ECG IMAGE OF THE MONTH
Mathew D. Hutchinson, MD, Section Editor

THE AMERICAN JOURNAL of MEDICINE®

Spiked Helmet Sign

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PRESENTATION

Although the presence of ST-segment elevations on a 12-lead electrocardiogram (ECG) is concerning for an acute coronary syndrome, it is essential to work up additional diagnostic possibilities beyond the most obvious. Herein we present a case of a 71-year-old woman with a history of hypertension, hyperlipidemia, myelofibrosis s/p allogeneic stem cell transplant (2019) complicated by graft-versus-host-disease admitted for nausea, epigastric discomfort, chest pressure, and shortness of breath. Her medications included amlodipine, losartan, simvastatin, tacrolimus, ruxolitinib, and methylprednisolone.

ASSESSMENT

On admission, she was afebrile with a regular heart rate of 96 beats per minute, elevated blood pressure (152/83 mm Hg), and 97% oxygen saturation on room air. A physical examination was notable for mild epigastric tenderness without any guarding or rigidity. An abdominal kidney, ureter, and bladder (KUB) X-ray demonstrated findings suspicious for adynamic ileus. A 12-lead ECG obtained (Figure 1) revealed ST-segment elevation in leads II, III, aVF, and V_3, V_4, V_5. Initial high-sensitivity troponin level was 26 ng/L (normal reference range <10 ng/L).

DIAGNOSIS

An emergent left heart cardiac catheterization (Figure 2) revealed an unremarkable coronary artery. Considering abnormal abdominal X-ray findings, an abdominal computed tomography (CT) scan was performed that demonstrated perforation and pneumatosis of the distal ileum proximal to the ileocecal valve with pneumo-peritoneum. Although the admission ECG demonstrated ST-segment elevation concerning for ST-segment elevation myocardial infarction (STEMI), a closer look at the rhythm strip in lead V_5 shows the upward shifting of the baseline that starts before the onset of the QRS complex and ends after the QRS complex, a finding not consistent with the STEMI criteria. This electrocardiographic finding was first described in 2011 by Littmann and Monroe[1] in a case series of 8 patients with acute abdominal pathology. This was called "Spiked Helmet Sign," as in each case, the ST-segment elevations resembled a dome-and spike pattern, giving the appearance of Pickelhaube, the German military spiked helmet (Figure 3) introduced in 1842 by Friedrich Wilhelm IV, King of Prussia.

This ECG pattern has been associated with critically ill patients with an exceedingly high risk of mortality.[1] The acute rise in the intra-abdominal or intrathoracic pressure appears to be the underlying cause. This pseudo-ST-segment elevation is predominantly seen in the inferior leads in patients with an intra-abdominal pathology (ranging from gastric dilation, bowel obstruction to acute abdominal catastrophes like bowel ischemia and perforation).[2-4] Similar findings, if confined to precordial leads, have been reported in patients with an acute rise in intrathoracic pressure like aortic dissection, pneumothorax, pneumomediastinum, or acute respiratory distress syndrome.[4-6] The exact mechanism of the spiked ST-segment elevations remains unknown. The changes in the cardiac position due to the pulsatile diaphragmatic motion caused by the direct stimulation of the diaphragm by the inferior wall of the left ventricle, the triggering of the left diaphragmatic leaf by the left phrenic nerve,[7,8] or the repetitive pulsatile epidermal stretch due to an acute rise in the intrathoracic or intra-abdominal pressure[9] are the proposed mechanisms.

MANAGEMENT

The patient underwent emergent exploratory laparotomy with small bowel resection and right hemicolectomy. The

Funding: None.
Conflicts of Interest: None.
Authorship: All authors had access to the data and a role in writing this manuscript.

