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Case Report

CASE REPORT

Hypomagnesemia as a potentially life-threatening adverse effect of omeprazole

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Abstract

Hypomagnesemia can be caused by a wide range of diseases (e.g. gastrointestinal disorders, kidney diseases or endocrine disorders), but it can also be a side effect of several drugs. It can be asymptomatic or cause many different clinical symptoms, and the clinical manifestations mainly depend on the rate of development rather than the actual serum magnesium concentration. We here present a 40-year-old female patient with Torsade de pointes ventricular tachycardia and cardiac arrest caused by severe hypomagnesemia as an adverse effect of the proton pump inhibitor omeprazole.

INTRODUCTION

Hypomagnesemia can result from a variety of different causes including gastrointestinal diseases, kidney diseases and as a side effect of drugs in medical treatments. The symptoms depend on the rate of development as well as the actual serum concentration of magnesium. Furthermore, symptoms may be diverse because of the various biochemical and physical effects of magnesium, and similar to other electrolyte disturbances symptoms may be diffuse and/or atypical. In the following case report, we present a 40-year-old female patient with Torsade de pointes arrhythmia and cardiac arrest caused by severe hypomagnesemia as an adverse effect of proton pump inhibitor (PPI) treatment.

CASE REPORT

A 40-year-old female presented with nausea, fatigue and diarrhea at the emergency department. She also described palpitations but denied other cardiovascular symptoms, and no neuromuscular symptoms were reported. She had not been able to eat or drink properly for the last weeks, and her symptoms had progressed during the last days before admittance to the hospital. Medical history was significant only for familial hypercholesterolemia and gastric esophageal reflux disease. Especially, no chronic endocrine diseases were present. She used 20–40 mg omeprazole and 20 mg atorvastatin on a daily basis and she had smoked for the last 20 years. She denied using narcotics or alcohol and also to have taken any nephrotoxic drugs.

The patient was in acute stress at admittance. The blood pressure was 103/80 mmHg, heart rate was regular with 125 beats per minute and the respiratory rate was 24 per minute. On the physical examination she presented clinical signs of dehydration, otherwise the physical examination showed no abnormalities. The laboratory tests showed hemoglobin 18.6 g/dL (references: 11.7–15.3 g/dL), leukocyte count 27.8 * 10^9/L (references: 3.5–11.0 * 10^9/L), thrombocyte count 468 (references: 165–387 * 10^9/L), creatinine 349 μmol/L (references: 45–90 μmol/L), urea 8.6 mmol/L (references: 2.6–6.4 mmol/L), sodium 150 mmol/L (references: 137–145 mmol/L), potassium 3.6 mmol/L (references: 3.4–4.8 mmol/L), estimated glomerular filtration rate

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(GFR) 13 mL/min/1.73 m^2 (references: >30 mL/min/1.73 m^2), troponin I 925 ng/L (references: <15 ng/L), calcium 2.18 mmol/L (references: 2.17–2.52 mmol/L), albumin 53 g/L (references: 36–45 g/L), PTH 22.1 pmol/L (references: 1.6–6.9 pmol/L). A urine test strip was positive on proteins (2+) and microscopy of the urine showed a few hyaline casts. An electrocardiogram (ECG) revealed sinus tachykardi with frequency 125 beats per minute and diffuse changes in the ST-segments of lateral and anterior leads (aVL, II, III, V1, V2, V4, V5, V6). The corrected QT-interval was 388 ms. Ultrasound of the kidneys and transthoracic echocardiography were both normal.

The patient was then admitted to the department of internal medicine with the diagnosis acute renal failure probably secondary to dehydration, and she received intravenous Ringer's acetate infusion. Her urine production was sparse during the first hours of admittance, about 20 mL/hour.

