CENTRAL DIABETES INSIPIDUS AFTER ABDOMINAL SURGERY: A CASE REPORT

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Abstract

Post-operative polyuria due to Diabetes Insipidus is a commonly reported complication of pituitary surgery. However, central DI post abdominal surgery is rare and may be related to pre-existing DI or prolonged surgery with intraoperative blood loss. A thorough workup needs to be done to exclude central DI in such patients.

INTRODUCTION

Post-operative polyuria is a well-documented complication of prolonged surgeries. The increased sympathetic drive during surgery leads to stimulation of vasopressin and aldosterone. This stimulation, coupled with the large amounts of intravenous fluid patients receive during surgery, promotes fluid retention[1]. Decrease in the levels of vasopressin and aldosterone after surgery causes release of retained fluids leading to polyuria. However, polyuria can also be caused by Diabetes Insipidus (DI). While, post-operative Diabetes Insipidus can be transient or permanent depending on the extent of injury to the pituitary gland and is most commonly associated with pituitary surgeries[2]. Very few cases have been reported after abdominal surgeries. Here we report the case of a 48-year-old woman who developed central DI due to prolonged abdominal surgery with significant intraoperative blood loss.

CASE PRESENTATION

A 48-year-old woman presented with a one-year history of irregular heavy vaginal bleeding. She was hemodynamically stable at presentation and physical examination was unremarkable. Bimanual examination revealed the cervix to be thin and dilated to 8cm with a large mass protruding from the external os suspicious for an aborting myoma. Initial laboratory investigations are summarized in table 1. A total abdominal hysterectomy (TAH) and bilateral salpingo-oophorectomy (BSO) was planned and she was optimized with blood transfusions, IV fluids and tranexamic acid.

Her surgical course was complicated by left ureteral injury requiring left intravesical ureteral reimplant and left ureteral stent placement by urology. Serum osmolality increased from 287 mosm/kg on admission to 322 mosm/kg. Urine electrolytes were performed at this time which showed urine osmolarity of 93 mOsm/kg, urine sodium of 23 mmol/L, urine chloride 30 mmol/L, urine potassium of 9.0 mmol/L and urine creatinine of 23.5 mg/dl. Twenty-four urinary output on post-operative Day 1 was 7.1L and 11.9L on postoperative Day 2. She was extubated on postoperative Day 2. Renal ultrasonography (Day 4 post-operation) showed adequate placement of the left ureteral stent with left hydronephrosis.

Given the timeline of events, it was unclear if the polyuria was secondary to ureteral injury and post-obstructive diuresis versus diabetes insipidus. She was treated with intravenous desmopressin with a marked reduction in urine output to 4.2L in 24 hours and increased urine osmolarity (315m Osm/kg). MRI brain was performed which showed absence of the posterior pituitary bright spot consistent with posterior pituitary

dysfunction suggestive of central diabetes insipidus (DI) (See Figure 1). Further investigation revealed normal ACTH, cortisol, TSH and IgG levels. She was encouraged to drink to meet the demand of her thirst level and was treated with desmopressin when her urine output was more than or equal to 300ml/hr for 3 consecutive hours and serum sodium was more than 145 mmol/L. She was discharged on Desmopressin 0.1 mg daily.

DISCUSSION

Diabetes insipidus (DI) is a form of polyuria–polydipsia syndrome and is characterized by excessive hypotonic polyuria (>50 mL/kg body weight/24 h) and polydipsia (>3 L/day)[3]. It is characterized by the body's inability to retain free water and typically presents with polyuria, insatiable thirst and symptoms associated with dehydration. It is a rare disease with a prevalence of ˜1 in 25,000 individuals or about 0.004% of the global population with no gender predilection[4, 5].

DI may occur due to four fundamentally different defects in the physiological control of water balance including impaired antidiuretic hormone (ADH) secretion (central DI), impaired renal response to ADH (nephrogenic DI), excessive fluid intake (primary polydipsia), or increased metabolism of the ADH (gestational diabetes insipidus)[3]. The diagnostic challenge for the clinician is to confirm the presence of polyuria and distinguish between the various disease processes. Reliable distinction between the different etiologies of DI is imperative since treatment differs substantially. In this case report, we focus on central DI (CDI) which was diagnosed after TAH and BSO complicated by ureteral injury.

CDI is the most common type of DI. It results from inadequate synthesis of ADH by the supraoptic or paraventricular nuclei in the hypothalamus or impaired release of ADH from the posterior pituitary gland[3]. Acquired factors such as iatrogenic post neurosurgery (20%), hypothalamo-neurohypophyseal axis lesions (20%) and head trauma (16%), account for the majority of cases of CDI[6]. The inherited/familial causes account for 1% of CDI cases. Additionally, a large proportion of the cases of CDI (30-50%) is idiopathic and has been associated with destruction of the hormone secreting cells in the hypothalamic nuclei due to an autoimmune process[7].

While most of the post-operative DI cases reported have been associated with pituitary/cranial surgery, cases of DI after abdominal surgery are very rare. The diagnosis of an isolated posterior pituitary dysfunction was made after gynecological surgery in one case[8], whereas one patient was reported to have developed DI after liver transplantation surgery[9]. The cause of DI in the latter case has not been clearly delineated. Other causes reported include cobalt induced DI from hip prosthesis and propofol induced DI[10, 11].

