Prevalence of secondary ST-T wave ECG abnormalities confounding the diagnosis of acute myocardial ischemia in patients presenting to the emergency department with a chief complaint of chest pain

Example
- John, 63
- Overweight
- 30 year smoker
- Hypertension

Secondary Repolarization Changes
“Abnormalities in the ST segment and T wave that occur as a direct result of changes in the sequence and/or duration of ventricular depolarization, manifested electrocardiographically as changes in QRS shape and/or duration”

Background

AHA Scientific Statement
Practice Standards for Electrocardiographic Monitoring in Hospital Settings
An American Heart Association Scientific Statement From the Councils on Cardiovascular Nursing, Clinical Cardiology, and Cardiovascular Disease in the Young

Published by the International Society for Cardiography and the American Association of Critical Care Nurses
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Guidelines

“Class III: Cardiac monitoring is not indicated because a patient’s risk of serious even is so low that monitoring has no therapeutic benefit”

Class III for ST-segment monitoring include: LBBB, frequent intermittent RBBB, ventricular pacing, coarse A fib, intermittent ventricular rhythm

ST-segment Monitoring Confounders

- Secondary ST changes induced by non-ischemic causes
  - LBBB
  - LVH with strain
  - Pacing
  - Ventricular rhythm
- Causes that interfere with proper ST measurement
  - Coarse Afib/flutter
  - RBBB

Knowledge Gap

Clinical utility of telemetry monitoring chest pain patients with non-ischemic ST-segment changes

Purpose

Define the frequency of chest-pain patients with ST confounders and evaluate the clinical significance of these ECG abnormalities

Specific Aim 1: Determine the magnitude of the problem among patients seen at the ED for chest pain:

Aim 1(a). What is the distribution of ischemic vs. non-ischemic causes of chest pain?
Aim 1(b). What percentage of patients admitted to a telemetry unit to rule out ACS had a final diagnosis of non-ischemic chest pain?
Aim 1(c). What is the prevalence of ECG abnormalities that lead to secondary non-ischemic ST changes or interfere with proper ST measurement?

Specific Aim 2: Investigate the relationship between the presence of non-ischemic ST confounders and other important clinical variables:

Aim 2(a). Is there a relationship between the presence of non-ischemic ST confounders and demographic and clinical characteristics of patients?
Aim 2(b). Is there a relationship between the presence of non-ischemic ST confounders and chest pain etiology?
Aim 2(c). Is there a relationship between the presence of non-ischemic ST confounders and course of hospitalization?
Methods

- 9-1-1 ECG
- Labs & Clinical Data
- Discharge

Demographic and Clinical Data

- Age, sex, race
- CAD risk factors
  - Smoking history, obesity class
  - HTN, DM, HLD, CAD
  - Past cardiac history
- Clinical presentation
  - Chest pain equivalent
  - Presenting ECG and labs

Clinical Outcomes

- Etiology
  - ACS
  - Non-ischemic cardiopulmonary
  - Non-cardiac
  - Undifferentiated
- Admission status, length of stay
  - Discharge from ED (LOS < 12 hrs)
  - Admitted overnight (12 hrs < LOS < 36 hrs)
  - Admitted for treatment (LOS > 36 hrs)
- ST-segment monitoring confounders

Data Collection and Coding

- ECG’s de-identified
- 3 reviewers for ECG (blinded from outcomes)
- Reviewer for clinical outcomes based on EMR

Statistical Analysis

- SPSS software
- Categorical and continuous variables
- Descriptive analysis
- Independent T-test or Mann-Whitney U test
- Chi-square
- p<0.05 significance
Specific Aim 1: Determine the magnitude of the problem among patients seen at the ED for chest pain:

Aim 1(a). What is the distribution of ischemic vs. non-ischemic causes of chest pain?

- 43% Ischemic
- 17% Non-ischemic
- 32% Unknown
- 9% Other

Specific Aim 2: Investigate the relationship between the presence of non-ischemic ST confounders and other important clinical variables:

Aim 2(a). Is there a relationship between the presence of non-ischemic ST confounders and demographic and clinical characteristics of patients?
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Aim 2(a). Is there a relationship between the presence of non-ischemic ST confounders and demographic and clinical characteristics of patients?

Aim 2(b). Is there a relationship between the presence of non-ischemic ST changes and chest pain etiology?

Aim 2(c). Is there a relationship between the presence of non-ischemic ST changes and course of hospitalization?

Discussion

Overview

- 75% admitted
- 83% non-ischemic chest pain
- 1 in 6 patients had ST-segment monitoring confounders
- Older age, CAD risk factors related to ST confounders
- ACS and cardiopulmonary etiologies related to ST confounders
- 1 in 5 patients admitted had confounders, increased length of stay by 1 day

Limitations

- No data on false alarms in telemetry units
- Data on 30-day readmission, re-infarction, mortality not available yet
Discussion

**Conclusion**
- ST-segment monitoring confounders prevalent among patients that present to the ED with chest pain
- Relationships exist between confounders and other important clinical variables

**Future Direction/Research**
- Establish alternative methods for monitoring patients with confounders
- Implement more frequent vital signs, biomarkers evaluation
- Determine frequency of unnecessary treatment in ST-segment monitoring false alarms
- Enhance computerized algorithms specifically for confounders (LVH, LBBB)

Thank you!