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Spiked helmet pattern ST elevation in subarachnoid hemorrhage

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ABSTRACT

Subarachnoid hemorrhage (SAH) is occasionally associated with the electrocardiographic (ECG) pattern of ST-segment elevation myocardial infarction (STEMI). Missing the true clinical diagnosis can result in inappropriate and harmful interventions. We report the case of a 40-year-old female who was found down. The ECG was diagnostic for acute lateral STEMI. Further analysis of the ECG showed marked prolongation of the QT interval and the "spiked helmet sign" (SHS). The patient was ruled out for myocardial infarction and a head CT demonstrated a massive SAH with acute hemorrhage into the ventricles. Review of the literature and of our own ECG files revealed additional cases where severe acute central nervous system (CNS) conditions were associated with the SHS.

Introduction

Acute CNS events, most commonly SAH, are frequently associated with ECG abnormalities mimicking myocardial ischemia or infarct [1–7]. Because the clinical presentation can be nonspecific, i.e. comatose, the ECG often will drive evaluation and management. The use of antiplatelet agents and heparin, however, is detrimental in SAH, and emergent cardiac catheterization can result in unnecessary delay of appropriate treatment. Recognizing ECG signs that point to the correct diagnosis, therefore, can be lifesaving. The purpose of this presentation is to raise awareness to the electrocardiographic spiked helmet sign – a clue for the consideration of a possible CNS event.

Case report

A 40-year-old woman was noted to have seizure-like activity at work. Paramedics found her apneic and pulseless. She underwent CPR and received 4 rounds of epinephrine after which she had return of spontaneous circulation. In our emergency department she was unconscious with no corneal or gag reflexes. The ECG (Fig. 1, top) was diagnostic for lateral STEMI. Bedside echocardiogram revealed mild global hypokinesis without regional wall motion abnormalities. Head CT showed large subarachnoid hemorrhage with blood in the ventricles. 24 h later she still had no corneal or gag reflex, and the family agreed to withdraw care.

In addition to STEMI, the ECG revealed two important findings. First, the QT interval was markedly prolonged with a QTc >600 ms (Fig. 1). Second, the ST elevation demonstrated the "spiked helmet sign" (SHS) [8]. The SHS is characterized by an upward shift of the baseline that starts before and ends after the QRS complexes causing a dome-and-spike configuration resembling a German military spiked helmet (Fig. 1, bottom).

Discussion

The SHS was first described in 2011 [8]. The original publication and subsequent reports demonstrated that it is an important ECG finding that can mimic STEMI, but one that is almost always associated with non-cardiac critical illness and high risk of death [8–18]. When present in the inferior leads, the SHS is usually the result of an acute abdominal event [9–11]. When present in the chest leads, it usually reflects an acute thoracic event [11–13]. The most widely accepted cause of the SHS in these cases is a sudden increase in intrathoracic or intraabdominal pressure that results in pulsatile epidermal stretch occurring in concert with the cardiac cycle.

Recently a few case reports and commentaries have suggested that excessive sympathetic discharge can also cause the SHS [14–18]. The SHS has been shown to be present after stellate ganglion ablation [14], in Tako-Tsubo cardiomyopathy [15], in "stormy" clinical course in STEMI [16], in acute intracerebral hemorrhage [17] and, as in our case, following SAH [18]. A retrospective and non-systematic review of our own ECG files revealed 3 additional cases where acute CNS events were associated with the SHS (Fig. 2).

It is not known why patients with SAH occasionally present with ECGs suggestive of STEMI. Those who underwent cardiac catheterization

