Navigating troubled waters: Hyperglycaemic Hyperosmolar State precipitated by Nephrogenic Diabetes Insipidus

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INTRODUCTION

- Hyperglycaemic hyperosmolar state (HHS) is a common medical presentation, typically occurring in older patients with Type 2 diabetes mellitus.
- Mortality rates of up to 60% have been reported.
- We describe a rare case of HHS, likely to be precipitated post lithium-induced nephrogenic diabetes insipidus (DI).

CASE HISTORY

- A 62-year-old female with bipolar disorder presented to ED with lethargy, confusion and reduced mobility.
- Past medical history: bipolar disorder, hypothyroidism and recurrent UTIs.
- Medication history: lithium (>10 years duration), diazepam, olanzapine, sodium valproate and levothyroxine.
- She remained persistently hypernatraemic with Na >170mmol/L despite commencement of intravenous fluids.
- 10 days after admission, her blood glucose was noted to be 35mmol/L with serum osmolality of 398mOsm/kg
- She was deemed to be in **HHS** and treatment commenced with fixed rate insulin infusion and 0.9% saline.
- Over the next few days, the patient's clinical state deteriorated and she was transferred to ITU.
- Despite a fall in blood glucose, her plasma Na remained persistently elevated despite intravenous 0.45% saline.
- She remained polyuric with an increasing plasma osmolality and a low urine osmolality. This prompted the consideration of **nephrogenic DI** as a concomitant pathology.
- Overnight water deprivation test confirmed the diagnosis of DI

INITIAL INVESTIGATIONS

Bloods:
Hb 109g/dL, WCC 12 x 10^9/l , Neu 9.0 x 10^9/l
Na 143mmol/L, K 4.0mmol/L, Urea 7mmol/L, Cr 98mmol/L
TFTs- normal
Lithium levels 1mmol/L (0.4-0.8 mmol/L)
HbA1c (IFCC): 36mmol/mol (5.4% six months pre-admission)

Venous blood gas: pH 7.43, bicarbonate 25.9mmol/L

ECG: normal sinus rhythm
CXR/Urine dip: negative

RESULTS

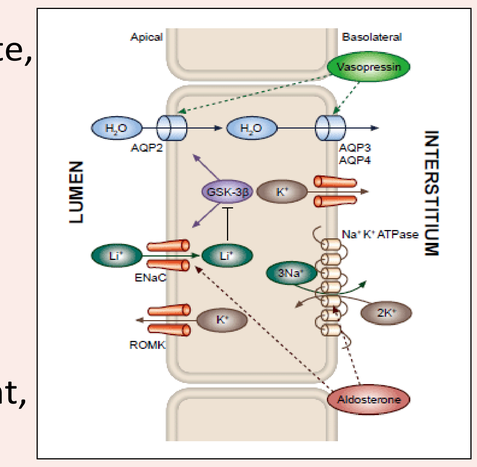
	Pre-HHS treatment	Post-HHS treatment	Post-DI treatment
Glucose (mmol/L)	35	7	-
Serum Osmolality (mOsmol/kg)	398	350	289
Urine Osmolality (mOsmol/kg)	-	219	267
Serum Na (mmol/L)	176	150	144

MANAGEMENT

- Amiloride with hydrochlorothiazide was started as treatment for nephrogenic DI.
- Subsequent improvement was observed with falling serum osmolalities and plasma sodium.
- Her plasma glucose remained stable on oral anti-hyperglycaemic agents.

Discussion & Learning Points

- Nephrotoxic renal effects of lithium may occur even within what is considered a therapeutic range.
- Lithium acts through entering the collecting ducts through epithelial sodium channels (ENaC) and inhibits signalling pathways (adenylate cyclase and glycogen synthase3-beta) causing disruption of the aquaporin-2 structure. These changes are initially reversible but thereafter can become permanent.
- Following recovery of hyperglycaemia, persistent polyuria and hyperosmolar state, should prompt consideration of differentials to include diabetes insipidus.
- Amiloride and hydrochlorthiazide are effective in the treatment of nephrogenic diabetes insipidus.
- It is important to recognise the two conditions may coexist in the same patient, so that appropriate therapies may be initiated.



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