Rural Healthcare Quality Network

Hospital Peer Review

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Hospital Peer Review is a monthly newsletter sponsored by the Rural Healthcare Quality Network to alert Critical Access Hospitals regarding findings from the Peer Review Program. Summarized are a few of the key findings and best practices that would be helpful for other critical access hospitals to be knowledgeable about. This newsletter is edited by Myron Bloom, Medical Director and he can be reached at drmbloom@msn.com.

STE or STEMI: Smiles, Frowns or Tombstones

In 1980, DeWood reported that patients presenting with acute chest pain, persistent ST-segment elevation progressing to Q waves, and elevations of cardiac biomarker levels were found to have a total thrombotic coronary occlusion in 87% of cases.[1] But studies show that around a fifth of STE is pericarditis, and pericarditis occurs in a fifth of patients after myocardial infarction, but most pericarditis is not related to myocardial infarction. So how can we differentiate an acute myocardial infarction, specifically a STEMI, from pericarditis and normal variant early repolarization?

In the first hours to days, acute pericarditis is characterized by diffuse ST elevation with reciprocal ST depression in leads aVR and V1. There may also be an atrial current of injury, which is highly specific although not sensitive for pericarditis, reflected by elevation of the PR segment in lead aVR and depression of the PR segment in other limb leads and in the left chest leads, primarily V5 and V6. Notably in pericarditis, the PR and ST segments typically change in opposite directions; for example, in aVR the PR segment is elevated (often by only 1 mm or so) while the ST segment is usually slightly depressed.[2]

The ST segment in acute pericarditis is often elevated at the J point or may rise obliquely in a straight line or curvilinear upward, usually has an upward concavity (Smile) and is rarely taller than 5 mm. Although similar patterns can occur with STEMI, the typical finding is an upward convex ST elevation (Frown or Tombstone), a pattern not characteristic of acute pericarditis, and may be more than 5 mm in height.[2]

While the STE in AMI is usually limited to either the anterior & lateral leads (I, aVL, V1 to V6) or the inferior (II, III, aVF) leads facing the localized area of the infarct, the ST-T changes in pericarditis are more generalized being present in both chest leads as well as limb leads. When pericarditis involves the anterior leads, STE is most commonly seen in V5 and V6 with decreasing frequency going from V4 to V1. In the limb leads, it is often more evident in leads I

and II than in leads III, aVF, and aVL. Importantly, reciprocal ST segment depression is often seen in STEMI, but not seen with pericarditis except in aVR and V1.[2]

Again, like in AMI, the ST segment elevations seen with acute pericarditis may be followed by T wave inversions. However, whereas the leads facing the infarction tend to show similar changes in AMI, the more diffuse epicardial injury in pericarditis is reflected by different degrees of STE and T wave inversion in different leads. Hyperacute T waves, which can be seen in STEMI, are not typical in pericarditis; Q waves, which often occur in STEMI, are generally not seen in pericarditis. Pericarditis generally causes only superficial inflammation, not frank myocardial necrosis and thus Q waves are not seen unless there is concomitant myocarditis.[2]

The normal early repolarization variant, characterized by ST elevation of the J point, is more likely to be present in the V2-V4, occur in men than women, in patients under age 40 (≥0.1 mV in 90% in men 17 to 24 years [3]), African American, and in individuals who are athletically active[4]. ST elevations occur in both the limb and precordial leads in most cases of acute pericarditis (47 of 48 in one study), whereas about half of subjects with early repolarization have no ST deviations in the limb leads[5]. However, a recent study raises the question about the relatively rare early repolarization in the inferior leads as an adjusted relative risk for arrhythmic death of 1.43 and for cardiac death of 1.28, especially when the J point elevation is more than 0.2 mV.[6]

Electrocardiographic Differentiation of Acute Pericarditis from Acute Myocardial Infarction		
	Pericarditis	**STEMI**
PR depression	Frequent but transient	Rare
ST segment	Widespread concave (smile) II>III	Localized convex (frown) III>II
Q waves	Very unusual	May be present

First test for STEMI then test for Pericarditis when faced with STE and a scenario compatible with STEMI:

- Reciprocal ST depression except in aVR or V1 is a STEMI
- STE in III > II is a STEMI
- STE that is horizontal or convex upward (frown or tombstones) is a STEMI
- Any NEW Q waves is a STEMI

In the absence of those findings, try to rule in pericarditis:

- Presence of a friction rub or PR depression in multiple leads (both of which are transient) supports a diagnosis of pericarditis.
- Hearing a pericardial friction rub may be a clue for pericarditis as it is highly specific for acute pericarditis. In study of 703 patients with pericarditis, the fleeting finding of a

pericardial friction rub was detected in 20% overall, 25% of those with a Q-wave infarct, and 9% of those with a non-Q-wave infarct. The rub can be localized or widespread, but is usually best heard over the left sternal border using the diaphragm with firm pressure and with the patient leaning forward or resting on elbows and knees while holding their breath.[7]

Endnotes:

1. DeWood MA, Spores J, Notske R, et al. Prevalence of total coronary occlusion during the early hours of transmural myocardial infarction. *New England Journal of Medicine.* October 16, 1980;303(16):897-902.
2. "Evaluation and management of acute pericarditis" and "Electrocardiogram in pericarditis and pericardial effusion." *Up to Date* version 17.3, September 2009.
3. Surawicz B, Parikh SR. Prevalence of male and female patterns of early ventricular repolarization in the normal ECG of males and females from childhood to old age. *Journal of the American College of Cardiology*. November 20, 2002;40(10):1870-1876.
4. Klatsky AL; Oehm R; Cooper RA; Udaltsova N; Armstrong MA. The early repolarization normal variant electrocardiogram: correlates and consequences. *American Journal of Medicine*. August 15, 2003;115(3):171-177.
5. Spodick, DH. Differential characteristics of the electrocardiogram in early repolarization and acute pericarditis. *New England Journal of Medicine.* September 2, 1976;295(10):523-526.
6. Tikkanen JT, Anttonen O, Junttila MJ, et al. Long-term outcome associated with early repolarization on electrocardiography. *New England Journal of Medicine*. December 24, 2009;361(26):2529-2537.
7. Spodick, DH. Pericardial rub. Prospective, Multiple observer investigation of pericardial friction in 100 patients. *American Journal of Cardiology*. March 1975;35(3):357-362.