CASE REPORT

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Polyuria: A Case Report and Clinical Approach

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Abstract

Increased urinary volume and frequency are commonly encountered presentations in the general clinical practice. Hyperglycaemia due to uncontrolled diabetes mellitus is the commonest cause for the same. However, polyuria is a specific term which connotes a urine output of more than 3 L per day which is a rather uncommon finding. It can occur because of excessive non re-absorbable solutes which osmotically drive water with them through the renal tubules. The other umbrella category of pathophysiology can be because of an impaired thirst mechanism which is centered in the hypothalamus (primary polydipsia). Lastly, impaired antidiuretic hormone secretion (central diabetes insipidus) or impaired antidiuretic hormone function on kidneys (nephrogenic diabetes insipidus) can produce the same effects. Aetiologically speaking, there can be various causes that fall under each category. Herein, we present a case of central diabetes insipidus which required an algorithmic approach to delineate the underlying pathophysiology. Objective, efficient and clinically driven approach to diagnosis of uncommon pathologies cannot be over-emphasised. This case proves this maxim yet again.

Key words: Antidiuretic hormone, polyuria, central diabetes insipidus, water deprivation test, desmopressin response test.

Introduction

Antidiuretic hormone (ADH) - along with the thirst mechanism-play central roles in maintaining water balance in the body[1]. ADH-secreting neurons are found in the hypothalamus whose axons terminate in the posterior pituitary. ADH eventually enters the bloodstream to act on the collecting ducts of the kidney to reabsorb water.

Polyuria is defined as a urine output of more than 3 L per day in adults[2]. Broadly speaking, it can occur because of:

1. Excess renal excretion of non re-absorbable solutes (referred to as 'solute diuresis').
2. Defect in either ADH secretion or reduced renal responsiveness to ADH (referred to as 'water diuresis') which are referred to as central diabetes insipidus (CDI) and nephrogenic diabetes insipidus (NDI), respectively.
3. Primary polydipsia (PP).

Glucosuria (most commonly secondary to hyperglycaemia), use of mannitol, radio-contrast dyes, high protein or parenteral diet, resolving acute tubular necrosis or urinary obstruction or use of diuretics are the causes of 'solute diuresis'.

CDI can be secondary to major head trauma, sellar tumours, infections, granulomas, aneurysm, Sheehan's syndrome or an empty sella.

NDI can be due to pyelonephritis, sickle cell anaemia, hypercalcaemia, analgesic nephropathy, multiple myeloma, sarcoidosis or any acquired as well as congenital tubular disease. Commonly used drugs like lithium and amphotericin are also known to cause NDI.

PP can be psychogenic (schizophrenia, obsessive-compulsive disorder), secondary to hypothalamic disease (damage to thirst centre because of sarcoidosis, tuberculosis, head trauma, multiple sclerosis) or because of increased thirst due to chlorpromazine and other anti-cholinergic drugs.

Case report

A 44-year-old Indian lady teacher, non-diabetic, and a treated case of pulmonary tuberculosis presented with sudden onset polyuria (~ 8 L/day), polydipsia (~ 6 L/day), 6 kg unintentional weight loss and mild intensity frontal headache for the last 4 months. Her menstrual cycle became shortened to 20 days without any other menstrual aberration. There was no associated major head trauma, visual disturbance, dysosmia, galactorrhoea, seizure, paralysis, aphasia, fever, pregnancy preceding onset of symptoms, dysuria, skin rash, psychiatric complaints, radio-contrast injection, high protein intake,

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urinary obstruction or any chronic drug use. Her pre-morbid psychiatric status was unremarkable. Her general examination was unremarkable except for resting tachycardia (110/m) and low blood pressure (systolic: 96 mmHg, diastolic: 60 mmHg). Her systemic examination was non-contributory.

Before showing at our hospital, the patient had visited multiple doctors. She was treated for urinary tract infection multiple times. In view of no relief with standard antibiotics, she was assumed to have primary polydipsia and her problem was ascribed as psychosomatic. Disappointed after showing at numerous places, she came here.

Relevant investigations at our center were as follows: Creatinine - 0.58 mg/dl; serum sodium - 142 mmol/l; serum calcium - 8.93 mg/dl; urine specific gravity - 1.005 (low); TSH - 5.77 uIU/ml (0.27 - 4.2) with free T3 and free T4 within reference range; p-ANCA - weak positive. Her serum ACE levels were within reference range with ANA being negative (both quantitative and qualitative).

Her urine osmolality was 79 mOsm/kg (300 - 900) on admission. After 8 hours of water deprivation, it increased to 173 mOsm/kg and after desmopressin response test it further increased to 478 mOsm/kg. Her weight, urine volume, urine osmolality and serum osmolality were measured 2 hourly during the water deprivation test. From the 8th hour, she was allowed to have normal diet and 20 mcg desmopressin was given by inhalation. Thereafter, the same parameters were recorded. All the measurements are enlisted in Table I. As is evident, with increasing time from water deprivation, her urine osmolality gradually increased with no significant alteration in serum osmolality and mild reduction in weight. However, the increase in urine osmolality at the end of 8 hours was far lower (i.e., way below 300 mOsm/kg) than it would be with a well functioning ADH-mediated water conserving mechanism (i.e., above 300 mOsm/kg). Therefore, it was confirmed to be a case of diabetes insipidus. About 2 hours after desmopressin inhalation, her urine volume was significantly decreased and urinary osmolality rose by more than 50% (from 173 mOsm/kg to 439 mOsm/kg). This was evidence that there was deficient ADH production and her kidneys were responsive to exogenously supplied ADH derivative. Thus, a diagnosis of CDI was made. Her MRI brain was significant for absent posterior pituitary bright spot. This culminates in our anatomical diagnosis of posterior pituitary-related CDI. The aetiological diagnosis however could not be spotted. The patient was discharged with advice to take tablet desmopressin 0.1 mg orally once daily at bedtime.

