# As Serious as a Heart Attack



#### Navigating the Hurdles in Effecting STEMI System Care



2010 EMS STATE OF THE SCIENCE: GATHERING OF EAGLES XII Dr. David Keseg M.D. FACEP, Medical Director Columbus Division of Fire

## **Columbus STEMI System**

Approach to setting up the system
Problems we faced
Solutions to those problems
The future challenges

## **Time is Muscle**

 As a community, what can we do to improve the care we deliver to patients complaining of chest pain?

- Patients
- EMS Providers
- Emergency Department
- Cardiology
- Cath Lab

#### SEMINAL EVENT

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#### ACC/AHA PRACTICE GUIDELINES-FULL TEXT

# ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1999 Guidelines for the Management of Patients With Acute Myocardial Infarction)

Developed in Collaboration With the Canadian Cardiovascular Society



# AHA/ACA GUIDELINES POINTS OF FOCUS

#### • EMS

 Emphasis on early defibrillation; AEDs; 911 dispatchers training & use of national protocols

#### • Chest Pain Evaluation & Treatment

 Emphasis on giving chewable ASA, unless contraindicated & prehospital ECG & checklist

#### Prehospital Fibrinolysis

- Upgraded to a Class IIa (Level B) Recommendation

Prehospital Destination Protocols

- Where to transport STEMI patients-Have a plan in place
- Special considerations
  - Cardiogenic Shock
  - Fibrinolytic contraindicated

Antman et al. JACC 2004;44:675-7.

#### **Patients Transported by EMS After Calling 9-1-1**



# TWO PROBLEMS

#### Not all the hospitals in Columbus did PCI





#### Not every EMS system performed or could transmit 12 lead EKGs



# **Evolution of STEMI Care**



 Cooperative effort between hospitals and EMS was needed for success



## Map of Columbus Hospitals

#### 6 PCI HOSPITALS

## 2 NON PCI HOSPITALS



### **Issues of Exclusions from STEMI Care**

Prestige

 "We can give them thrombolytics and get them to a PCI center within the critical time period"

Economic
 – Not like trauma care



– Would all patients with Non-STEMIs and chest pain be diverted????







#### Central Ohio Trauma System STEMI Task Force

#### • Why a trauma organization?

- Prehospital COTS committee
- Diversion task Force
- EMS Infectious Disease Protocol
- Prehospital Algorithm for Concealed Weapons
- Policy for leaving newborns at health care facilities

Central Ohio Trauma System STEMI Task Force

 On August 24, 2004, Prehospital Committee members shared the newly published ACC/AHA STEMI Guidelines at a meeting with the request that the COTS forum be used to address the recommendation

"every community should have a written protocol that guides EMS system personnel in determining where to take patients with suspected or confirmed STEMI."

#### Central Ohio Trauma System STEMI Task Force

Rationale for Establishment

 To review the new guidelines for ST Elevation MI and make recommendations to COTS for standardization of EMS and hospital policies and procedures regarding the evaluation and care of these patients.

#### **Goals and Objectives**

- Assess the capabilities of Central Ohio hospitals for taking care of STEMI patients
- Review standard EMS protocols for evaluation and care of these patients
- Establish what EMS units have the capability of transmitting 12 lead EKGs in the field and what hospital EDs have the capability to receive these transmissions
- Determine the need for EMS education on the interpretation of 12 lead EKGs in the field
- Recommend a standard of care for EMS and hospitals taking care of patients experiencing a STEMI that will follow the ACC/AHA guidelines
- Ask the Central Ohio hospitals that have PCI capabilities what their commitments would be to assure access to their facilities in a timely manner
- Assess the feasibility and necessity for pre-hospital thrombolysis capabilities

#### Central Ohio Trauma System STEMI Task Force ATTESTATION

**ST-Elevation Myocardial Infarction (STEMI) Capabilities** 

Please note: Information for this survey is inclusive of both EMS- and self transported STEMI patients in 2004.

