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Hyponatremic encephalopathy due to polyethylene glycol-based bowel preparation for colonoscopy: A case report

Hyponatremic encephalopathy due to PEG

Abstract

BACKGROUND

Adequate bowel preparation is critical for colonoscopy screening. At present, the most widely used intestinal cleaner recommended at home and abroad is Polyethylene glycol (PEG). Intestinal cleansers can cause electrolyte disturbances and hyponatremia. However, hyponatremic encephalopathy due to hyponatremia induced by PEG solution, although rare, can lead to serious irreversible sequelae and even death.

CASE SUMMARY

In this report, we discuss a case of neurological dysfunction due to hyponatremia, also known as hyponatremic encephalopathy, observed in a 63-year-old woman who underwent PEG-based bowel preparation for colonoscopy. She was eventually transferred to our intensive care unit (ICU) for treatment due to her Glasgow Coma Scale (GCS) score of 9/15 (E2V1M6) and abnormal laboratory tests.

CONCLUSION

¹Physicians should be thoroughly familiarized with the patient's history before prescribing PEG for bowel preparation, and timely identification of patients with hyponatremic encephalopathy is essential, as delayed treatment is associated with poor neurological outcomes. An intravenous infusion of 3% sodium chloride is recommended at the onset of early symptoms. The goal of treatment is to adequately treat cerebral edema while avoiding serum sodium correction beyond 15 to 20 mEq/L within 48 h of treatment to prevent osmotic demyelination syndrome (ODS).

Key Words: Polyethylene glycol; Intestinal preparation; Hyponatremic encephalopathy; Hyponatremia; Brain; Case report.

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Core Tip: Core Tips : Hyponatremic encephalopathy caused by the use of polyethylene glycol (PEG) solution for intestinal cleaning is rare, which can lead to irreversible sequelae and even death. This case is a female with neurological dysfunction due to hyponatremia induced by the use of pegylated for bowel preparation before colonoscopy. The patient was in a coma with brain CT suggesting cerebral edema, and was transferred to ICU for treatment with 3% sodium chloride (NaCl) injection. The patient's medical history should be fully understood before using PEG for bowel preparation, as both untimely and overtreatment can lead to serious complications.

INTRODUCTION

Colonoscopy is a gold standard for diagnostic screening of colon disorders [1]. High-quality bowel cleansing is a prerequisite for colonoscopy. Polyethylene glycol (PEG)-based solution is the most widely used intestinal cleansing agent, although several cases have been reported to cause hyponatremia^[2-4], it is a relatively safe option for patients at risk of electrolyte imbalance and dehydration [5]. As the most common electrolyte abnormality, hyponatremia is closely related to the brain. Indeed, several neurological disorders are frequently associated with hyponatremia, and hyponatremia itself can involve central nervous system dysfunction^[6]. Thus, hyponatremic encephalopathy induced by PEG solutions is of concern to us, although rare and potentially serious. Hyponatremic encephalopathy was first proposed by Arieff [7] and is defined as neurological symptoms associated with hypotonic cerebral edema^[8], is most commonly seen in the intensive care unit (ICU), with a prevalence of only 1% of postoperative patients [9, 10]. Its clinical manifestations include headache, nausea and vomiting, seizures, and decreased consciousness, *etc.* but the severity depends on the degree and rate of serum sodium reduction. At present, relevant guidelines indicate that hypertonic saline is considered to be a safe and effective treatment for acute or symptomatic hyponatremic encephalopathy^[11, 12]. However, hyponatremic encephalopathy is the result of multiple factors, and the current studies on its clinical characteristics and

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treatment are limited^[7, 13]. Here, we describe a case of a 63-year-old female who presented with acute hyponatremic encephalopathy and seizures after bowel cleansing with PEG for colonoscopy.

3 **CASE PRESENTATION**

Chief complaints

A 63-year-old female patient was brought to the local hospital in September 2021 due to a loss of appetite for the past month.

History of present illness

Therefore, the tumor was first suspected and a colonoscopy was performed in combination with the patient's medical history. This patient took PEG with 4.5L water to clean the bowel before the colonoscopy. This patient was found unconscious and developed seizures the following afternoon, and a series of differential diagnoses were made to consider whether the patient had suffered from intracranial vasculopathy, cardiogenic causes, shock, or hypoglycemia. She was eventually transferred to our intensive care unit (ICU) for management.

History of past illness

The patient presented with gastric cancer 13 years ago and underwent radical gastrectomy. The patient subsequently developed liver metastases and received multiple chemotherapy regimens. In addition, the patient had a 10-year history of ulcerative colitis.

2 *Personal and family history*

The patient denied a family history of malignant tumors or other diseases.

Physical examination

This patient was admitted to the ICU with a Glasgow Coma Scale (GCS) score of 9/15 (E2V1M6) and no signs of meningeal irritation. The pupil examination revealed equal-sized and reactive to light.

