set criteria for patient selection
-Aim to present within set deadline

Retrospective data collection of > 20 patients in 2019 and 2020 each from all specialty admissions

- Na <120
- male and female
- >16 yrs old

Examine parameters that need improvement

Results (pre- and post- Protocol Implementation)



Intervention (Trust Protocol)⁵

Acute Management of Hyponatraemia Protocol (adults >16 years of age)

This guideline aims to take the non-specialist through the initial assessment, investigation and treatment of hyponatraemia whilst awaiting the expert opinion of a specialist

Basic Principles:

- Normal adult sodium range is 133-146mmol/L. Hyponatraemia only significant if sodium < 130mmol/L
- Symptoms/signs usually only occur when sodium < 125 mmol/L. Acute hyponatraemia is less well tolerated.
- Hyponatraemia may be acute (<48 hours) or chronic (>48 hours). Treat as chronic if unclear and/or no severe symptoms.
- Review clinical history and undergo full clinical assessment to try to determine the underlying cause of hyponatraemia
- Perform these tests to aid diagnosis: U&Es, glucose, paired serum and urine osmolality, LFTs, TFTs, cortisol, urine Na⁺ and K⁺
- Exclude pseudo-hyponatraemia. Check blood glucose levels (Local assay has no interaction with lipids or proteins).
- Management decisions should be made on the basis of presenting clinical symptoms rather than the degree of hyponatraemia
- Limit rise in sodium in first 24 hours to ≤10 mmol/L and ≤8 mmol/L in each following 24 hours. For high risk patients (malnourished, alcoholism, or hypokalaemia) limit to ≤8 mmol/L and ≤6 mmol/L respectively.
- Hypertonic saline (sodium chloride 2.7%) is restricted for use in severely symptomatic patients only and must be the responsibility of a senior clinician (ST3 and above) with appropriate training and experience

Signs and Symptoms:

- Severe symptoms: vomiting, cardiorespiratory distress (i.e. bradycardia or apnoea), seizures, reduced consciousness/coma (GCS ≤8)
- Moderately severe symptoms: nausea without vomiting, confusion, headache
- Mild: lethargy, fatigue, muscle cramps (mostly asymptomatic)

Flowchart:

Are there any acute and/or severe symptoms of hyponatraemia and serum sodium is <130mmol/L?

- YES:** Treat as a medical emergency. Refer urgently to the acute care team and/or the patient's consultant (in working hours) or on-call ST3+ (out of hours) and discuss transfer to critical care. PRESCRIBE under senior guidance (ST3 and above only): Intravenous sodium chloride 2.7% 150ml over 20 minutes. Give via volumetric infusion utilising Guardrails. MUST be given via a central venous catheter or large peripheral vein. After 30 mins, re-check serum Na⁺ levels. Send urgent sample to the lab.
 - Has serum Na⁺ risen by 5mmol/L?
 - YES:** Re-assess symptoms after 30 minutes. Have symptoms resolved?
 - YES:** Re-check Na⁺ every 4-6 hours and treat as page 2 guidance.
 - NO:** Is serum Na⁺ ≥130mmol/L?
 - YES:** CAUTION: OVER-RAPID CORRECTION OF HYPONATRAEMIA CAN CAUSE OSMOTIC DEMYELINATION SYNDROME. LIMIT RISE IN SODIUM IN FIRST 24 HOURS TO ≤10 MMOL/L AND ≤8 MMOL/L IN EACH FOLLOWING 24 HOURS. (AIM FOR LESS RISE IN HIGH RISK PATIENTS)
 - NO:** Repeat the intravenous infusion of sodium chloride 2.7% 150ml over 20 minutes ONCE ONLY. A MAXIMUM OF 2 INFUSIONS OF 150ML SODIUM CHLORIDE 2.7% SHOULD BE ADMINISTERED.
 - NO:** If serum Na⁺ has failed to rise by 5mmol/L from the initial test or symptoms have not resolved after 1000 infusions of 150ml sodium chloride 2.7%, then the patient MUST be managed on critical care. Patients with on-going symptoms of cerebral oedema should be discussed urgently with critical care (if not previously done).
 - NO:** Check paired serum and urine osmolality and urine sodium concentration to aid diagnosis. **SEPAGE GUIDANCE:** Follow up with senior.

