

Acute Pericarditis and Early Electrocardiogram Signs: The Spodick's Sign. Features by a Briefcase Report

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Abstract

Pericarditis is an inflammatory disease of the pericardium that infectious and noninfectious agents could cause. For diagnosis, there are clinical criteria as typical pericardial chest pain and pericardial friction rub, echocardiography criteria as evidence of pericardial effusion.

But the electrocardiogram (ECG) plays an important diagnostic role and remains the most useful diagnostic test in differentiating acute pericarditis from myocardial ischemia.

We present a brief clinical case focusing on the diagnostic electrocardiographic signs for acute pericarditis.

Keywords: Pericarditis; Electrocardiogram; Spodick's Sign; Chest Pain

Abbreviations

ECG: Electrocardiogram; STEMI: ST Elevation Myocardial Infarction; ACS: Acute Coronary Syndrome

Introduction

Pericarditis is an inflammatory disease of the pericardium that infectious and noninfectious agents could cause. It is classified as acute (< 3 months), recurrent (repeated episodes of acute pericarditis), or chronic (> 3 months) in duration [1,3-5].

Clinical criteria for diagnosis are typical pericardial chest pain and pericardial friction rub.

Also, transthoracic echocardiography is recommended in patients with suspected pericarditis to reveal pericardial effusion. Echocardiography can help confirm the diagnosis, and clinical or echocardiographic evidence of tamponade indicates the need for pericardiocentesis [1-5].

But the Electrocardiogram (ECG) plays an important diagnostic role and remains the most useful diagnostic test in differentiating acute pericarditis from myocardial infarction (STEMI) [6].

We present a brief clinical case focusing on the diagnostic electrocardiographic signs for acute pericarditis.

Case Report

A.S. is a 24 years old young black man without cardiovascular risk factors.

In 2018 he experienced community pulmonary pneumonia, and in September 2020, symptomatic COVID.

In November 2020, he got to Emergency Room because of chest pain, dyspnoea and fever, which had already been present for some days.

The clinical examination showed tachypnea, no signs of high jugular venous pressure, efficacious heart tones, and no murmurs but pericardial friction rub.

The brachial blood pressure was 120/85 mmHg, peripheral pulse oximetry was 98%, and body temperature was 37.5 °C. The chest X-ray showed a mildly enlarged heart shadow.

The main laboratory parameters were: Troponin I high sensitivity 0.002 ng/dl, Creatinine 0.90 mg/dl; Hemoglobin: 13.0 g/dl, PCR 103 mg/dl, AST 61mg/dl, ALT 34 mg/dl, LDH 280 mg/dl, Na: 132 mEq/L, K: 4.5 mEq/L, INR 1.1.

The ECG showed a normal sinus rhythm, normal atrioventricular and intraventricular conduction, PR-segment depression, ST-segment elevation (Figure 1), and downsloping TP-segment best visualised in lead II (Figure 2).

Figure 1: ECG recorded in Emergency Room. It shows all elements for Stage-1 pericarditis: 1) diffuse PR-segment depression excepted lead aVR where PR is mildly elevated; 2) concave ST-segment elevation inferior and precordial lateral leads; 3) ST-segment depression lead V1; 4) TP-segment down sloping as Spodick's sign (leads II and precordial leads V4, V5, V6).

Figure 2: Focus on lead II. Blue arrows show TP-segment down sloping (Spodick's sign). Red arrows indicate PR-segment depression.

The echocardiogram displayed mild pericardial effusion but average heart dimension, segmentary kinetics, and systolic function.

Discussion

Acute pericarditis: clinical diagnostic criteria

Acute pericarditis is one of the diseases in which patients present to the emergency room with chest pain, and generally, the diagnosis comes in after ischemic causes are ruled out [1,7,8].

Idiopathic pericarditis is the majority of diagnosed cases. Other causes of pericarditis include viral, bacterial, fungal infections and tuberculosis. In addition, noninfectious causes are post-myocardial infarction pericarditis (early or late as Dressler Syndrome), chest trauma, neoplasm, renal failure (uremia), radiation therapy, and autoimmune disorders, and certain medications such as phenytoin or rifampin [1,7-9].

Patients present pleuritic chest pain generally abrupt in onset, sharp and severe, substernal or left precordial location; may radiate to the neck, arms, or jaw. The pain increases with inspiration and is relieved by leaning forward and worsened by lying supine [7,8].

Occasionally, patients report fever and myalgia.