#### (5) IF YOUR HOSPITAL DOES NOT HAVE PCI CAPABILITY:

(a) Our hospital protocol for transfer to PCI facility is	
(a)Our hospital is willing to share our written PCI transfer protocol.*	□Yes □No
(c) Our hospital can consistently affect the transfer of a STEMI patient who initially presents to us a PCI-capable hospital so that PCI is initiated within 90 minutes.	⊡Yes ⊡No
(d) Our future plans regarding PCI capability are	<ul> <li>□We plan to have PCI capability on (<i>date</i>)</li> <li>□We do not plan to add PCI capability</li> </ul>
(e) Our hospital has a multidisciplinary team (including primary care physicians, emergency medicine physicians, cardiologists, nurses, and ancillary staff) operating under a guideline-based, institution-specific written protocol for triaging and managing patients who are seen in the prehospital setting or present to the ED with symptoms suggestive of STEMI.	□Yes □No
(f) We are willing to share our written STEMI protocol.*	□Yes □No
(g) We have the capability to administer thrombolytics within 30 minutes of the patient's arrival to our hospital.	□Yes □No

#### Central Ohio Trauma System STEMI Task Force ATTESTATION

**ST-Elevation Myocardial Infarction (STEMI) Capabilities** 

Please note: Information for this survey is inclusive of both EMS- and self transported STEMI patients in 2004.

#### (6) IF PCI CAPABLE:

(a) Our hospital has a multidisciplinary team (including primary care physicians, emergency medicine physicians, cardiologists, nurses, and ancillary staff) operating under a guideline-based, institution-specific written protocol for triaging and managing patients who are seen in the prehospital setting or present to the ED with symptoms suggestive of STEMI.	□Yes □No	
(b) We are willing to share our written STEMI protocol.*	□Yes □No	
(c) Our hospital is committed to taking our STEMI patients to the cath lab for PCI as opposed to using fibrinolytics 100% of the time except for extenuating medical contraindications/ circumstances.	□Yes □No	
(d) The number of angioplasties (STEMI and otherwise) that our hospital performs annually is	❑None ❑51-100 ❑501-1,000	□1-50 □101-500 □>1,000
(a)The number of stents that our hospital places annually is	❑None ❑51-100 ❑501-1,000	□1-50 □101-500 □>1,000
(a)Our hospital's hours of operation that cath lab staff are available in hospital are (denoted in military time)	t	o

#### Central Ohio Trauma System STEMI Task Force ATTESTATION ST-Elevation Myocardial Infarction (STEMI) Capabilities

Please note: Information for this survey is inclusive of both EMS- and self transported STEMI patients in 2004.

(a)Our hospital's hours of operation that cath lab staff are on call and not in the hospital are (denoted in military time)	to
(i) The number of interventional cardiologists on staff at our hospital are	
(j) Following CORE measurements for STEMI definitions, our hospital can meet the ACC/AHA criteria of average ED door to balloon time within 90 minutes on a consistent basis.	□Yes □No
(k) Our hospital's cardiologists allow the emergency department to activate the cath lab for STEMI patients prior to Cardiology assessing the patient.	□Yes □No
(a) Our hospital is willing to conduct STEMI education for local EMS	□Yes

□No

Providers.

#### Central Ohio Trauma System STEMI Task Force White Paper

- We anticipate that this document may need to be revised as the ACC / AHA guidelines are updated.
- We remind EMS medical directors that the scientific literature is constantly evolving, and that they must maintain an awareness of the ongoing evidence base that forms the foundation of these guidelines.



#### WHITE PAPER FOR CENTRAL OHIO EMS AGENCIES ON THE PREHOSPITAL TRANSPORT OF STEMI PATIENTS TO LOCAL HOSPITALS BASED ON AHA/ACC STEMI GUIDELINES

#### WRITING COMMITTEE MEMBERS

Nancie M. Bechtel, RN, BSN, CEN, EMTB; Patty Blake, RN, CCRN; Brian Hiestand, MD, FACEP; David P. Keseg, MD, FACEP; Scott Koloff, Captain, EMTP; Michelle Woodham, RN, MHA

