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Review Article

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# Review of Causes of Hyponatremia in the Paediatric Age Group 10-Year Data in a Busy University Hospital

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## Introduction

Hyponatremia is one of the most common electrolyte disturbances in hospitalised children, which can potentially cause significant morbidity and mortality. We reviewed the causes of severe hyponatremia (Na+ < 125 mmol/L) over the last ten years (2006-2016) in the neonatal unit and the paediatric unit (<16-year-olds) at Norfolk and Norwich university hospital.

## Aim

The objective of this study was to review the causes of hyponatremia in hospitalized neonates and children under 16 years of ageand to find the prevalence of hyponatraemia with an abnormal urinary tract, which can cause transient pseudohypoaldosteronism.

## Method

We performed a retrospective observational study on the causes of severe hyponatremia (Serum Na < 125 mmo/l) in the neonatal unit and the children's unit. The study included neonates from birth to children up to 16 years of age who were admitted to Norfolk and Norwich university hospital between 2006 and 2016. Data was collected from patient case notes, Neonatal Electronic Patient Record (Badger net) and electronic pathology system.

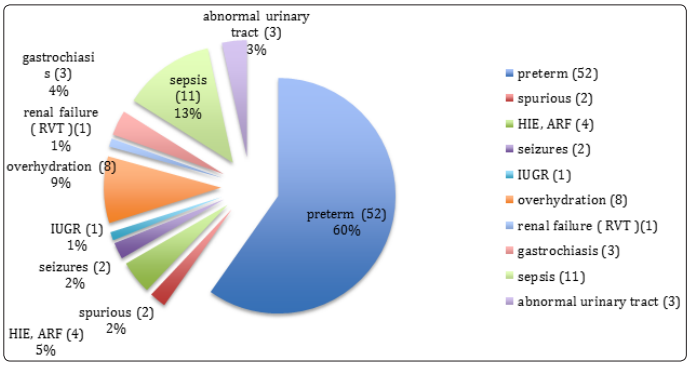
## Results

Hyponatraemia (Na < 125mmol/L) was found in 160 patients of whom 54% were neonates i.e. 87 patients. The most frequent cause of neonatal hyponatremia was prematurity (< 37 weeks of gestation); it attributed 60% of total neonatal cases of hyponatremia that was 52 / 87 cases.

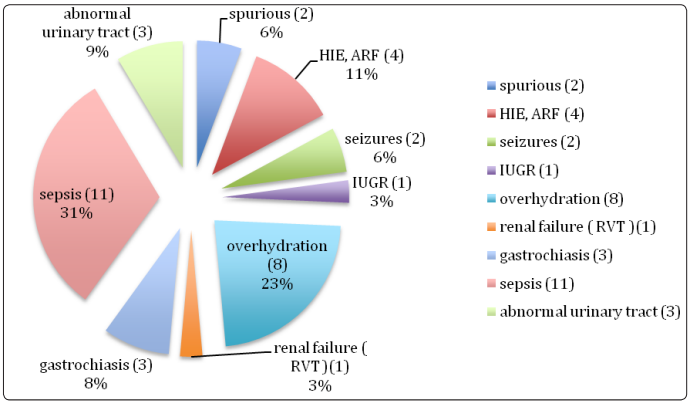
Amongst term neonates, (> 37 weeks of gestation), presumed sepsis requiring IV antibiotics was the commonest cause, 11 out of 35 neonates (31%) followed by renal impairment after hypoxic event which was 11%, 4 patients in total. 9%of the term neonates with hyponatremia had abnormal urinary tract but none of the preterm neonates with hyponatermia showed urinary tract abnormalities.

Amongst the paediatric age group (more than 28 days old and less than 16 years old), endocrine pathologies such as adrenal insufficiency, diabetes mellitus, chronic SIADH and pituitary abnormalities shared the largest proportion of causes, which was 16 out of 73 patients (22%). The abnormalities in urinary tract and gastroenterological pathologies were the second commonest causes, which was12 patients in each group out of 73 total patients (16%). Other renal pathologies such as renal failure and nephrotic syndrome attributed 4% of the total causes.

