



UNMASKING STEMI DIAGNOSIS IN PATIENTS WITH A VENTRICULAR PACED RHYTHM

Diego Gonzalez, MD; Jose Escabi-Mendoza, MD, FACC

Cardiology Department, VA Caribbean Healthcare System, San Juan, PR



INTRODUCTION

- Patients with a suspected acute myocardial infarction (AMI) in the setting of LBBB or ventricular paced rhythm (VPR) present a unique diagnostic challenge.
- These abnormal patterns can obscure the classical ST-segment ischemic changes, thus resulting in a delayed diagnosis and reperfusion of AMI.
- Guidelines recognize the use of three specific ECG Sgarbossa criteria (SC) [1-2] and modified SC (MSC) [3] for diagnosis of AMI in the setting of LBBB.
- However, in the case of right VPR, there are no specific STEMI guidelines endorsing the use of SC for diagnosis of acute coronary occlusion (ACO), mostly related to the limited evidence-based data with few studies validating such criteria [4-5].
- We present two cases with clinical and electrocardiographic findings consistent with AMI and review the usefulness of the Modified Sgarbossa Criteria (SMC) as equivalent STEMI findings in patients with VPR.

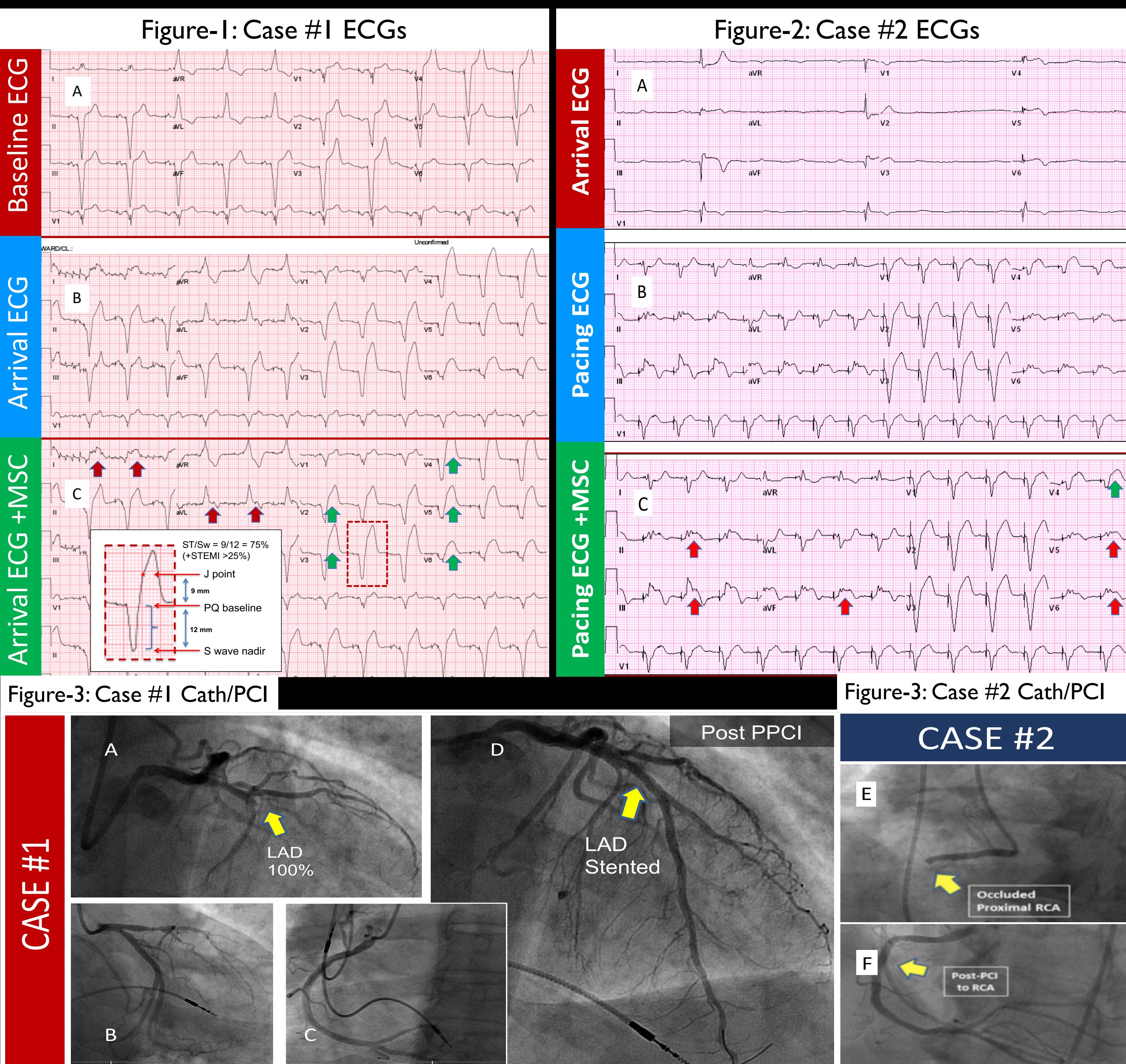
CASE PRESENTATION #1

- 65-year-old male with a medical history of essential hypertension, habitual marijuana smoking and a dual-chamber pacemaker implanted for complete atrioventricular block (CAVB), who presented to the emergency department (ED) with complaints of oppressive chest pain and diaphoresis of 3-hours of evolution. His arrival vital signs were remarkable for a blood pressure of 181/101mmHg and a pulse of 92bpm.
- Initial electrocardiogram (ECG) (figure-1B) showed sequential atrioventricular pacing. A closer inspection (figure-1C) revealed concordant ST-segment elevation (STE) >1-mm in lead-I (red arrows) and markedly discordant STE (>5mm; green arrows) when compared to the QRS vector (S-wave) on leads V2-V6 with a ST-segment to S-wave amplitude ratio of >25%. Such findings represent 2/3 MSC for the diagnosis of anterolateral STEMI in the setting of a VPR.
