Assessing the Accuracy of Computer ECG Interpretation for Acute Myocardial Infarction

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Disclosures

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No Disclosures

Introduction

- Quality Benchmark for STEMI: Door to Balloon (D2B) time < 90 min
  - Emphasis on ECG within 10 min of contact
  - Early cardiac catheterization lab (CCL) activation by EM providers & Pre-Hospital providers
  - Use of Computer-interpretation ECG (CI-ECG)

What is an Acute MI?

- Thygesen et al "Universal Definition of Myocardial Infarction"
  - Elevated markers with symptoms and ECG changes c/w new ischemia
  - Sudden death with symptoms and ECG changes c/w new ischemia
  - Necrosis on pathology report

Thygesen et al European Heart Journal (2007) 28, 2525–2538

Interpretation Agreement

- STEMI – surrogate for AMI
- Prior studies:
  - Accuracy of STEMI identification by Computer, Cardiologists, Emergency Physicians, Paramedics
  - Variability among all

Interpretation Agreement

Recognition of ST elevation by paramedics

M Whitbread, V Leah, T Bell, T J Coats

Emerg Med J 2002;**19**:66–67

Automated Electrocardiogram Interpretation Programs Versus Cardiologists' Triage Decision Making Based on Teletransmitted Data in Patients With Suspected Acute Coronary Syndrome

Elaine N. Clark, MA[a,*], Maria Sejersten, MD[b], Peter Clemmensen, MD, DMSc[b], and Peter W. Macfarlane, DSc[a]

Am J Cardiol 2010;106:1696–1702

Computer EKG Interpretation

- Used in many systems for field triage of MI
- Facilitates early activation of CCL
- Probably more reproducible then physicians

Objective

The objective of this study was to evaluate the performance characteristics of CI-ECG for coronary artery occlusion using angiography as the gold standard.

Methods
Study Population, Inclusions

- Single large, academic community ED
- January 2006 to February 2011
- Adult patients
  - Presented by EMS for evaluation of chest pain
  - Pre-hospital CI-ECG available
  - All admitted to CCL with high suspicion for AMI

Demographics

- Age, Gender
- Time to ECG, Reperfusion
- Cardiac enzymes

Pre-Hospital ECG

- Single Device type
  - Medtronic Physio Control
- Pre-hospital ECGs dichotomized
  - CI-ECG + ("AMI suspected")
  - CI-ECG –
- Approved by Institution IRB

Methods – Outcome

- Primary outcome of "definite AMI"
  - Angiography showing 100% occlusion
  - Thrombus in Culprit vessel
- Reviewed by independent Cardiologist

Statistics for CI-ECG

- Sensitivity
- Specificity
- Likelihood ratios

Results

- 173 Patients from CCL Registry with Pre-Hospital CI-ECG
- Overall cohort characteristics
  - 54% male
  - Mean age 65.7 (range 35-94)
  - Mean time from ECG to reperfusion 81.8 min +/- 25.5

ECG and Catheterization Results

	Definite AMI	No Definite AMI	Total (n=173)
CI-ECG +	73	36	109
CI-ECG –	43	21	64
Total (n=173)	116	57	173

Performance Characteristics of CI-ECG for AMI Diagnosis

Performance Characteristics	Value (95% CI)
Sensitivity (%)	62.9 (53.4, 71.6)
Specificity (%)	36.8 (24.8, 50.7)
Likelihood Ratio +	0.99 (0.78, 1.27)
Likelihood Ratio –	1.01 (0.75, 1.35)

Impact of Gender on Prediction of Coronary Artery Occlusion

	N	LR +	95% CI
Male	94	1.06	(0.77, 1.46)
Female	79	0.91	(0.63, 1.32)

Computer Interpretation ECG

- Does not predict coronary artery occlusion well
- Lack of evaluation of other methods of MI diagnosis

Limitations

- Single center
- Single ECG device and algorithm
- Single cardiologist interpretation, not blinded
- No access to clinical information

Future Endeavors

- False positive and false negative ECG morphologies may reveal patterns over-read or under-read by the computer
- Certain patient demographics might be associated with specific ECG findings, thus over-read by the computer
- Consider HPI in the decision to activate CCL and influence on results
- Conflicting interpretations between EMS and ED CI-ECGs due to differing computer algorithms

Conclusion

Computer interpretation of ECGs poorly identifies coronary artery occlusion.

Questions?

Thank you!

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