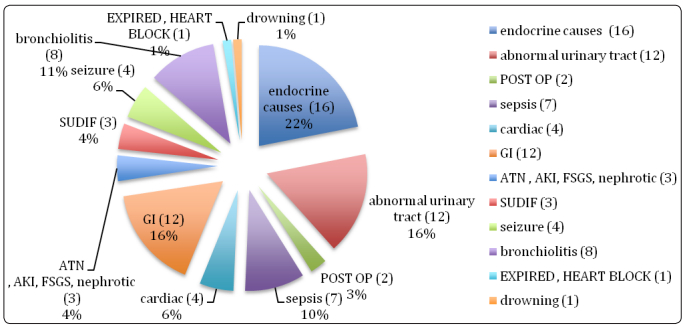
**Causes of hyponatremia in neonate patients (n=87)**




**Causes of hyponatremia in term neonates (n=35)**



**Causes of hyponatremia in paediatric patients (n=73)**




## Discussion

Our results show that abnormalities in renal tract was the second commonest cause of hyponatremia in all age groups contributing to total 25% of all cases (9% in term neonates and 16% in paediatric patients).

The cause of hyponatremia in severe urinary tract infection and obstructive pathologies of the renal tract is transient pseudohypoaldosteronism (PHA) type 1 where there is resistance to aldosterone action at the tubular level resulting in renal loss of sodium. Although the literature is abundant with case reports of hyponatremia because of PHA, but to the best of our knowledge there is limited data about the prevalence of transient PHA amongst children under 16 years.

Pseudohypoaldosteronism is classified into type 1 and type 2 (Gordon syndrome). Type 1 is further sub-classified into primary and secondary psedohypoaldosteronism (transient). The primary type 1 PHA can be autosomal recessive or autosomal dominant pattern or rarely due to mutation *de novo* and results in target organ unresponsiveness to mineralocorticoids. The target organ resistant is due to mutation in the amiloride-sensitive epithelial sodium channel gene or mineral corticoid receptor [1-4].

The characteristics of type 1 primary PHA are high urinary sodium losses in the presence of hyponatremia, decrease urinary potassium excretion, increaselevels of serum aldosterone and rennin, and increase urinary excretion of aldosterone. But plasma deoxycorticosterone and corticosterone concentrations are within normal limit.

Secondary or transient Type 1 PHA is commonly observed when urinary tract infections (UTI) occur on pre-existing structural urinary tract anomalies.It has been stated that some renal medical conditions such as tubulointerstitial nephritis, sickle cell nephropathy, systemic lupus erythematosus, amyloidosis, neonatal medullary necrosis, renal vein thrombosis and multiple myeloma are associated with transient type 1 PHA. Therefore, the electrolytes disturbances resolve once the infection is controlled with the antibiotic therapy and surgical repair releases the obstructive uropathy.

Our findings highlight the importance of transient pseudohypoaldosteronism as an important cause of hyponatremia in both neonates and paediatric age group. Any child with hyponatremia should have urine cultured to rule out urinary tract infection. If UTI is found in the presence of hyponatremia, renal ultrasound should be considered to exclude any underlying obstructive uropathy or renal abnormality. We suggest that every child with hyponatremia and evidence of UTI should have serum aldosterone level checked and urinary electrolytes done to confirm the possibility of transient PHA type 1.

This audit has helped in raising the awareness amongst both the medical and paediatric surgical teams to consider UTI and underlying uropathies in neonates and children with hyponatremia and to investigate them appropriately to confirm the diagnosis of transient secondary Type 1 pseudohypoaldosteronism.

Furthermore, infants with urinary tract infection can present atypically with failure to thrive. It is important to consider UTI and check serum electrolytes in such cases.

## Conclusion

Pathologies that cause hyponatremia in neonates and paediatric patients are different. The results from our study highlight that transientpseudohypoaldosteronism with urinary tract abnormality was the mechanism responsible for hyponatremia in a significant number of term neonates (9%) and children (16%) with hyponatremia.

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