#### TASK FORCE MEMBERS

Bobbi Allen, RN, Director, Emergency/Outpatient Services, Mount Carmel St. Ann's, Westerville, Ohio; Nancie Bechtel, RN, BSN, CEN, EMTB, Executive Director, Central Ohio Trauma System, Columbus, Ohio; Patty Blake, RN, CCRN Lead Cardiac Project Manager Outcomes Measurement Resources, Mount Carmel Health System, Columbus, Ohio; Nancy Colburn, RN, MSN, Manager Heart Services, Doctors Hospital/OhioHealth, Columbus, Ohio; MaryAnn DelAguaro, RN, Assistant Manager, Emergency Services, Grant Medical Center, Columbus, Ohio; Jeff Dreyer, MD, ED Physician Facilitator, Mount Carmel Health System, Columbus, Ohio; Carol Elliott, RN, MSN, Director, Emergency Services, Mount Carmel East, Columbus, Ohio; Dawn Elsea, RN, BSN, MBA, Quality Manager for Emergency Department, Trauma, & Burns, The Ohio State University Hospitals, Columbus, Ohio: Cathy Eveland, RN, Cardiac Project Manager Outcomes Measurement, Mount Carmel Health System, Columbus, Ohio; Rob Farmer, Chief, EMTP, Delaware County EMS, Delaware, Ohio; Thomas Gavin, MD, Emergency Services, The Ohio State University Hospitals, Columbus, Ohio; Brian Hiestand, MD, Emergency Services, The Ohio State University Hospitals, Columbus, Ohio; Dave Keseg, MD, Medical Director, Division of Fire, Columbus, Ohio; Craig Key, MD, Emergency Services, The Ohio State University Hospitals, Columbus, Ohio; Scott Koloff, Captain, EMTP, Training Officer, Division of Fire, Upper Arlington, Ohio; Loren Leidheiser, MD, Mount Carmel St. Ann's; Nancy McBride, RN, BSN, CEN, Outcomes Management Emergency Services/Cardiac Imaging Lab. Riverside Methodist Hospital, Columbus, Ohio: Kathy Spencer, RN, BSN, Outcomes Management Heart Services, Riverside Methodist Hospital, Columbus, Ohio; Becky Squires, RN, BSN, Clinical Educator, Emergency Dept., Doctors Hospital, Columbus, Ohio; Michelle Woodham, RN, MHA, Clinical Outcomes

#### Hospitals Without Primary Percutaneous Coronary Intervention (PCI)

Mount Carmel St. Ann's and The Ohio State University Hospitals East (OSU East) are "nonprimary PCI facilities" meaning that they do not provide interventional cath lab services for STEMI patients. Both hospitals have a protocol to care for STEMI patients, a protocol to transfer STEMI patients to a PCI-capable facility, and the ability to administer thrombolytics within 30 minutes of a patient's arrival to the hospital. Both have multidisciplinary teams operating under a guideline-based, written STEMI protocol and are committed to transferring STEMI patients to a PCI-capable facility so PCI can be initiated within 90 minutes. Mount Carmel St. Ann's has future plans to become a primary PCI facility. OSU East does not have plans to become a primary PCI facility at this time. *Table 2* provides specific details and hospital contacts for additional information about these two non-primary PCI hospitals in Franklin County, Ohio.



#### Primary PCI Facilities

The following Columbus, Ohio area hospitals have primary PCI capabilities: Doctors Hospital, Grant Medical Center, Mount Carmel East, Mount Carmel West, The Ohio State University Medical Center and Riverside Methodist Hospital. These hospitals have multidisciplinary teams operating under a guideline-based, written STEMI protocol and are committed to taking STEMI patients to the cath lab, 100% of the time for PCI as opposed to using fibrinolytics (unless contraindicated). These hospitals are committed to meeting the ACC/AHA goal of door to balloon time within 90 minutes of STEMI patients' arrival to the hospital. *Table 3* presents additional hospital specific details and contact information about these primary PCI hospitals in Franklin County.



## **STEMI Destination Protocols**

 STEMI protocols mandated the transport of STEMI patients to designated PCIcapable facilities



J. STEMI patients will be transported to facilities with percutaneous coronary interventional (PCI) capabilities. The following facilities which have PCI capabilities are designated as "CODE STEMI" receiving facilities:

## **STEMI Destination Protocols**

#### STEMI protocols mandated the transmission of 12 lead EKG to designated PCI-capable facility





K. When a STEMI patient is identified, the 12 lead EKG should be transmitted to the "CODE STEMI" receiving facility as per 12 lead transmission SOP 07-07-17. The receiving facility should be notified via radio or telephone with a "CODE STEMI" designation. When EMS providers arrive at the "CODE STEMI" receiving facility, they may be asked to transfer the patient directly to the cardiac catheterization lab at the direction of ED personnel. In that event, the hospital is responsible for sending a member of their ED personnel team with the EMS providers to escort them to the cath lab and the EMS providers should provide the transfer of the patient to the cath lab as expeditiously as possible.