- Emergent coronary angiography demonstrated 100% occlusion of the mid left anterior descending artery (LAD) (figure-3A-D). He underwent a successful percutaneous intervention (PCI) with restoration of TIMI III flow, with complete resolution of symptoms and improved STE changes.

CASE PRESENTATION #2

- 76-year-old male who arrived at the ED with complaints of general weakness, dizziness, nausea and diaphoresis of 3-hours of evolution. He denied chest pain, but his wife referred that the day before he had epigastric discomfort of several hours of duration with recurrent nausea and emesis. He was profoundly bradycardic (25bpm), hypotensive (70/43mmHg) and looked pale and lethargic.
- His arrival ECG (figure-2A-C) revealed a complete atrioventricular block with a slow junctional escape rhythm, inferior Q-waves, subtle lateral STE of 1mm (V5-V6), inferior STE (L-II, III & aVF) and high lateral ST-segment depressions (aVL & L-I). These changes were initially difficult to recognize given his severe bradycardia. He was initially managed with aggressive intravascular volume expansion and dopamine infusion with subsequent emergent placement of temporary transvenous pacemaker.
- A subsequent ECG performed (figure-2B-C) after placement of the transvenous pacemaker revealed ventricular pacing 100% and more pronounced concordant STE in the inferior (between 3-4mm) and lateral leads (2mm), meeting the first MSC for STEMI equivalent changes.
- An emergency coronary angiography was performed with the assistance of intra-aortic balloon pump (IABP) for hemodynamic support. This revealed a proximal right coronary complete occlusion that was treated successfully with PCI (figure-3E-F), with complete reopening and TIMI 3 flow. Subsequently, he regained normal atrioventricular conduction without need of permanent pacing and with an adequate clinical recovery.

