

Clinical Communications: Adults

GLOBAL T-WAVE INVERSIONS WITH ISOLATED HYPOMAGNESEMIA

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Abstract—Background: The physiological actions of magnesium within the cardiac conduction system and myocytes have yet to be fully elucidated. Because concurrent hypocalcemia or hypokalemia were also present in previous human reports, specific electrocardiographic effects of isolated hypomagnesemia have not been clearly delineated. **Objective:** We report a case in which dynamic electrocardiogram (ECG) changes were demonstrated in isolated hypomagnesemia. **Case Report:** A 37-year-old man with history of heavy alcohol use was admitted for syncope. The ECG showed global T-wave inversions with prolonged corrected QT (QTc) duration on ECG. Extensive work-up including cardiac catheterization was unremarkable. His serum magnesium was noted to be low at 1.1 mg/dL, and his serum calcium and potassium were within normal limits. The patient received magnesium infusion with subsequent ECGs showing resolution of his global T-wave inversions and prolonged QTc. **Conclusion:** This case is unique because it reports dynamic ECG changes in a patient with isolated hypomagnesemia. Although isolated hypomagnesemia is commonly believed to result in dysrhythmia, we were unaware of any previous cases of ECG abnormalities in humans. Clinically, we advise checking serum magnesium and correcting hypomagnesemia when prolonged QTc duration and global T-wave inversions are seen on ECG. **Published by Elsevier Inc.**

Keywords—electrocardiogram; electrolyte abnormalities; hypomagnesemia; T-wave inversions

INTRODUCTION

Interest in magnesium and its role in cardiac electrophysiology started >75 years ago when temporary control of acute dysrhythmia was achieved with magnesium infusion

(1). Since then, several studies have looked at not only treatment of dysrhythmias with magnesium but also the relationship of electrocardiogram (ECG) changes and dysrhythmias to isolated hypomagnesemia. ECG changes initially reported in animal studies with hypomagnesemia included peaked T waves, slight ST depression, and QRS prolongation (2). ST abnormalities have been observed in humans with hypomagnesemia but only in patients with coexistent hypocalcemia or hypokalemia (1,3,4). This is the first reported case, to our knowledge, of global T-wave inversions and prolongation of corrected QT (QTc) interval in isolated serum hypomagnesemia.

CASE REPORT

A 37-year-old male college student presented to the emergency department (ED) with nausea, vomiting, and transient syncope. The patient was walking to a bus stop when he suddenly felt nauseated. After an episode of nonbloody emesis, he had brief loss of consciousness. Emergency medical services were called, and the patient was brought to our emergency department for evaluation.

The patient's medical history was significant for four to five lifetime episodes of transient syncope. The patient was evaluated by another ED several months earlier. An ECG at that time revealed normal sinus rhythm with no T-wave abnormalities. He was treated with intravenous (IV) fluids and discharged home. The patient's social history was significant for episodic heavy alcohol and marijuana use. The patient's last alcohol binge was 3 to 4 days prior to admission, at which time he had consumed 10 beers.