## EMS Use of 12 lead EKGs

- Considerations for implementation of out-of-hospital 12 Lead ECG programs should include local factors such as EMS vehicle staffing, response and transport times, and the capabilities and resources of the local emergency departments.
- 12-Lead ECGs in the out-of hospital setting should be obtained in a selected population of those patients presenting with chest pain.
- The use of 12-Lead ECGs in the out-of-hospital setting should not prolong field times; that is, should not delay transport to definitive care.
- The out-of-hospital 12-Lead ECG should not be used as a screening tool in "no transport" decisions.



# EMS Use of 12 lead EKGs

The out-of-hospital 12-Lead ECG should be viewed as part of a continuum of patient care, to identify acute coronary syndromes before the initiation of standard chest pain protocols, including treatment that may produce resolution of ischemic changes. It should not replace timely evaluation and treatment upon arrival to the Emergency Department.



# Why 12 Leads?



Single Lead Dependence

 Provides only one "look" at the heart.

 Rapid Identification of Infarction/Injury

 Diagnosis made sooner in many cases

 Decreased Time to Reperfusion Treatment
 Increased Index of Suspicion

# Why 12 Leads?



**"The US National Heart Attack Alert Program recommends that EMS systems provide out-of-hospital 12-lead ECGs to facilitate early identification of AMI and that all advanced lifesaving vehicles be able to transmit a 12-lead ECG to the hospital"** 

American Heart Association in collaboration with International Liaison Committee on Resuscitation. Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care: International Consensus on Science, Part 7: The Era of Reperfusion. Circulation. 2000; 102 (suppl I): I-175.

## Physicians Value Pre-hospital 12-lead

 Study in 2002 by Brainard, et al. published in Pre-hospital Disaster and Medicine proved indicated both cardiologists and emergency physicians valued pre-hospital 12-lead EKGs

gram; emergency; emergency physician; emergency medical services; prehospital; reperfusion; standard of care; survey

#### Abbreviations

ACLS = advanced cardiac life support ALS = advanced life support AMI = acute myocardial infarction CI = confidence intervals ECG = electrocardiogram ED = emergency department EMS = emergency medical services 50 mm; 95% CI = 43-56 mm/. The Justitiable increase in field time was perceived to be 3.2 minutes (95% CI = 2.7-3.8 minutes), with 23 (32.8%) preferring that it be done on scene, 46 (65.7%) during transport, and one (1.4%) not at all.

**Conclusions**: Prehospital 12-lead ECGs generally are perceived as worthwhile by cardiologists and EPs. Cardiologists have a higher opinion of the value and utility of field ECGs. Since the reduction in mortality from the 12-lead ECG is small, it is likely that positive physician attitudes are attributable to other factors.

Brainard AH, Froman P, Alarcon ME, Raynovich B, Tandberg D: Physician attitudes about prehospital 12-Lead ECGs in chest pain patients. *Prehosp Disast Med* 2002;17(1):33–37.

#### Central Ohio Trauma System STEMI Task Force Survey Questions Regarding EMS 12 lead EKG Capability

*Please note: Information for this survey is inclusive of both EMS- and self transported STEMI patients in 2004.* 



#### Central Ohio Trauma System STEMI Task Force Survey Questions Regarding EMS 12 lead EKG Capability

Please note: Information for this survey is inclusive of both EMS- and self transported STEMI patients in 2004.

(a) What brand(s) of monitor/defibrillator are you using to do 12 leads?		
(a)When does your protocol specify that your EMS personnel perform a 12 lead EKG? <i>(Check all that apply.)</i>	□Altered LOC □ DAbdom □ pain en DArm □ pain □ DChest P Pain □	IDiabetes IDiaphor sis IFatigue IJaw ain
(a)How many 12 lead EKGs does your agency perform per year? (a)Do you have the capability to transmit your 12 lead EKGs to hospital emergency departments (EDs)?	□Yes □In progress of establishin □No	 
(a)If "Yes" to (d), do you transmit 12 leads by <i>(check all that apply)</i> :	< Cell phone < Facsimile < Landline phone < Radio < Other	
(a) If "yes" to (d), what are some barriers to transmission of 12 leads?		
	□On scene	