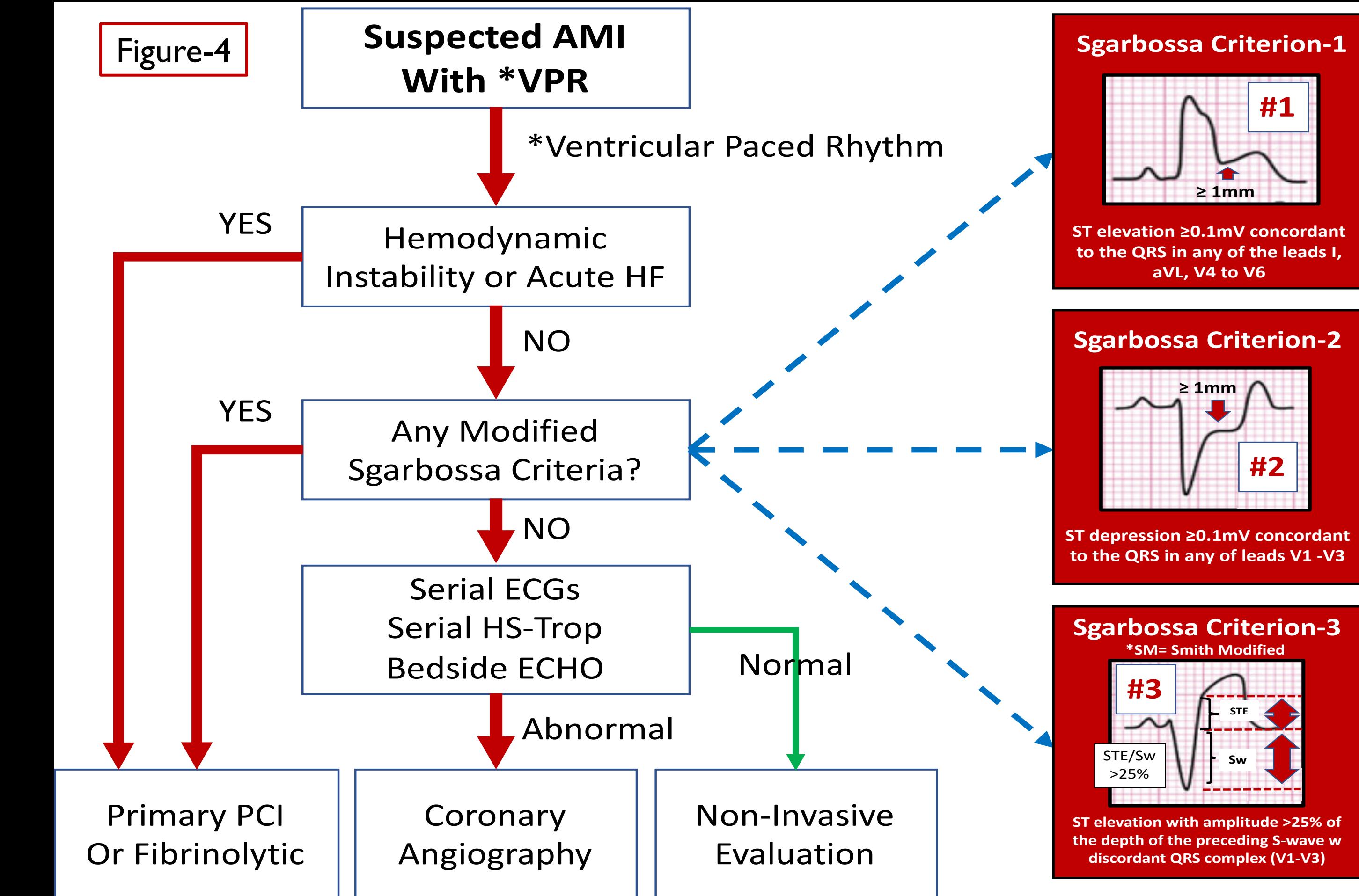
DIAGNOSTIC IMAGING



DISCUSSION

- The prevalence of VPR in patients presenting with AMI is significantly increasing due to the growing life expectancy and better survival of patients with heart disease. These patients have three times the average door-to-balloon PCI time and twice the mortality when compared to those without pacing rhythm mostly due to delayed diagnosis [5].
- Some have suggested the adaptation of the MSC (figure-4) for "STEMI equivalent" recognition in patients with right VPR since the ECG morphology is similar to a LBBB rhythm, yet there are only few studies validating such criteria [4-5].
- More recently, published preliminary result from an ongoing retrospective multicenter study (PERFECT) designed to test the performance of the MSC for the diagnosis of ACO with VPR has showed encouraging findings. Fifteen subjects who had right VPR with AMI and angiographic evidence of ACO were compared to 79 control patients and the sensitivity and specificity of MSC was 67% and 99% respectively, very similar as in the case of LBBB [5].
- Both of our cases illustrate the value of recognizing the MSC for STEMI diagnosis in the context of VPR. In the first case, it led to an earlier STEMI code activation by the ED physician, which resulted in a door-to-balloon time of <90 minutes. In the second case, it assisted with convincing the interventional cardiologist of ongoing injury in the absence of chest pain for an emergent angiographic evaluation and intervention.
- Although, there is no clear correlation of these ECG STEMI equivalent findings as to predict the affected ventricular wall or occluded coronary vessel, in both of our cases the ST-segment abnormalities that met the MSC correlated with the usual ECG/vascular territories as in patients with non-paced rhythms.

DIAGNOSTIC ALGORITHM