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0002-9343/$ -see front matter
https://doi.org/10.1016/j.amjmed.2020.05.043

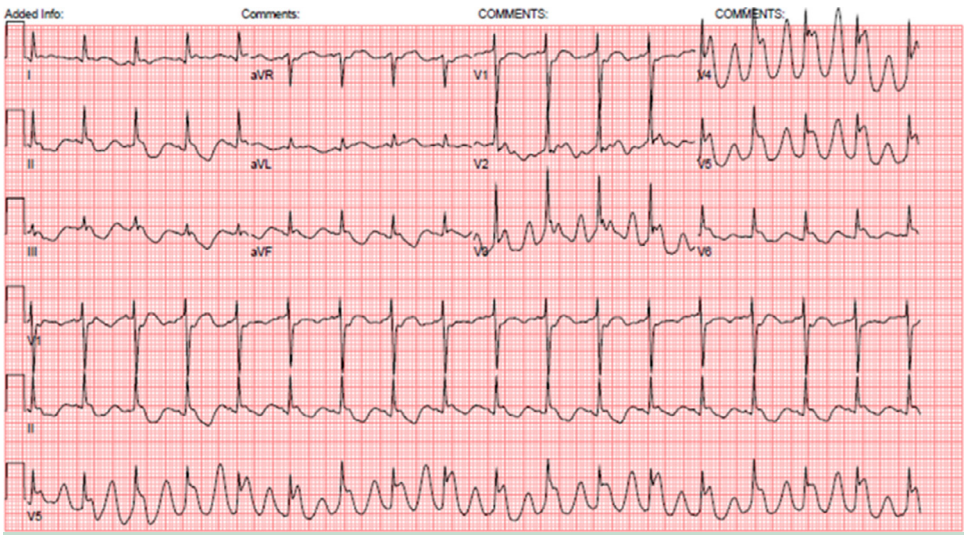

Figure 1 A 12-lead electrocardiogram on presentation demonstrating sinus rhythm with ST-segment elevations leads II, III, aVF, and V_3, V_4, V_5.

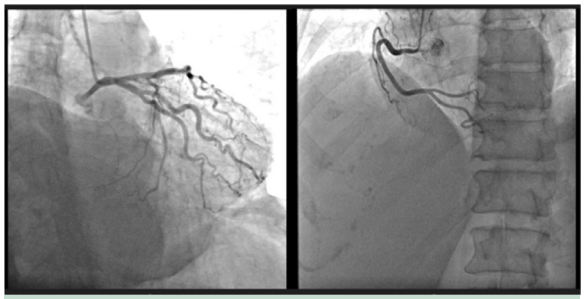

Figure 2 A coronary angiogram in a right anterior oblique cranial and left anterior oblique cranial view demonstrated the left main coronary artery, left anterior descending artery, left circumflex artery, and right coronary artery, respectively, were angiographically unremarkable.

transthoracic echocardiogram performed postoperatively demonstrated normal left ventricular function without any wall motion abnormalities. Repeat 12-lead ECG on day 2 postoperatively showed complete resolution of ST-segment elevations without any evolving ST-T changes or appearance of Q waves (Figure 4).

Our patient's case illustrates that ST-segment elevation on ECG can be caused by conditions other than an acute coronary syndrome. A quick search for alternate diagnoses (either intrabdominal or intrathoracic pathology) and workup is essential to avoid unnecessary delays in the recognition and treatment of the catastrophic noncardiac clinical conditions associated with this ECG finding.

