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CASE REPORT

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Hyponatremia-induced generalized seizure after taking polyethylene glycol for colon preparation—A case report and brief review of the literature

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Abstract

Severe hyponatremia is life-threatening in hospitalized patients. We present an elderly female who developed severe hyponatremia, seizure, and loss of consciousness after taking polyethylene glycol (PEG) solution before colonoscopy. The risk of hyponatremia with PEG for colon preparation in elderly susceptible patients is high. We review the relevant literature.

KEYWORDS

colonoscopy, hyponatremia, polyethylene glycol, seizure

1 | INTRODUCTION

Acute severe hyponatremia is a serious and potentially life-threatening condition that may lead to seizure and coma in hospitalized patients or as outpatient procedures.[1] Hyponatremia has been associated with more serious complications in older patients, in females, and in hospitalized patients. It has been associated with hypothyroidism, surgical procedures, gastrointestinal fluid loss, congestive heart failure, central nervous system injuries,[2] and drugs such as hydrochlorothiazide,[3] selective serotonin reuptake inhibitors (SSRIs) such as citalopram, escitalopram, paroxetine, fluoxetine, and sertraline,[4] and less commonly with polyethylene glycol (PEG) in preparation for colonoscopy.[5]

There are only few reports of hyponatremia induced by PEG, used in the preparation for colonoscopy, that led to seizure in patients between 50- and 80-year-old. Hereby, we present an elderly female patient, in her nineties, who developed severe hyponatremia complicated by generalized grand mal seizure and loss of consciousness after taking PEG for colonoscopy preparation. She fully recovered from this incidence and was discharged to home with no neurologic sequelae. We briefly review the relevant literature.

2 | CASE PRESENTATION

A 91-year-old lean lady who weighed 40 kg was admitted to our hospital for colonoscopy as part of work-up for severe anemia and positive stool occult blood test. She complained of fatigue, weakness, anorexia, dizziness, and paresthesia in her distal extremities. She had no history of dyspnea, chest pain, cough, weight loss, diarrhea, melena, and rectorrhagia. Her past medical history was significant for hypertension and atrial fibrillation, and a hospital admission due to pneumonia 10 months ago. She had no history of diabetes mellitus, hyperlipidemia, malignancy, renal disease, smoking, alcohol, or illegal drug use. Her social history was unremarkable. Her home medications were daily folic acid 1 mg, spironolactone 25 mg,

furosemide 40 mg, metoprolol succinate 23.75 mg, and sertraline 50 mg.

On admission, she was alert and oriented times three. Her vital signs were blood pressure 110/65 mmHg, pulse rate 80/min, normal respiratory rate and body temperature. She was pale without icterus. Jugular veins were visible in semi-sitting position. Heart rhythm was regular with frequent extra beats. Lungs were clear to auscultation. Abdomen was soft and nontender with no organomegaly.

Her laboratory results on admission: White blood cell count 7700/mm^3, Hgb 6.6 g/dl, platelet count 427,000/mm^3, serum creatinine (Cr) 1.6 mg/dl, CKD-EPI eGFR 30 ml/min/1.73m^2, blood urea nitrogen (BUN) 27 mg/dl, serum sodium (Na^+) 143 mEq/L, potassium (K^+) 5.3 mEq/L, aspartate aminotransferase (AST) 30 IU/L, alanine aminotransferase (ALT) 15 IU/L, alkaline phosphatase (ALP) 140 IU/L, total bilirubin 0.6 mg/dl, direct bilirubin 0.2 mg/dl, calcium (Ca) 9.1 mg/dl, phosphate (P) 3.4 mg/dl, magnesium (Mg) 2.2 mg/dl, albumin 3.9 g/dl, partial thromboplastin time (PTT) 30 s, prothrombin time (PT) 11.3 s, international normalized ratio (INR) 1.1. Venous blood gas (VBG): pH 7.33, PCO2 45 mmHg, HCO_3^- 24 mmol/L. Electrocardiography (ECG): Sinus rhythm with premature atrial contractions (PACs), left anterior hemiblock. Chest X-Ray (CXR): unremarkable.

She was put on a low salt diet and received pantoprazole 40 mg daily and 2 units of packed red blood cells. Her Hgb increased to 10 and later to 12 g/dl. After 4 days of spironolactone withdrawal her serum K^+ and Cr declined to 3.6 mEq/L and 1.3 mg/dl, respectively.

An upper gastroduodenal endoscopy showed only gastritis. The patient was subsequently prepared for colonoscopy using polyethylene glycol powder (pidrolax®), Sepidaj Pharmaceutical Co. The patient was instructed to take 4 L of water with 280 g of PEG starting 48 h before the procedure, and an additional 2 L of water with 140 g of PEG 12 h before the procedure. She also received bisacodyl 10 mg every 8 h, sertraline 50 mg daily, and oral furosemide 40 mg daily while on a low salt diet.