We believe that a stepwise triage and management algorithm using clinical findings and the MSC for the diagnosis of AMI (as similarly advocated by Smith et al. for patients with LBBB [3]) may be very useful for diagnosis of STEMI in patients with VPR (figure-4).

CONCLUSION

- In patients with VPR and a clinical presentation suggestive of AMI, the presence of at least one MSC in the ECG represents a STEMI equivalent finding with a similar accuracy as when these are used in patients with LBBB.
- Proper training of the frontline physicians with these STEMI equivalent criteria in patients with VPR will significantly improve reperfusion times and clinical outcomes.

REFERENCES

- Sgarbossa EB, Pinski SL, Barbagelata A, et al. Electrocardiographic diagnosis of evolving acute myocardial infarction in the presence of left bundle-branch block. GUSTO-I (Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries) Investigators. *N Engl J Med* 1996; 334:481-7.
- Tabas JA, Rodriguez RM, Seligman HK, Goldschlager NF. Electrocardiographic criteria for detecting acute myocardial infarction in patients with left bundle branch block: a meta-analysis. *Ann Emerg Med* 2008; 52:329-336.e1.
- Smith SW, Dodd KW, Henry TD, Dvorak DM, Pearce LA. Diagnosis of ST-elevation myocardial infarction in the presence of left bundle branch block with the ST-elevation to S-wave ratio in a modified Sgarbossa rule. *Ann Emerg Med* 2012; 60:766-76.
- Maloy K, Bhat R, Davis J, Reed K, Morrissey R. Sgarbossa Criteria are Highly Specific for Acute Myocardial Infarction with Pacemakers. *West J Emerg Med* 2010; 11(4):354-7.
- Dodd KW, Elm KD, Hart M, et al. Performance characteristics of the modified Sgarbossa criteria for diagnosis of acute coronary occlusion in emergency department patients with ventricular paced rhythm and symptoms of acute coronary syndrome. *Acad Emerg Med* 2017;24(S1):S36.
- Bertel N, Witassek F, Puhan M, Erne P, Rickli H, Naegeli B, et al. Management and outcome of patients with acute myocardial infarction presenting with pacemaker rhythm. *Int J Cardiol* 2017; 230:604-9.