Our patient developed central DI, as evidenced by the MRI findings and response to desmopressin, after surgery. The surgery itself was prolonged and had a complicated course with extensive blood loss (more than 2 liters) requiring multiple transfusions. The patient was having heavy irregular menstrual bleeds for more than a year before surgery. Coupled with this, the large amounts of blood loss during surgery could have contributed to posterior pituitary ischemia leading to impaired synthesis and release of ADH.

The presence of intraoperative ureteral injury with urological intervention and following hydronephrosis created suspicion for post-obstructive diuresis being the culprit of the patient's polyuria. Therefore, the key step in identifying DI in this case was the presence of hypotonic urine (urine osmolarity of 90 mOSm/kg) which ruled out osmotic diuresis.

The indirect water deprivation test has been documented as the gold standard in literature for diagnosing DI. It involves depriving the patient of fluids and regularly measuring the patient's urinary excretion, urine osmolality, plasma sodium, and plasma osmolality. The fluid deprivation is continued for either seventeen hours maximum, until plasma concentration is greater than or equal to 150 mmol/L, or a loss of 3%-5% of the patient's body weight has occurred[12]. After exogenous administration of synthetic ADH, or desmopressin (DDAVP), the patient's urine osmolarity is measured to compare to the osmolarity before DDAVP administration. At the end of the test, the urine osmolarity for healthy individuals should be above 800 mOsm/kg osmolarity with no increase in urine osmolarity following DDAVP. Both nephrogenic and

central DI will have urine osmolarity below 300 mOsm/kg[13]. Although the indirect water deprivation test was not officially done for this patient, after fourteen hours of fasting, she was noted to have urine osmolarity of 93 mOsm/kg. The response to DDAVP differentiates nephrogenic and central DI. After DDAVP, urine osmolality will increase >50% for CDI and <50% for NDI. Our patient's urine osmolarity increased from 93 mOsm/kg to 315 mOsm/kg after administration of DDAVP pointing to a diagnosis of CDI.

Further workup in patients with CDI includes biochemical evaluation of a morning plasma measurement of pituitary hormones (growth hormone, ACTH, TSH, FSH and LH) and hormones from their target organs. An MRI of the sella and suprasellar regions with gadolinium would identify any anatomical pituitary or hypothalamic disruptions (macroadenomas, empty sella, infiltrative diseases). The normal posterior pituitary demonstrates hyperintensity on T1 images (also known as the 'bright spot'), suggested to be due to phospholipid-rich granules storing AVP and oxytocin[14]. As seen in this case, the absence of this bright spot could indicate an absence of posterior pituitary function (See Figure 1).

To avoid the main adverse effect of hyponatremia, the minimum desmopressin dose required to control symptoms should be started. A retrospective review has shown that 27% of central DI patients show mild hyponatremia on routine electrolyte testing and 15% develop more severe hyponatremia, over long-term follow-up[15].

In conclusion, accurate diagnosis of DI and ascertaining the underlying cause poses a challenge in present clinical practice. The appropriate diagnosis is critical to ensure improved quality of life for the patient. The first step in approaching patients with polyuria-polydipsia syndrome is appropriate medical history and examination, baseline laboratory assessment using serum electrolytes and urine osmolarity. The indirect water deprivation test, although cumbersome, can provide a diagnosis with increased accuracy. There is also promising potential for the utility of copeptin levels in the future. Most ambulatory patients remain eunatremic due to the compensatory thirst mechanism associated with DI. However, desmopressin remains widely used in the treatment of DI. It is recommended to start with the lowest dose to achieve symptom control to avoid hyponatremia.

AUTHOR CONTRIBUTIONS

AM and KJ reviewed the literature and wrote the manuscript; KCJ, EF and SG conceptualized the idea and were involved in the treatment of the patient; all authors read and approved the final version of the manuscript.

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Figure Legends:

Figure 1: Sagittal view of the MRI brain highlighting loss of the pituitary bright spot (orange arrow)

Table Legends:

Table 1: Laboratory values of the patient during course of hospitalisation

Abbreviations used: BUN: Blood Urea Nitrogen; POD: Post-Operative Day; Units in parentheses

Table 1: Laboratory values of the patient during hospitalisation

		POD #1	POD #3	POD #5	At discharge
Urinalysis	Urine Osmolality (mosm/kg)	93	218	264	315
	Urine Sodium (mmol/l)	23	72	117	53
	Urine Potassium (mmol/l)	9	16	15	16
	Urine Chloride (mmol/l)	30	87	99	98
	Urine Creatinine (mg/dl)	23.5	27.2	12.9	67.3
	Urine specific gravity	1.005			
Metabolic Profile	Glucose (mg/dl)	88	123	99	96
	BUN (mg/dl)	2.86	7.62	5.62	3.56
	Creatinine (mg/dl)	0.7	1	0.5	0.5
	Serum Sodium (mmol/l)	144	156	140	139
	Serum Potassium (mmol/l)	3.4	3.6	3.6	4
	Serum Chloride (mmol/l)	112	122	113	109
	Serum Albumin (g/dl)	3.8			
	Serum Osmolality (mosm/kg)	291			

BUN: Blood Urea Nitrogen; POD: Post-Operative Day; Units in parentheses