The Lived Experience of Prehospital ECG in Rural Emergency Care

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Jason Lenz APRN, CNP
Agency

- Hoyt Lakes Ambulance service in cooperation with the Northern Pines Medical Center located in northeastern Minnesota

- Professional team includes EMTs, ED staff (MD, RN, CNPs, and PAs), STEMI coordinator for Essentia Health, and Information Technology staff
- Rural St. Louis County
- Basic Life Support Ambulance Service
- Critical Access Hospital within a healthcare system
Introduction

- Coronary heart disease: Leading cause of mortality in the United States

- ST-Elevated Myocardial Infarction (STEMI) accounts for 25-40% of Acute Coronary Syndrome (ACS) in the United States

- Timely administration of either angioplasty or a thrombolytic agent improves outcomes for patients
Partial thickness damage of heart muscle in NSTEMI

Full thickness damage of heart muscle in STEMI
Performance Measures

Reperfusion therapy for patients with STEMI. The bold arrows and boxes are the preferred strategies.

(ACC/AHA 2013)
Problem Summary

- Despite evidence that earlier time of treatment from onset reduces mortality, time-to-treatment remains prolonged.

- Critical access hospitals meet optimal performance on the process measures for AMIs 91% of the time compared to non-CAHs which met this measure 97.8% of the time.
Utilizing prehospital emergency services to diagnose and triage STEMI patients as part of a system of care has been suggested to help improve time-to-treatment.
Prehospital ECGs have been shown to shorten the time-to-reperfusion in patients experiencing STEMI.

Prehospital ECGs alone (not a part of system of care) are not as effective when compared with prehospital ECGs with early notification of the receiving hospital.
Literature Review Summary

- The ability to transmit and accurately interpret the transmitted prehospital ECG is a feasible option for early notification.

- Suggested that prehospital ECG may lower mortality and morbidity, more studies are required.
Literature Review Summary

- Prehospital ECG recommended in the national guidelines from the American Heart Association.

- Studies have shown that reductions in door-to-intervention times have been shown when prehospital ECG used to activate the catheterization laboratory while patient is enroute to the hospital despite this:
Prehospital ECGs were recorded in less than 10% of STEMI patients.

When used, the information is not translated into action or coordinated with a system of care to decrease delays in reperfusion therapy.
Literature Review Summary

- Limited research has been done on the use of prehospital ECG by basic life support (BLS) providers

- Rural areas provide primarily BLS ambulance services, usually by volunteers supplemented by a relatively small number of advanced life support (ALS) providers
Recommendations:
The American Heart Association 2013

- All communities should create and maintain a regional system of STEMI care

- Performance of a 12-lead Electrocardiogram (ECG) by prehospital Emergency Medical Services (EMS) at the site of First Medical Contact (FMC) with symptoms of STEMI
Mission Statement

Improve the care of the STEMI patient transported to the Northern Pines Medical Center by the Hoyt Lakes Ambulance Service by initiating the transmission of prehospital ECG.
IMPLEMENTATION & TRAINING
Key community leaders were informed and allowed input

- Medical Director
- Director of Nursing
- Ambulance service officers
- Tri-City Ambulance
- Medical Staff
- Monitor with ECG and transmission capabilities
- Completion of the competency on the use of the MRx Heart Start monitor.
STEMI Training

- Attend STEMI Boot Camp sponsored by Essentia Health or on-site training by Jason Lenz APRN, CNP
STEMI Training

- The America Heart Association (AHA) course titled, Learn Rapid STEMI ID
Lead Placement

- All EMT’s demonstrated correct lead placement on three different occasions on a live volunteer or manikin.
<table>
<thead>
<tr>
<th>Indications</th>
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<tbody>
<tr>
<td><strong>Inclusion Criteria</strong></td>
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<tr>
<td>Patients 18 years of age or older with:</td>
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<tr>
<td>• Chest Pain</td>
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<tr>
<td>• Moderate or severe respiratory distress</td>
</tr>
<tr>
<td>• Symptoms similar to previous angina or myocardial infarction</td>
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<tr>
<td>• Syncope or near syncope</td>
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<tr>
<td>• As directed by medical control</td>
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<tr>
<td><strong>Exclusion Criteria</strong></td>
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<tr>
<td>• Symptoms greater than 6 hours</td>
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<tr>
<td>• Trauma patients</td>
</tr>
<tr>
<td>• Patients who are:</td>
</tr>
<tr>
<td>• Unconscious</td>
</tr>
<tr>
<td>• Sedated</td>
</tr>
<tr>
<td>• Require cardiopulmonary resuscitation</td>
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<tr>
<td>• Transport time of 5 minutes or less</td>
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<td>• Younger than 18</td>
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</table>
Possible STEMI patient

Prehospital ECG

ECG Transmitted to CAH from MRx via Bluetooth phone

ECG received by e-mail(MD, DON, project lead)

ECG prints at CAH nursing station

ECG read by CAH MD

STEMI?