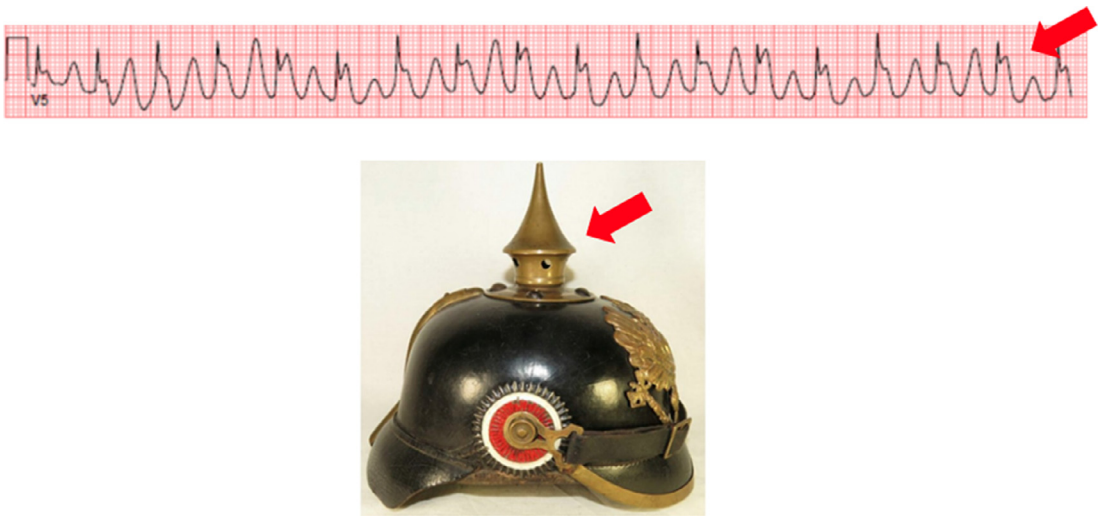

Figure 3 Lead V5 rhythm strip demonstrating the ST-segment elevations with the upward shifting of the baseline that starts before the onset of the QRS complex and ends after the QRS complex resembling the Pickelhaube of a German military spiked helmet.

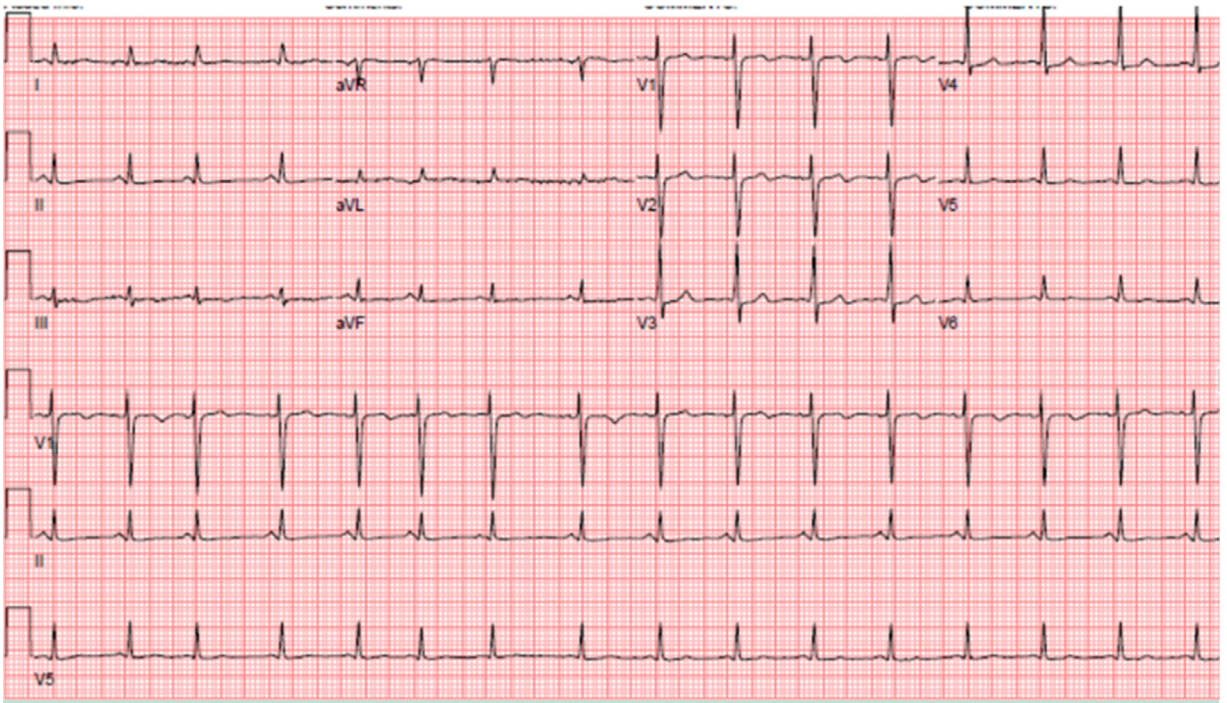

Figure 4 Repeat 12-lead electrocardiogram performed postoperatively, demonstrating complete resolution of ST-segment elevations without any evolving ST-T changes or appearance of Q waves.

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