Twenty-four hours after drinking polyethylene glycol mixed in 4 L of water, she developed two generalized tonic-colonic seizures 1 h apart, became obtunded and lost consciousness. Her serum Na^+ had declined from 138 to 115 mEq/L.

3 | INVESTIGATION AND TREATMENT

She received intravenous diazepam and sodium valproate 800 mg followed by 100 ml of 5% hypertonic saline and then normal saline. Sertraline was discontinued, and oral pantoprazole was changed to intravenous route.

Computerized tomography (CT) scan of head showed age-appropriate brain atrophy. Magnetic resonance imaging (MRI) of brain revealed small vessel disease and an old ischemic insult in right occipital lobe.

Neurology consultant recommended acetyl salicylate 80 mg and clopidogrel 75 mg daily for the old ischemic insult of brain.

4 | OUTCOME AND FOLLOW-UP

After 24 h, she slowly recovered consciousness but developed anuria and bladder distention that was relieved by bladder catheter insertion. Her serum Na^+ increased to 131 mEq/L and later to 138 mEq/L. Three days later, she became fully conscious and oriented as before her hospitalization and recognized her relatives and her situation. She was discharged from hospital with no neurological deficits, except for loss of taste and smell, and had no seizure at follow-up after 20 months.

5 | DISCUSSION

Seizure due to acute hyponatremia in patients taking PEG for colon preparation is rare. Acute decrease in serum sodium concentration induces an osmotic gradient between the extracellular and the intracellular fluid in brain cells that leads to osmotic movement of water into the brain cells. Therefore, neurologic signs and symptoms of hyponatremia are attributed to cerebral edema.

Some of the predisposing risk factors for the development of cerebral edema and neurological complications due to acute hyponatremia are old age, female gender, thiazide diuretics, selective serotonin reuptake inhibitor (SSRI) antidepressants, premenopausal women after surgery, children, psychogenic polydipsia, and hypoxia.[6,7]

Polyethylene glycol is a biologically inactive iso-osmotic laxative that binds to water and keeps water inside the lumen of gastrointestinal tract.[8,9] It usually does not cause any electrolyte abnormalities.[10–12] However, hyponatremia may develop due to PEG administration by several mechanisms, such as, antidiuretic hormone (ADH) release as a result of acute volume loss and increased plasma osmolarity, nausea and vomiting,[13] or absorption of PEG from gut into blood, and since PEG is an effective osmotic agent it shifts water out of the cells resulting in iso-osmotic dilutional hyponatremia. Although most of the clearance of PEG occurs via kidney filtration during the first 24 h,[14] clearance of PEG in our patient might have been impaired due to her low GFR. Moreover, drinking large volume (>2 liter) of clear liquids with PEG,[15] has

TABLE 1 Comparison of patients' characteristics in different reports.

Reference	No. of patients	Age (year)	Sex (F, M)	Type of preparation	Serum Na (mEq/L)	Serum K (mEq/L)	Serum Cr (mg/dl)	Indication for preparation	Drugs at admission	Past medical history	Brain CT scan/ MRI	Outcome
Present case	1	91	F	PEG	115	5.3	1.6	Anemia/OB+, colonoscopy	Sertraline, furosemide, metoprolol, spironolactone	HTN	No related abnormality	Complete recovery
Ayus et al.[21]	1	62	F	PEG	116	3.9	0.6	Colonoscopy	Thiazide	HTN, HL	Cerebral edema	Complete recovery
	1	51	M	PEG	122	5.1	7.7	Bleeding/ colonoscopy	Amlodipine, atenolol, Lasix, Phoslo, Prilosec	DM, ESRD	Not done	Died
Frizelle et al.[5]	3	75	F	Na phosphate	116	2.4	N/A	Rectal bleeding, Rectal surgery, Rectocele/ surgery	Cyclopenthiazide, atenolol	HTN	Normal or not done/—	Third case: repeat seizure after 9 months
		64	F	Na picosulfate	111	2.6			Quinapril, aspirin, diltiazem	HTN		
		27	F	Mg citrate	132	3.2			Diclofenac, Cilazapril, Hydrochlorothiazide, Nortriptyline	Depression		
Nagler et al.[22]	1	73	F	PEG	117	3.3	0.6	Screening colonoscopy	Levothyroxine sodium and citalopram	Ht, depression	N/A	N/A
Baeg et al.[23]	2	70	F	PEG	110	N/A	N/A	N/A	Amlodipine, ibandronic acid, clopidogrel	HTN	No abnormality	Complete recovery
		65			127				Levothyroxine	Breast cancer, thyroidectomy		
Cho et al.[24]	1	76	F	Na picosulfate/ Mg citrate	112	2.4	0.6	Colonoscopy	Thiazide atorvastatin, Levothyroxine, propranolol, diazepam,	HTN, HL, Ht, depression	No related abnormality	Recovery
Ko et al.[8]	1	62	F	PEG	113	3.4	0.5	Screening colonoscopy	Glimepride, sitagliptin, metformin and atorvastatin	DM, dyslipidemia	mild small vessel disease	Complete recovery
Samad et al.[13]	1	68	F	PEG, Na picosulphate	106	3.1	Normal	Elective colonoscopy	Irbesartan, hydrochlorothiazide, tamoxifen, rabeprazole, atorvastatin, vitamin D, ezetimibe	HTN, breast cancer, right nephrectomy, tonsilectomy	Normal CT	Complete recovery
Saradna et al.[7]	1	64	F	PEG	114	N/A	N/A	Routine colonoscopy	Thiazide	HTN, HL	N/A	Recovery
Naidu et al.[25]	1	74	F	Mg citrate	115	N/A	N/A	Colon cancer/ colonoscopy	Losartan, metoprolol, levothyroxine, escitalopram	HTN, Ht, depression, colon cancer	Normal CT	Complete recovery
Costelha et al.[18a]	1	48	M	Na picosulfate/ Mg oxide/ citric acid	110	3.1	1.0	Diagnostic colonoscopy	Mirtazapine and bupropion	Depression	Normal	Complete recovery