YES

Notify PCI capable hospital and expedite patient transport to PCI hospital

NO

Treat at CAH
- Sinus rhythm (normal P axis, V-rate 50-99)
- Probable left atrial enlargement (P >50mS, <0.10mV V1)

**BORDERLINE ECG**

Unconfirmed diagnosis

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**Rate**: 84
**PR**: 146
**QRSd**: 93
**QT**: 377
**QTc**: 446

**Aaxes**

<table>
<thead>
<tr>
<th>Axis</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>82</td>
</tr>
<tr>
<td>QRS</td>
<td>78</td>
</tr>
<tr>
<td>T</td>
<td>73</td>
</tr>
</tbody>
</table>

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**Reference ID**: 131201204935bbd4
EVALUATION

- Three month evaluation period
- Evaluation included:
  - Number of successful versus attempted ECG transmissions
  - If the use of the prehospital ECG by the BLS service decreases door to intervention times in STEMI patients in a rural healthcare setting
EVALUATION

- 90% of eligible patients will have received a prehospital ECG transmitted successfully to the CAH

- Goal met when 12 of 13 eligible patients received a prehospital ECG transmitted successfully to the CAH (92%)
### CASE STUDIES

**140304103949bbd4**

**Patient:** Female

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>50</td>
</tr>
<tr>
<td>PR</td>
<td>191</td>
</tr>
<tr>
<td>QRSD</td>
<td>128</td>
</tr>
<tr>
<td>QT</td>
<td>482</td>
</tr>
<tr>
<td>QTc</td>
<td>440</td>
</tr>
</tbody>
</table>

**Axes:**

- **P:** 65
- **QRS:** 57
- **T:** 98

**ECG Findings:**

- Sinus rhythm
- Left bundle branch block
- Normal P axis, V-rate 50-99
- QRSD > 120, broad/notched R

**Unconfirmed diagnosis:**

- ABNORMAL ECG

**ECG Details:**

- 25 mm/sec
- 10 mm/mV
- 10 mm/mV
- 60° 0.05 - 40 Hz

**Reference:**

- Incident ID: 140304103949bbd4
- Room: HLFD
- Department: HLFD
- Operator: HLFD
- Date: 3/4/2014 10:43:23 AM
- PH1008
83 y/o female patient called 911 after 1 hour of chest pain
12-lead transmitted to CAH ER
STEMI confirmed
Bypassed rural hospitals
EMS first medical contact to device time 98 minutes!
Findings

- EMT on the BLS ambulance service can identify the indications for a prehospital ECG.

- Focus was on the importance of the prehospital ECG as part of a system of care.

- EMTs had the ability to correctly place leads to complete an ECG in the field.
Findings

- Successful transmission of the prehospital ECG
  - Technically feasible
  - Reduces time to primary percutaneous intervention
  - Reliable in the diagnosis of STEMI
  - May be more cost-effective than training of prehospital providers alone
  - Benefit reaches beyond STEMI
Rate: 171
PR: 177
QRSd: 177
QT: 344
QTC: 581

Patient: Male

Note:
- Extreme tachycardia with wide complex, no further rhythm analysis attempted
- >>> Very High Heart Rate <<<

- ABNORMAL ECG -

Unconfirmed diagnosis
## Findings

<table>
<thead>
<tr>
<th>Aurora</th>
<th># STEMI's contacted Pre-Hospital by EMS</th>
<th>% EMS performing 12-Lead ECG in the Field</th>
<th>Average EMS First Medical Contact to ECG (min.)</th>
<th>% Receiving Lytic at Aurora ED</th>
<th>Average 1st Hospital Door to PCI (min.)</th>
<th>% Interhospital Transport by Helicopter</th>
<th>Average time spent by patient in regional ED (min.)</th>
<th>Average Symptom Onset to PCI (min.)</th>
<th>Average 911 call to PCI (min.)</th>
<th>Average EMS Door in Door Out time in ED (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 1st, 2013 to Dec 31st 2013</td>
<td>4</td>
<td>0</td>
<td>N/A</td>
<td>50</td>
<td>120</td>
<td>50</td>
<td>74</td>
<td>386</td>
<td>143</td>
<td>22</td>
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<tr>
<td>Jan. 1st, 2014 to June 1st 2015</td>
<td>5</td>
<td>80</td>
<td>11</td>
<td>0</td>
<td>110</td>
<td>80</td>
<td>55</td>
<td>176</td>
<td>159</td>
<td>22</td>
</tr>
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Findings

This clinical project showed that even though cellular coverage areas are historically better in urban areas, transmission of a prehospital ECG is technically feasible in rural areas.
Barriers/Unanticipated Events
QUESTIONS
References