SERUM SODIUM <130MMOL/L WITH MODERATELY SEVERE SYMPTOMS OR ASYMPTOMATIC

Perform the following tests to aid diagnosis: U&Es, glucose, paired serum and urine osmolality, LFTs, TFTs, cortisol, urine Na⁺, urine K⁺. OTHER INVESTIGATIONS AS INDICATED (e.g. short synacthen test, CK, CT head).

Assess circulating volume status and potential cause of hyponatraemia. Start cause specific treatment guided by the available results.

Hypovolaemic	Euvolaemic (Urinary Sodium usually >20mmol/L)	Hypervolaemic
Reduced skin turgor, dry membranes, low BP or postural hypotension. Check Urinary Sodium	Consider causes: 1. Glucocorticoid insufficiency 2. Hypothyroidism 3. Exercise associated hyponatraemia 4. SIADH	Consider causes: 1. Cardiac failure 2. Liver cirrhosis 3. CKD 4. Overhydration
>20 mmol/L 1. Diuretic use 2. Mineralocorticoid deficiency 3. Renal tubular acidosis 4. Salt wasting nephropathies 5. Cerebral salt wasting	>100 mOsm/kg 1. Glucocorticoid insufficiency 2. Hypothyroidism 3. Exercise associated hyponatraemia 4. SIADH	<100 mOsm/kg
Resuscitation fluids according to local protocol (OLI - Clinical Information - IV Fluids - RLHT IV Fluid therapy guideline - Adults) Stop/Withhold diuretics	Stop/withhold drugs which may cause hyponatraemia if appropriate. Investigate SIADH diagnosis and look for secondary causes of SIADH.	Restrict fluid intake to <750-1000mls per day. Management of co-morbidities.

CAUTION: ELECTROLYTE FREE WATER BALANCE using FURTHER SODIUM

If the patient's fluid status is unclear: Give a therapeutic trial of intravenous sodium chloride 0.9% 1litre over 12 hours and recheck Na⁺ after 6 hours. If hypovolaemic, Na⁺ should increase. Patients with SIADH will not improve or may worsen - discontinue fluids if so.

Drug Causes of SIADH (Syndrome of Inappropriate Anti-Diuretic Hormone secretion):

- Antidepressants: SSRIs, Tricyclics, MAOIs
- Anticonvulsants: Carbamazepine, Sodium Valproate, Lamotrigine
- Antipsychotics: Phenothiazides, Butyrophenones
- Anticancer drugs: Vinca alkaloids, Meplizalin, Cyclophosphamide, Methotrexate, Platinum compounds
- Antidiabetic drugs: Chlorpropamide, Tolbutamide
- Diuretics: Thiazides, Loop diuretics
- Miscellaneous: Opiates, MDMA, Interferon, NSAIDs, Clofibrate, Amiodarone, Proton pump inhibitors (minimal contribution)
- Vasopressin analogues: Desmopressin, Oxytocin, Terlipressin, Vasopressin

Discussion

There was an improvement in nine parameters in the re-audit, but improvements are required in all parameters to achieve up to 100% compliance. Balancing measures with impact on patients, clinicians and the Clinical Sciences Department should be examined to determine sustainability in quality improvement progress.

Areas of further development

- Post-project questionnaire revealed overall satisfaction with the protocol, but also the need to improve its online accessibility.
- Audits in Paediatrics/ Emergency Department throughout the trust.

Conclusions

- Timely and accurate diagnosis and investigation is crucial in managing hyponatraemia, and therefore helpful in improving overall prognosis and mortality in Covid-19 infection.
- No consensus on overall unified algorithm for hyponatraemia management - more appropriate to be tailored to trust needs
- Consider implementation of recurrent PDSA cycles to continue to respond to clinician feedback/ needs re: protocol and obtain further data to compile a run chart

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