On physical examination, patients may have tachycardia and pericardial friction rub.

Therefore, four are the clinical criteria for diagnosis:

- Typical pericardial chest pain
- Pericardial friction rub
- Specific ECG variations
- New or worsening pericardial effusion on echocardiography.

Patients must have two of the above criteria for confirming the diagnosis [11,12].

Acute Pericarditis: ECG diagnostic criteria

ECG remain the most crucial tool in diagnosing acute pericarditis. However, its features can be seen in no more than 60% of the cases [6].

As a rule, the pericardial sac lacks electrical activity, but inflammatory pericardium can bother the action potential in the adjacent epicardium, leading to specific ST segment alterations on ECG.

In damaged myocardial cells, the distortion of the action potential shape induces a voltage gradient (current of injury) between injured myocardial cells and surrounding unaffected cells.

On ECG, the ST-segment elevation or depression reflects this current of injury. Generally, we can see concave-upward ST-segment

elevation because the current of injury occurs in transmural or epicardial cells. Due to the widespread nature of pericarditis, the damage does not coincide with a specific coronary territory as in STEMI, so the ST-segment elevation is diffuse, too [13].

Therefore, pericarditis can also involve the atria and is responsible for PR-segment depression.

ECG abnormalities of acute pericarditis undergo four different and chronological stages that we summarized in table 1, and the complete diagnostic ECG features we outlined in table 2.

	Stage I	Stage II	Stage III	Stage IV
	Hours or Days	Days or Weeks	Weeks	Months
ECG features and signs	PR-segment depression PR-segment elevation in aVR Diffuse concave ST-segment elevation with concordant upright T waves Absence of ST-segment changes in reciprocal leads aVR and V1 may have ST-segment depression Spodick's sign	Normalization of ST and PR segments T waves progressively invert	T wave inversion persist with isoelectric ST-segments	Gradual resolution of T wave inversion

Table 1: It shows ECG features in pericarditis during the different chronological stages.

ECG findings evocative of acute pericarditis	
Concave-upward ST-segment elevation	ST-elevation is less than 5 mm
More extensive leads involvement	Less reciprocal ST-segment depression
PR-segment elavation in lead aVR	PR-segment depression in other leads
Absence of pathological Q waves	Variability in the time of T-waves inversion

Table 2: Main findings evocative of acute pericarditis.

In addition to the described criteria, Spodick's sign is another interesting ECG finding.

In 1974 Spodick described a downsloping TP segment in patients with acute pericarditis [14].

This sign is often best visualized in lead II and lateral precordial leads.

If looked adequately for, the sign is present in up to 80% of patients, and it helps distinguish between acute pericarditis and acute coronary syndrome (ACS).

PR-segment depression can sometimes be a mimicker when used alone, as seen in both acute pericarditis and ACS. However, the presence of PR-segment depression and Spodick's sign is often a pathway for the diagnosis [6,14,15].

Our case report and ECG findings

- In our case, the clinical criteria satisfy the diagnosis of acute pericarditis. The patient presents typical pericardial chest pain, pericardial friction rub, and pericardial effusion detected with the echocardiogram, and these elements already appear sufficient for a correct diagnosis.
- Focusing on the ECG, we detect widespread PR-segment depression except for lead aVR where it appears elevated, concave-ascending ST-segment elevation inferior and

precordial lateral leads, ST-segment depression lead V1. Last but not least, we also observe the typical Spodick's sign characterised by the downsloping of the TP segment (Figure 1). This sign is more evident in lead II (Figure 2) and precordial lateral lead (V4, V5, V6).

- Therefore this ECG contains all the typical early diagnostic elements of acute stage 1 pericarditis, including Spodick's sign, and appears, in our opinion, instructive and informative.
- Generally, as part of the diagnostic process of acute pericarditis, physicians focus on the alterations in the ST segment or PR segment. These also are in acute coronary syndrome (STEMI or SCA).
- Clinicians rarely look for or notice Spodick's sign which, combined with other findings on the ECG, can help confirm the diagnosis of acute pericarditis [6].
- Spodick's sign is a meaningful diagnostic indicator but alone is not pathognomonic for acute pericarditis.

Conclusion

In our opinion, this clinical case demonstrates that the electrocardiogram continues to maintain an essential role in diagnosing acute pericarditis and its methodological analysis through the search for typical signs and aspects can contribute to the precision diagnosis.

Conflict of Interest

No conflict of interest to declare.

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