□En route

(a)Do you most often perform the first 12-lead EKG:

#### Central Ohio Trauma System STEMI Task Force Survey Questions Regarding EMS 12 lead EKG Capability

(a) Do you have a QA process for evaluating the quality of the 12-lead capture? If "Yes, " describe:	∢Yes □No
(a) Do you have a QA process for evaluating correct interpretation of 12 leads? If "Yes, " describe:	□Yes □No
(i) Does your 12-lead give an automatic interpretation?	□Yes □No
(a)Do your protocols allow you to bypass the closest hospital for the "most appropriate" hospital based on disease process?	□Yes □No
(a)If "Yes" to (j), how far out of your jurisdiction are you willing to go?	□By minutes: □By miles:
(a)What is your average transport time in minutes?	
(a)How much scene time in minutes do you estimate it takes on average for your EMS personnel to generate a 12 lead EKG?	
(a)If you can transmit 12 lead EKGs to hospital EDs, how much additional scene time do you estimate on average it requires?	· · · · · · · · · · · · · · · · · · ·
(a)Do you feel having 12 lead EKG transmission capability is:	□Essential □Important □Not necessary □Detrimental
(a)Do you feel your EKG training in EKG interpretation is:	□Excellent □Fair □Inadequate

# History of Pre-hospital EKG Columbus Division of Fire Running 12-lead EKGs for over 15 years Used to use Welch cups and limb straps the LifePak 5







## **EMS Perception of 12-lead**

Many medics didn't see the value in 12-leads
 Thought three leads were sufficient





- We instituted training within the Division of Fire taught medics to more accurately interpret the 12-lead EKG and learn the value of 12 leads





## **Other EMS Perception Problems**

- This sounds like telemetry!
  Medics valued autonomy
  Transmission perceived as "Mother may I" shift back to on-line medical control
- Had to convince the masses they were not going backward to Johnny and Roy days.



## Protocols

#### A 12-lead EKG is required to be run on any patient having chest pain or with recent complaint of chest pain.

C. Auminister four chewable party repline tablets of mg-

D Initiate IV infusion of 0.9% NS at TKO rate. Consider volume infusion of 200-300 ml bolus for hypotension

E. A 12 lead EKG should be performed for any patient having chest pain or a recent history of chest pain. If a 12 lead EKG is performed, consider transmission telephonically to the receiving ED if they have capability to receive. See SOP 07-07-17 for determination of whether to transmit the 12 lead EKG or not.

F. If no pain relief after 5 minutes and blood pressure is greater than 90 mmHg, repeat NTG spray. May give maximum of 3 sprays



# **12-lead EKG Transmissions**

Initial attempts (2000)were unsuccessful
 – Technology not perfected

- Phones big and bulky (yes, we actually had bag phones!)
- High cell phone bills





Non-compliance from paramedics

 Inconsistent ability to receive transmissions at hospitals

# August 2005

Tried again to implement transmissions

 Knew transmission would become the standard of care
 Explored funding options
 Phones donated by cell service provider

 Transmission cables donated by one hospital



## **Frustrations with Cell Phones**

 Slow transmission Poor cell coverage Circuit-switch technology Expensive cell phone service • Additional device to charge and plug into monitor



#### Central Ohio Trauma System (COTS) 12 lead forum

- February 2008 began planning 12-lead forum
- Purpose: To elicit information from hospital and EMS partners about current issues, barriers, and possible solutions related to transmission of pre-hospital 12lead EKGs from the field
- Examined other cities to learn from their successes and failures

# **Three 'Café Questions' Asked**

- What experiences have you or your agency/ institution had that affect the transmission/receipt of pre-hospital EKGs?
- What are the barriers related to transmitting/ receiving pre-hospital 12-lead EKGs?
- What would it take for your agency/institution to be able to transmit/receive 12-lead EKGs consistently?