Table I:

Time (hr)	Weight (kg)	Urine volume (ml)	Urine osmolality (mOsm/kg)	Serum osmolality (mOsm/kg)
Start of water deprivation at 0 hour				
0	49.4	600	79	289
2	49.1	420	98	294
4	48.5	400	132	295
6	48.5	390	159	295
8	48.1	325	173	296
At 8 hr, food and liquids was allowed *ad libitum* and 20 mcg desmopressin was given by inhalation				
9.5	48.7	200	279	300
10.5	49	50	439	290

Approach to polyuria

Before labelling the patient's complaint as polyuria, it is vital to objectively demonstrate it. A 24 hour urine collection is obviously diagnostic. Although history and physical examination can help us delineate most pathologies, a spot urine osmolality can serve as the principal parameter to help us narrow down our diagnosis. A urine osmolality of greater than 300 mOsm/kg is diagnostic of solute diuresis while urine osmolality of less than 250 mOsm/kg is found in NDI, CDI and PP[3,4].

In case of low urine osmolality (less than 250 mOsm/kg), an 8 hour water deprivation test can be employed to differentiate NDI and CDI from PP. If urine osmolality increases to more than 300 mOsm/kg then it means both ADH production and functioning are fine. Thus, this is a case of PP.

On the other hand, if after water deprivation, osmolality does not increase significantly (i.e., remains below 300 mOsm/kg), a desmopressin response test can be employed to different CDI from NDI. This involves administering either 20 mcg of desmopressin as nasal spray or 2 mcg of desmopressin by intramuscular route, following which urine osmolality is again measured after about 2 hours. If it rises by more than 50%, then this is a case of CDI, while if the rise is less than 50%, then this is NDI.

This algorithmic approach can be highly rewarding in cases of uncommon pathologies; however, the aetiology still requires astute clinical acumen. Thus, water deprivation test and desmopressin response test are only adjuncts to outline and simplify the diagnostic decision-making process. They do not preclude conventional history taking and physical examination.

Discussion

Diabetes insipidus is a rare illness[5]. Polyuria, when used strictly in terms of its definition, is also an uncommon presentation without relevant symptoms and signs of urinary tract infections, uncontrolled diabetes mellitus, resolving ATN or use of osmotic agents. As is evident from the current case, the patient was evaluated multiple times for urinary tract infection and treated too. This was done without evidence of either clinical or laboratory corroboration. At no point of time, her 24 hour urine output was measured. Afterwards, her complaints were labelled psychosomatic manifestations – this despite the fact that both her pre-morbid and current state did not raise any psychiatric flags.

Part of the delay in diagnosis is lack of familiarity and rarity of the disease under consideration. The other part has to do with lack of rationality in pursuing the diagnosis. And lastly polyuria, unless objectively measured, can be highly subjective since outpatient void is rarely quantifiable. All the above concern is over and above the fact that the workup for polyuria is straightforward and doesn't require complicated analyses at the initial stages.

The presentation of this case; however, mundane it may seem to an endocrinologist, is an attempt to prompt clinicians to initiate the workup of polyuria at their end without pronouncing apparently common diagnoses at the outset. Water deprivation test – under most circumstances – is a simple test that can be undertaken at any inpatient facility with minimal support. Desmopressin response test is also a straightforward test that only requires availability of the said drug. Thus a rationally driven diagnostic policy for polyuria, especially for rare cases like this, has the advantage of reducing the burden on tertiary healthcare, bringing down the financial load on the patient and providing a self-reassuring instance to the primary care physician.

References

1. Gizoswki C, Trudel E, Bourque CW. *Best Pract Res Clin Endocrinol Metab* 2017; 31 (6): 534-46.
2. Tournikioti K, Voumvourakis K, Moussas G *et al*. Primary Polydipsia: a case report. *R J Nerv Ment Dis* 2013; 201 (8): 709-11.
3. Nigro N, Grossmann M, Chiang C *et al*. Polyuria-Polydipsia Syndrome: a diagnostic challenge. *Intern J Med* 2018; 48 (3): 244-53.
4. Mount DB. Azotemia and Urinary Abnormalities. In: Jameson JL, Fauci AS, Kasper DL *et al*. Editors. Harrison's Principles of Internal Medicine 20th edition. New York: McGraw-Hill; 2018; p. 294-5.
5. Bockenhauer D, Bichet D. Pathophysiology, Diagnosis and Management of Nephrogenic Diabetes Insipidus. *Nature Reviews Nephrology* 2015; 11 (10): 576-88.