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Unexplained polyuria and non-obstructive hydronephrosis in a urological department

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Case report

A 40-year-old man commenced combined nephrological and urological investigations in August 2002 because of mild chronic renal failure (serum creatinine 1.4 mg/dl, creatinine clearance 65 ml/min/1.73 m^2) associated with bilateral hydronephrosis and hydroureters.

Relevant past history included compulsive water drinking from the age of 18. On examination the patient weighed 62 kg and he was normotensive. Urinalysis was normal. After insertion of a urethral catheter it was noted that the patient voided ~7–8 l of urine daily (even after i.v. fluid replacement was stopped). Despite this 'post-obstructive diuresis' renal function did not improve. Repeated urine osmolarity throughout this period was ~100 mosm/kg/day.

A water deprivation test was carried out (Table 1) and a diagnosis of central diabetes insipidus (CDI) was made. Further investigations at this stage included negative antithyroid, antiparietal and antinuclear antibodies. MRI of the brain, before and after gadolinium injection, was normal with no thickening of the pituitary gland or the infundibulum.

The patient was commenced on oral desmopressin (Minirin®) therapy at an initial nocturnal dose of 0.05 mg. This dose was subsequently increased to 0.1 mg twice daily. Urine volumes on the differing dosages are detailed in Table 2.

In June 2003 no reflux was seen on voiding cystography. An elective transurethral incision of the bladder neck was performed successfully and the urethral catheter was removed. In July 2003 repeat ultrasound of the urinary tract revealed a urinary residual volume of only 40 ml. Bilateral hydronephrosis were still present but significantly improved. Urinary bladder walls were thickened and trabeculated. Bladder distension was obvious.

Presently (December 2003) the patient is asymptomatic apart for mild nocturia, he remains normotensive and on daily oral desmopressin (0.15 mg). Daily diuresis is ~3 l/day and renal function is stable (serum creatinine 1.5 mg/dl).

Discussion

Polyuria (by definition: a diuresis >3 l/day), in a urological setting, is most often associated with the relief of an obstructive uropathy. In these patients some degree of renal failure is present and the polyuria is caused by a diuresis of retained solutes coupled with a reduced tubular reabsorption of fluids [1].

Prolonged polyuria as a cause of bilateral, non-obstructive hydronephrosis was first described by Osler in 1892 [2]. Since then, excessive urine flows and extensive dilatation of the urinary tract have been most frequently documented in young children with nephrogenic diabetes insipidus, often hereditary and X-linked [3–10] but also in patients with CDI [6,7,11] and psychogenic polydipsia [7,8,12,13]. Apparently, persistently large urine volumes can lead to urinary bladder distension and hypertrophy, with subsequent intramural obstruction of the distal ureters

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Table 1. Results of the water deprivation test carried out on the presented patient

Time of day	08:30	09:30	10:30	11:30	12:30	13:30	14:30
Plasma Na (mEq/l)	139	139	140			141	145
Plasma uric acid (mg/dl)	5.2	5.2	5.1			5.2	5.7
Plasma osmolarity (mosm/kg/day)	300	297	292	312	300	306	300
Urine osmolarity (mosm/kg/day)	71	65	79	106	258	316	380
Hourly urine output (ml)	450	490	460	440	140	70	30
Weight (kg)	62.5	62	61.5	61	61	60.5	60.5
ADH levels (normal 0.5–3.7 pg/ml)	<0.5	<0.5	<0.5	<0.5	11.5	12	11

Water deprivation test started at 08:30. At 11:30 2 μg desmopressin given SC. ADH levels were measured using radioimmunoassay [16].

Table 2. Measured urine volumes (via indwelling urethral catheter) with differing doses of oral desmopressin

Total daily diuresis	Nocturnal diuresis	Daytime diuresis	Desmopressin dose/day
8200 ± 280 ml	1950 ± 175 ml	6250 ± 350 ml	0.05 mg PM
6560 ± 830 ml	2430 ± 270 ml	4130 ± 800 ml	0.05 mg ×2
4720 ± 670 3 ml[a]	2200 ± 680 ml	2400 ± 380 ml	0.1 mg AM, 0.05 mg PM
4370 ± 480 ml	2600 ± 400 ml	2500 ± 600 ml[b]	0.1 mg ×2

[a] $P < 0.01$ (unpaired *t*-test, two-tail) *vs* total daily diuresis at desmopressin dose of 0.05 mg.
[b] $P < 0.01$ (unpaired *t*-test, two-tail) *vs* daytime diuresis at daily desmopressin doses of 0.05 and 0.10 mg.

[6,7,10,11]. In time, bladder contractility is compromised, ureteric peristalsis diminishes and large residual urine volumes worsen this functional obstructive uropathy [7,8,13]. Also, because of social embarrassment, these patients often self-cause urine retention and this only acts to exaceberate the 'obstructive' uropathy even further [3,6].

Although many patients have undergone surgical procedures in an aim to alleviate this functional obstruction [4,9,14], treatment should be essentially medical. It should be based on correct and early diagnosis of the cause behind the polyuria, teaching of the patient as to the importance of frequent voiding [7,14], the possible use of non-steroidal anti-inflammatory drugs and thiazides in nephrogenic diabetes insipidus [6,15] and the importance of desmopressin in CDI [2,6,7,15]. Drugs capable of interfering with water homeostasis should be avoided, as should anticholinergic drugs with their undesired ability to impair bladder contractility [13].

Correct therapy, even after a short period of time, can lead to a marked improvement in renal tract dilatation. This will occur more often in those children diagnosed early on and who have had urinary tract dialatation for only relatively short periods of time. However, urinary tract dilatation, presumably of many years duration, can also be improved [4–7,10,14].

Although chronic renal failure is infrequent in these patients [4,6–8,10,14], it can occur—as was so graphically demonstrated in four schizophrenic patients with psychogenic polydipsia who were concurrently using anticholinergic drugs [13].

The patient presented is relatively unique because of a number of points. First, he presented at a late age after routine blood tests revealed mild chronic renal failure. If this patient had remained undiagnosed and untreated, renal failure would, most probably, have progressed unabated. Secondly, he has CDI, with only three other patients with CDI presenting with hydronephrosis and hydroureters [6,7,11]. All patients were relatively young (presenting ages 12–21 years) and all had many years of polyuria. Measured residual urine volume was large in two of the three patients in which it was measured [6,11]. In all three patients desmopressin therapy reduced urine volume and led to marked radiological improvement in hydronephrosis. In the one patient with renal failure, this also improved after only 1 month of therapy (reduction in serum creatinine from 1.3 to 0.9 mg/dl).

The management of diabetes insipidus in adults was well reviewed by Singer *et al*. in 1997 [15]. In patients with CDI, treatment must be individualized. Desmopressin should be initially given to the patient just prior to bedtime, in order to ensure a reduction in nocturnal diuresis. Furthermore, 'it is important to permit brief, intermittent polyuric episodes. Ideally, this should be accompanied by designing a desmopressin schedule such that polyuria recurs predictably before one of the scheduled daily doses, preferably so as not to disrupt sleep [10].'

Teaching points

(i) Long standing polyuria, irrespective of the underlying cause, can cause significant uromechanical dilatation and renal failure.
(ii) A water diuresis, (Uosm <250 mg/kg/day), in the absence of increased water intake or hypotonic i.v. fluids, should lead to a suspicion of diabetes insipidus.
(iii) The polyuria associated with CDI is amenable to therapy and leads to both a partial correction of hydronephrosis and stabilization of renal function.

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Conflict of interest statement. None declared.

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