Five hours after admittance the patient became critically ill presenting convulsions, cyanosis and loss of consciousness. Resuscitation was started immediately and the ECG showed Torsade de pointes ventricular tachycardia. A bolus injection of intravenous magnesium (20 mmol) converted her arrhythmia to sinus rhythm and she woke up. Severe hypomagnesemia was diagnosed with magnesium <0.27 mmol/L (references: 0.71–0.94 mmol/L). Magnetic resonance imaging of the cerebrum and cerebral angiography were both normal. Further treatment with intravenous Ringer's acetate and 5% glucose solution supplemented with $MgSo_4$ caused normalization of the serum level and she also showed gradual clinical improvement. Careful examination could not detect any gastrointestinal or renal cause of hypomagnesemia. Although, her diarrhea present at admittance probably contributed to her severe hypomagnesemia causing the arrhythmia.

She was discharged home after 14 days in hospital with daily oral supplements of magnesium. However, 3 months later she was again admitted to hospital with hypomagnesemia despite the daily supplementation. The laboratory tests showed magnesium 0.28 mmol/L (references: 0.71–0.94 mmol/L), creatinine 106 μmol/L (references: 45–90 μmol), sodium 144 mmol/L (references: 137–145 mmol/L), potassium 3.2 mmol/L (references: 3.4–4.8 mmol/L), estimated GFR 57 mL/min/1.73 m^2 (references: >30 mL/min/1.73 m^2), calcium 2.42 mmol/L (references: 2.17–2.52 mmol/L), PTH 4.8 pmol/L (references: 1.6–6.9 pmol/L). Her kidney function had improved and her renal failure at the first admittance was probably secondary to the severe dehydration. After a thorough examination, it was concluded that the hypomagnesemia was a side effect of the PPI omeprazole. She had taken PPI for the last 13 years and her serum magnesium was within the normal range at the last control 7 years before the first admittance. Her PPI treatment was stopped and she is now under surveillance in the outpatient clinic with stable normal serum magnesium levels for 5 months after last discharge.

DISCUSSION

Symptoms of hypomagnesemia typically begin to be manifested at serum levels <0.66 mmol/L (1.6 mg/dl) [1]. The magnesium balance is maintained by renal regulation of magnesium reabsorption and hypomagnesemia can result from a variety of causes. However, it usually occurs secondary to other disease processes or drugs, and features of the primary disease process may complicate or mask magnesium deficiency. Magnesium plays an important role in several biochemical and physiological processes, and is the fourth most abundant cation in the body. Hypomagnesemia therefore tends to cause symptoms from different tissues including the neuromuscular, central nervous system and the cardiovascular system [2]. The classic symptoms of severe hypomagnesemia include tetany, convulsions, bradycardia, hypotension and in worst case death. The prevalence of hypomagnesemia in hospitalized patients varies (7–11%) and is even more frequent in patients with other coexisting electrolyte abnormalities [3–5]. Hypomagnesemia in critical ill patients is associated with increased mortality [6]. Unfortunately, there are no readily and easy methods to assess magnesium status, although serum magnesium and the magnesium tolerance test are the most widely used [2].

PPIs are extremely widely used, and during the last decades PPI-induced hypomagnesemia has become a well-established phenomenon [7–9]. Growing evidence suggest that PPI impair the intestinal magnesium absorption through molecular mechanism of magnesium transporters; probably influenced by a complicated interplay of molecular biology, pharmacology and genetic predisposition [10]. Our patient in the case report presented severe hypomagnesemia resulting in Torsade de pointe and cardiac arrest. She was successfully treated and widely investigated, searching for the cause of her hypomagnesemia which was found to be an adverse effect of PPI. Her PPI was stopped and she then presented stable serum concentration of magnesium within the normal range in the following surveillance.

CONCLUSION

Severe hypomagnesemia can cause life-threatening ventricular arrhythmias. Hypomagnesemia can be caused by many different conditions, e.g. be a side effect of the widely used drug PPI. Serum concentration of magnesium should be analyzed in hospitalized patients especially when the patient presents with other electrolyte disturbances or when conditions affecting magnesium metabolism are present.

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CONFLICT OF INTEREST STATEMENT

None declared.

ETHICAL APPROVAL

No approval is required.

CONSENT

The patient gave written consent for publication of this case report.

GUARANTOR

Øyvind Bruserud and Bent-Are Hansen.

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