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0022-0736/

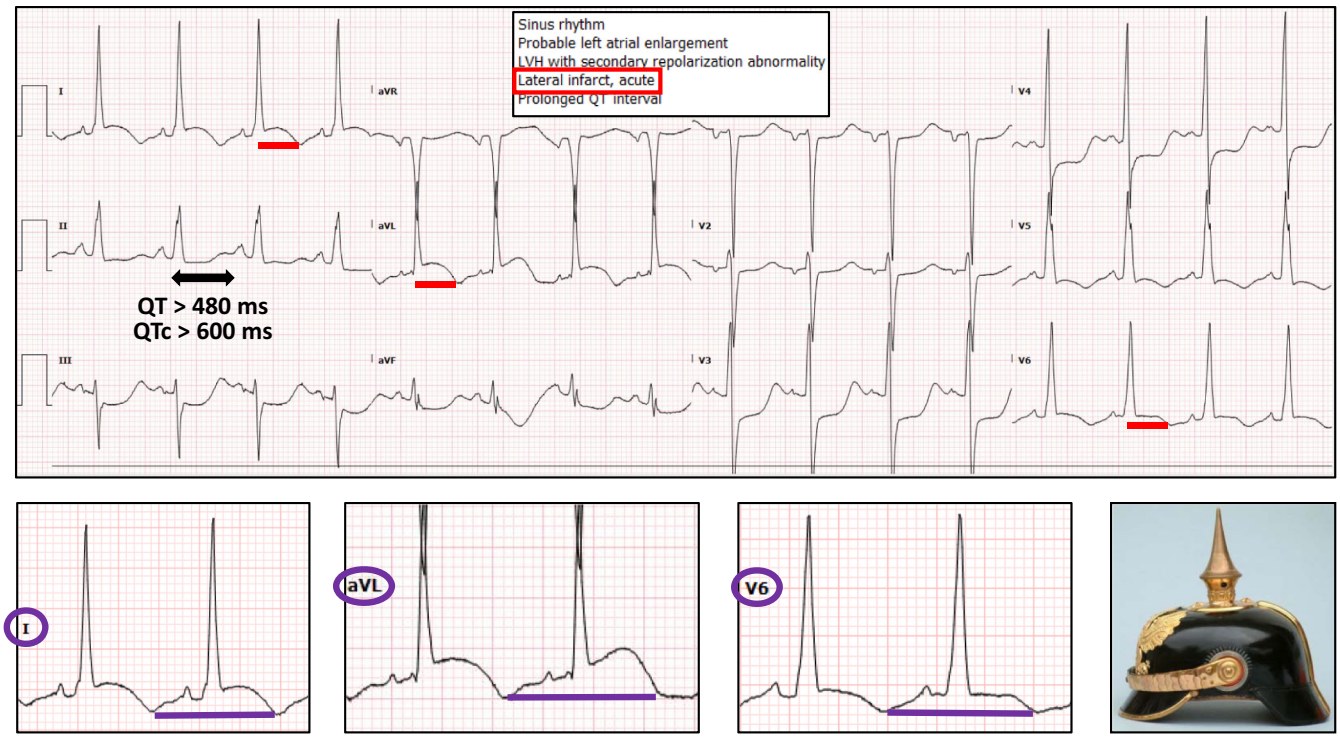

Fig. 1. Top: Initial electrocardiogram of a patient with subarachnoid hemorrhage suggestive of acute lateral ST-elevation infarct. Diagnostic ST elevations are marked by red lines. Software interpretation has been moved to the middle. Bottom: Enlarged lateral leads demonstrate the "spiked helmet sign" (purple); German military spiked helmet.

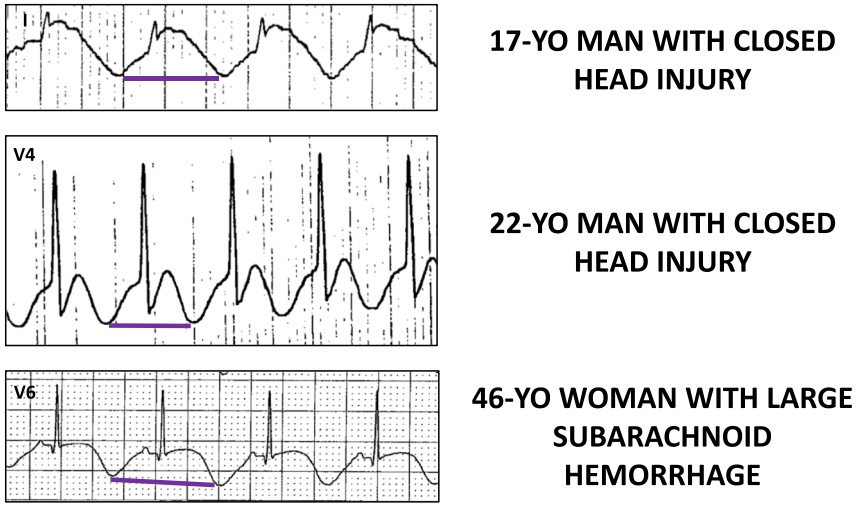

Fig. 2. Selected ECG leads demonstrating the spiked helmet sign in three young patients who presented with acute CNS events.

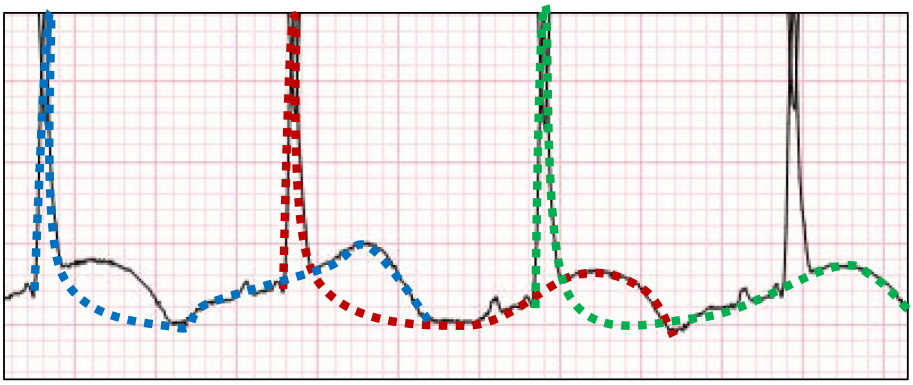

Fig. 3. Hypothetical mechanism of the spiked helmet sign in subarachnoid hemorrhage. The color-coded dotted lines represent possible relationships between the QRS complexes and large, markedly delayed T-U waves mimicking ST-segment elevations.

did not have coronary artery obstruction or vasospasm [5–7]. The exact cause of the SHS in SAH is also uncertain, but it is tempting to speculate that the upward baseline shifts that sandwich the QRS complexes may reflect giant distant T-U waves originating from the previous cardiac cycles (Fig. 3). This hypothesis is supported by the observation that extreme hypocalcemia, a condition which too is associated with marked QT prolongation, can also cause a STEMI pattern with the spiked helmet sign [19–21].

Summary

In the absence of prospective studies, the sensitivity and specificity of the spiked helmet sign in the diagnosis of SAH is unknown. Nonetheless, it is our recommendation to consider SAH or other CNS events behind an electrocardiographic STEMI pattern under the following conditions: (1) clinical presentation with acute neurological findings such as loss of consciousness or coma; (2) marked prolongation of the QT/QU intervals; (3) the electrocardiographic spiked helmet sign. Under these circumstances, consider head CT first before anticoagulation and emergent cardiac catheterization is pursued.

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