

Urine Sodium to Chloride Ratio: A Useful Test for Investigating Hypokalaemia

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Background

A 36-year-old woman presented to her general practitioner with secondary amenorrhoea. She reported unintentional weight loss of 6 kg in the previous 3 months. Her only previous history was an emergency admission 3 months prior for upper abdominal/lower chest pain, the cause of which was unexplained. She is a single parent of two children, with a history of anxiety disorder. Her BMI was 18, she was normotensive, and she was being prescribed Amitriptyline and Fluoxetine.

Initial Investigations

Initial biochemical findings were uninformative in relation to her amenorrhoea but her U+E profile did reveal incidental hypokalaemia (Na 141 mmol/L; K 3.0 mmol/L; creatinine 85 µmol/L). A fortnight later she presented at MAU with complaints of palpitations, feeling generally unwell, dizziness, and constipation. ECG investigations showed ST, T and U wave abnormalities consistent with hypokalaemia. Potassium was 2.8 mmol/L; urine potassium 18.5 mmol/L; aldosterone, renin, and aldosterone renin ratio were normal. Oral and IV potassium replacement were commenced and she was discharged and referred to endocrinology. However, prior to attending her endocrinology appointment, she presented with persistent hypokalaemia at multiple locations in our region. She persistently denied taking diuretics, vomiting, laxatives, diarrhoea, liquorice, and anorexia. She eventually presented at the ED with chest pain, paresthesia and the following biochemical results which established a clear picture of hypokalaemic hypochloreaemic partially compensated metabolic alkalosis: Na 140 mmol/L; K 2.5 mmol/L; urea 8.0 mmol/L; creatinine 93 µmol/L; chloride 87 mmol/L; magnesium 0.79 mmol/L; pH 7.489; pCO₂ 7.41; bicarbonate 42.2 mmol/L.

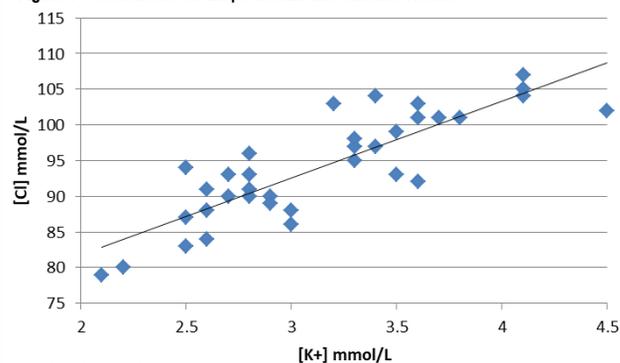
Table 1 - Endocrinology Investigations

Test	Result	Reference Range
Blood		
Sodium	142 mmol/L	[133 – 146]
Potassium	3.0 mmol/L	[3.5 – 5.3]
Urea	6.2 mmol/L	[2.5 – 7.8]
Creatinine	86 µmol/L	[45 – 84]
eGFR	75 ml/min/1.73sqm	
Magnesium	0.81 mmol/L	[0.70 – 1.00]
Bicarbonate	36 mmol/L	[22 - 29]
Cortisol	312 nmol/L 06:00 – 10:00	[166 – 507]
ACTH	12 ng/L	[<46]
Total IgA	1.91 g/L	[0.80 – 2.80]
IgA to TTG	Negative	
Urine		
24-hour Potassium	47.4 mmol/24hr	
24-hour Calcium	2.6 mmol/24hr	[2.5 – 7.5]
24-hour Sodium	173 mmol/24hr	
24-hour Cortisol	20 nmol/24hr	[0 – 162]
Random Urine		
Potassium	35 mmol/L	
(Urine potassium on other occasions: >100, 83.7, 61)		

Further Investigations

With the evidence of inappropriate renal potassium wasting and the exclusion of Conn's, Liddle syndrome, apparent mineralocorticoid excess syndrome, and Cushing's, endocrinology referred the patient for review by renal medicine. Her weight loss issues were ongoing with a BMI of 16.9 by this point, she appeared frail and thin and reported feeling tired and fatigued. She was consistently hypokalaemic with concurrent hypochloreaemia, as shown in figure 1.

Figure 1 – Concurrent serum potassium and chloride results



An initial urine laxative screen was negative. However, rhenin and bisacodyl indicative of herbal laxative ingestion were detected in a sample 1 week later. Significantly, a urine chloride <20 mmol/L was also found, which was similarly low on repeat testing, excluding Bartter's and Gitelman's syndrome. This left vomiting in the differential diagnosis, something the patient had strenuously denied on multiple occasions. Further urine investigations revealed markedly uncoupled sodium and chloride excretion (Mean UNA:Cl 5.7 mmol/mol), a notable pattern reported in a comprehensive chronic hypokalaemia study by Wu et al. in 2017, in which a UNA:Cl > 1.6 mmol/mol had 95.2% sensitivity and 98.7% specificity for the diagnosis of anorexia/bulimia nervosa.

Conclusions

Following the patient's time under renal medicine, she was referred back to endocrinology at which point her BMI had dropped to 15.4. The endocrinologist explained to the patient and her mother the suspicion of anorexia with significant purging behaviour as the underlying diagnosis. However, both the patient and mother denied any evidence of an eating disorder, and the patient was reluctant to see psychiatrists or eating disorder specialists. However, after almost 2 years since first presenting, the patient eventually agreed to psychiatric assessment.

This case highlights the utility of timely urinary investigations and specifically the value of urinary sodium to chloride ratio in the diagnosis of chronic hypokalaemic metabolic alkalosis in normotensive patients.

References

1. Wu KL, Cheng CJ, Sung CC, Tseng MH, Hsu YJ, Yang SS, et al. Identification of the causes for chronic hypokalaemia: importance of urinary sodium and chloride excretion. *Am J Med* 2017;130:846–55.