Laboratory examinations

Laboratory results revealed serum sodium (114 mmol/L, reference: 136-144 mmol/L), potassium (3.4 mmol/L, reference: 3.6-5.2 mmol/L), chloride (82 mmol/L, reference: 101-111 mmol/L), bicarbonate (21 mmol/L, reference: 22-26 mmol/L), blood urea nitrogen (BUN) (32.4 mg/dL, reference: 9-20 mg/dL), creatinine (0.44 mg/dL, reference: 0.6-1.2 mg/dL), glucose (187.2 mg/dL, reference: 70-120 mg/dL). That means a total loss of 19.65g Na deficit. The level of hematocrit decreased from 32.8 to 29.6 vol%.

Imaging examinations

A computed tomography (CT) scan was performed and revealed cerebral edema (Figure 1).

FINAL DIAGNOSIS

After a series of differential diagnoses, combined with the patient's medical history, relevant examination, and treatment, the patient was finally diagnosed with hyponatremic encephalopathy.

TREATMENT

This patient did not have any history of sedatives. She was initially treated with 3% sodium chloride (NaCl) injection. The serum sodium gradually increased to 124 mmol/L after 6 h. Infusions ceased until this patient was free from further seizures.

OUTCOME AND FOLLOW-UP

The following afternoon, the patient's serum sodium returned to 135 mmol/L. Her neurological condition also improved dramatically during this period, with a GCS score of E4V5M6. A CT scan of the brain edema subsequently normalized (Figure 1). The patient was discharged home after 2 days of hospitalization. After 1-month of follow-up, the patient's neurological function recovered completely.

DISCUSSION

Acute hyponatremia is often accompanied by major neurologic manifestations [13,14]. An increasing number of studies have reported acute hyponatremia caused by the use of PEG-based solutions during colonoscopy preparation [15, 16]. The main symptoms of hyponatremia are nausea, vomiting, headache, seizures, and coma. However, cerebral edema is rare [3, 15]. We demonstrate again that bowel preparation with PEG for colonoscopy with PEG may lead to brain cerebral edema associated with hyponatremia. The patient's hyponatremia may be caused by several reasons. First of all, the patient had a history of gastric cancer and had undergone radical surgery at an early stage, which more or less affected gastrointestinal sodium absorption. Moreover, this patient had several high-risk factors, such as older age (>60 years), female sex, and poor dietary intake. Hyponatremia is the most common electrolyte disorder in clinical practice, which is usually caused by excessive secretion of antidiuretic hormone (ADH) or infusion water retention. The syndrome of inappropriate ADH (SIADH) secretion can be caused by a variety of factors, such as ectopic secretion of ADH by tumor cells themselves, and the deterioration of the overall functional status of the patient can also induce ADH release independent of osmotic stimuli [17]. Therefore, hyponatremia is most likely the result of ectopic production of arginine vasopressin (AVP) by the tumors in elderly patients in response to physiologic, non-osmotic ADH.

The European guideline recommends the use of hypertonic saline, usually 3% NaCl, for acute or symptomatic hyponatremia. Hypertonic saline is an effective and potentially life-saving treatment for brain edema induced by hyponatremia, because its high sodium concentration allows water to be diverted from the intracellular space [18].

Twelve cases of hyponatremia induced by PEG-based solutions have been reported (Table 1). Most patients were older than 60 years and most were female. Among them, one patient (case 3) had end-stage renal disease, and five patients (cases 2, 8, 9, 10, and 11) had akenimpaired their urination due to thiazide diuretics. Cases 4 and case 6 had insufficient thyroid replacement and were older than 65 years, suggesting further exacerbation of their hyponatremia. In the presence of normal renal, thyroid, and adrenal function, patients 1 and 5 received additional 4 L of rehydration and 3 L of PEG. Non-osmotic AHD stimulation combined with massive infusion is the main cause of hyponatremia in such patients. In addition, intestinal manipulation during bowel preparation for colonoscopy may lead to increased ADH. Patient (12) received a double dose of PEG, which caused a severe internal environmental disturbance. All the patients recovered fully except for the patient who had dialysis-dependent chronic kidney disease (CKD) and who died from cardiac arrest. This case report has several limitations. First, the single case itself has limitations, and high-quality evidence is needed to confirm. Second, some techniques, like non-invasive brain stimulation (NIBS) techniques, should be more widely used in clinical practice in the future; Third, not all aspects of hyponatremia encephalopathy were discussed.

CONCLUSION

Given this case report, ¹ physicians should be thoroughly familiarized with the patient's history before prescribing PEG for bowel preparation, and timely identification of patients with hyponatremic encephalopathy is essential, as delayed treatment is associated with poor neurological outcomes. An intravenous infusion of 3% sodium chloride is recommended at the onset of early symptoms while avoiding serum sodium correction beyond 15 to 20 mEq/L within 48 h of treatment to prevent osmotic demyelination syndrome (ODS).

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