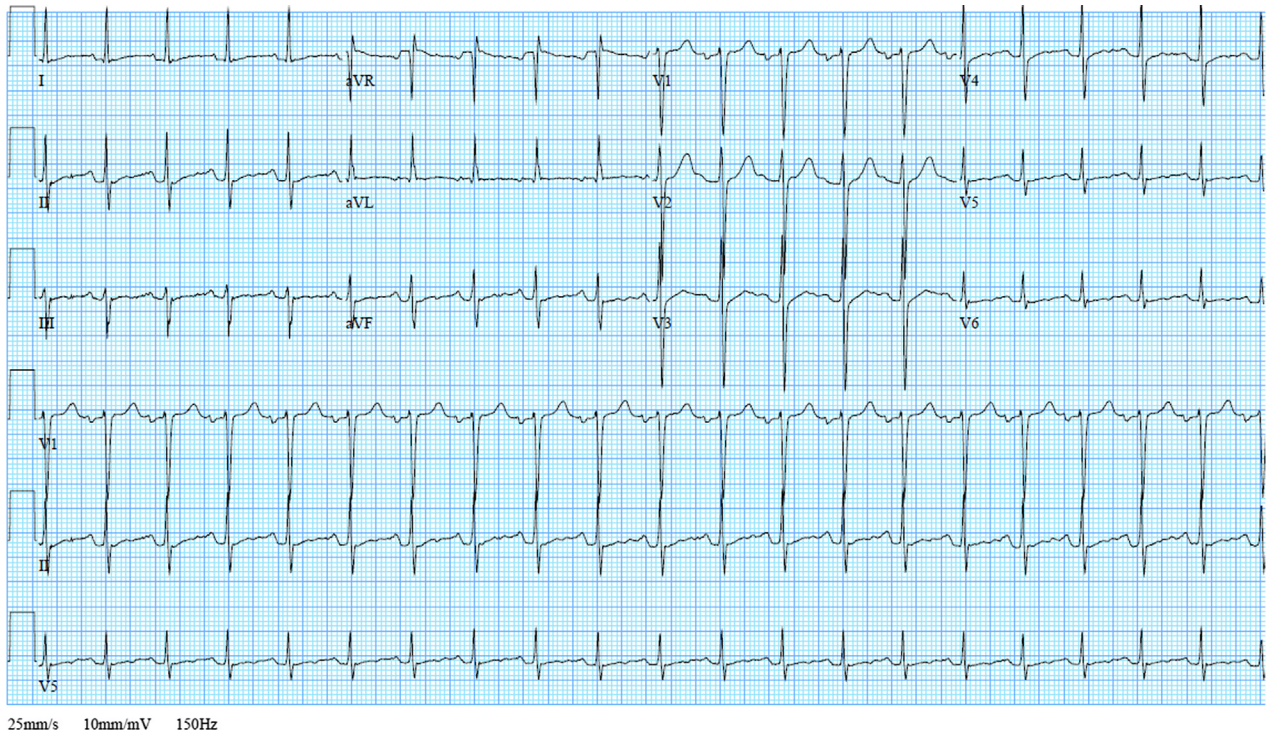


Figure 1. The initial 12-lead electrocardiogram showed sinus tachycardia with nonspecific T-wave abnormalities. QTc duration was normal (448 msec).

The patient's initial vital signs included a temperature of 36.8°C, a pulse of 111 beats per min, blood pressure of 157/113, and a respiratory rate of 20 breaths per min with oxygen saturation at 99%. The initial ECG showed sinus tachycardia with non-specific T-wave abnormalities (Figure 1). The patient received a 1-L normal saline bolus. While being observed in the emergency department, the patient had multiple episodes of nonbloody emesis over a 12-h period. Laboratory investigations several hours after the initial presentation were notable for low serum magnesium at 1.1 mg/dL (normal, 1.5–2.6 mg/dL). Potassium and calcium were normal at 3.8 mEq/L and 9 mg/dL, respectively (Table 1). Cardiac markers (e.g., troponin I, myoglobin, and creatine kinase MB) were trended over 9 h and were all within normal limits. A repeat ECG found new global T-wave inversions and a prolonged QT interval (Figure 2). Table 2 lists some causes of global T-wave inversions. The patient had no chest discomfort. His examination was unremarkable except for a mild bilateral upper extremity intention tremor. Given his examination and new ECG changes, non-contrast head computed tomography (CT) and head and neck CT angiography scans were performed, ruling out intracranial pathology. Electroencephalogram and brain magnetic resonance imaging scans were also performed,

revealing no abnormalities except for diffuse cerebral and cerebellar atrophy.

The patient was admitted to the inpatient cardiology service for further evaluation of his symptoms and abnormal ECG. He was treated with IV magnesium sulfate to correct his hypomagnesemia and oral metoprolol for hypertension. Repeat laboratory testing revealed a normal serum magnesium level of 1.7 mg/dL and 2.4 mg/dL after

Table 1. Basic Metabolic Panel and Serum Magnesium Value

Variable	Day 1			Day 2
	2:50 AM	10:17 AM	5:00 PM	3:00 AM
Serum sodium (mmol/L)	137	—	—	135
Serum potassium (mmol/L)	3.8	—	—	3.5
Serum chloride (mmol/L)	95	—	—	97
Serum bicarbonate (mmol/L)	29	—	—	28
Serum urea nitrogen (mg/dL)	7	—	—	7
Serum creatinine (mg/dL)	0.93	—	—	0.91
Serum magnesium (mg/dL)	1.1	1.7*	2.4†	2.1

Dashes indicate that no values were obtained during that time period.

* After infusion of magnesium (2 g).

† After infusion of magnesium (4 g).

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