Abbreviations: DM, diabetes mellitus; ESRD, end stage renal disease; HL, hyperlipidemia; Ht, hypothyroidism; HTN, hypertension; N/A, not available; OB+, occult blood positive; PEG, polyethylene glycol.

[a]This patient developed coma not seizure.

been associated with hyponatremia, and our patient had drunk about 4 liters before she developed symptoms.

The present case was an elderly woman who had some degree of renal impairment (eGFR using CKD-Epi equation 30 ml/min/1.73 m^2) related to her age and long-standing hypertension. She was on a low salt diet and was taking sertraline. She took PEG with 4 liters of water and developed severe acute hyponatremia. She was also taking furosemide diuretic. However, furosemide does not contribute to hyponatremia because it decreases osmotic concentration of medullary interstitium by inhibition of sodium chloride reabsorption at the thick ascending limb of loop of Henle that results in diminished water reabsorption from urine by the ADH in the medullary collecting ducts.

Selective serotonin reuptake inhibitors-induced hyponatremia has a prevalence rate of ~9% in elderly population, especially in those with body weight of less than 60 kg.[16] The mechanism of SSRIs-induced hyponatremia is related to ADH, either its inappropriate secretion or increased sensitivity of kidney to ADH.[16,17]

In our patient, old age, reduced renal function, low salt diet, excessive water ingestion (4 liters with PEG), and sertraline, all contributed to the development of acute hyponatremia and central nervous system symptoms.

There are few reports related to the development of hyponatremia and seizure in patients receiving colon preparation medications, that are summarized in Table 1. All except two patients were female, and only two patients were younger than 50 years.[5,18] This confirms that old age and female gender predispose to hyponatremia, possibly due to higher sensitivity of their kidneys to arginine vasopressin (AVP) and/or increased renal V2R expression,[19] and higher baseline level or response of AVP to stimuli in elderly patients.[20]

One male patient with end stage renal disease (ESRD) died from acute hyponatremia while receiving colon preparation for elective colonoscopy.[19] It shows that prognosis of acute hyponatremia, regardless of gender, in patients with other significant medical conditions could be grave. Another male patient developed coma but not seizure.[16]

The present case was an elderly woman with serum Cr of 1.6 mg/dl (eGFR ~30 ml/min/1.73 m^2) who developed severe hyponatremia, seizure, and coma while receiving PEG for colon preparation, and concomitantly taking SSRI and a low salt diet. She suffered no long-term consequences since hyponatremia was detected and managed promptly. Thus, we should be aware of the risk of hyponatremia in the high-risk patients and check serum sodium level to prevent such a potentially catastrophic complication.

6 | CONCLUSION

The risk of developing hyponatremia during colon preparation with PEG in elderly patients who have other concomitant risk factors for hyponatremia may be high. Serum sodium concentration should be measured in such high-risk patients to prevent potentially catastrophic events.

AUTHOR CONTRIBUTIONS

Shiva Seyrafian involved in literature review and drafting of the paper; read and approved the final version of the paper to be published. Vahid Sebghatollahi read and approved the final version of the paper to be published. Bahar Bastani critically reviewed and edited the manuscript for intellectual content.

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CONFLICT OF INTEREST

None.

DATA AVAILABILITY STATEMENT

Not applicable.

CONSENT

A written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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