## **Answers to Questions**

- Many experiences focused on inconsistent reactions to 12-lead EKGs and radio reports
  - Communication issue
  - Paramedics felt pre-hospital EKGs were "disregarded"
- Barriers focused on monetary constraints and communication difficulties
  - How do we pay for a better way?
- Sustainability needed for transmitting
  - Regional guideline recommended



## **Collaborative Effort**

 Almost all EMS used Physio that drove the hospitals to use the Physio Lifenet receiving station

Every hospital was visited by EMS to implement the Lifenet receiving stations
This provided a standardized system for EMS transmission of STEMIs

# **STEMI Management Solution**



#### Turuncure

#### About LIFENET Cardiac Care System

The LIFENET® Cardiac Care System is intended to transmit 12-lead ECG and other vital sign data from a monitor to a remote location. The patient data car by qualified medical personnel.

#### Treatment Protocol When Transmitting Data

When considering any treatment protocol that involves transmitting patient data by telecommunications, you must be aware of possible limitations. Success network services that may or may not always be available. This is especially true for cellular communication that is influenced by many factors, such as:

- Geography
- Location
- Weather
- The number of cellular service users

# **STEMI Management Solution**

- Tracks all transmissions and transmission attempts
- Gives reports on frequency of transmissions
  - By transport vehicle and hospital destination
- Can determine if STEMI or not by whether transmission met certain criteria
- Sends notification of unsuccessful attempts assisting providers in troubleshooting



# Transmission Summary Report

#### LIFENET Monthly Transmission Summary

2/1/2009 - 3/1/2009

175

#### Account Name: Columbus FD (OH)

#### Total Transmissions in February:

Transmissions to Account:	Riverside Methodist Hospital (Columbus, OH)	47
Transmissions to Account:	Doctors West Hospital (Columbus, OH)	6
Transmissions to Account:	Grant Medical Center (Columbus, OH)	42
Transmissions to Account:	Ohio State University	18
Transmissions to Account:	Mount Carmel East (Columbus, OH)	30
Transmissions to Account:	Mount Carmel West (Columbus, OH)	26
Transmissions to Account:	Mount Carmel St. Anns Hospital (Westerville, OH)	5
Transmissions to Account:	OSU Hospital East (Columbus, OH)	1



# Velociter Modems-2008

- New modems addressed many issues
  - The system sends a copy of the EKG to the ED, cath lab and cardiology simultaneously, allowing advanced notice of incoming STEMI.
  - Cooperative effort between EMS agencies and hospital systems
  - Modems paid for by two hospital systems and donated to area departments



#### It takes more than just the 12 lead

#### PREHOSPITAL 12 LEAD EKG: EFFICACY OR EFFECTIVENESS

Robert A. Swor, Stacey Hegerberg, Mark Goldstein, Christine C. McEachin, William Beaumont Hospital, Royal Oak, Michigan

Conclusion: A minority of pts with EMS EKGs had pre-arrival AMI team activation. EMS EKGs combined with systems that activate hospital resources, but not EMS EKGs alone, decrease time to lab and reperfusion.

### **Success Stories**

- There are many reports of Cardiologists coming down to meet paramedics upon EMS arrival of STEMI patients!
- Paramedics have moved patients directly from their cot to the cath table sometimes watching the cath procedure
- Anecdotal reports of dramatic saves



Admit date:02-20-09 Discharge Date:03-09-09 48yo male in cardiac arrest PMH: Hypertension EKG: Anterior MI Cath Report: Totally occluded LAD; Anatomy not conducive to CABG EF 35% Pt discharged to ECF



Pre-Hospital EKG: Cardiac Arrest 2012: EMS left scene 2015: EMS arrival to Hosp Heart Alert called 2015: Patient in Cath Lab See left: Time of Stent

#### Door to balloon: minutes

## **Feedback to Paramedics**

Gives closure to the pre-hospital provider
Provides an opportunity to learn
Positive reinforcement for continued compliance
Outcomes liaison or contact person at hospital is the key

# **Mission Accomplished?**



NOT EXACTLY

But we're getting there!

# **EMS** Role

Identify patients suffering from STEMI

- Develop protocols to treat these patients
- Identify appropriate transport destinations
- Accurately communicate patient's condition
- Encourage continuum of care after arrival at the hospital Early warning signs





of a heart attack:

- Pressure in center of chest
- Pain in shoulders, neck or arms
- Chest discomfort with fainting, sweating or nausea

ADAN

# **The Future**

- Educate the public
  - What symptoms to look for and when to call 911
- Continue to emphasize pre-hospital 12-lead EKG
- Train paramedics in the three "R's"
  - Rapid recognition
  - Rush to the hospital
  - Reperfusion



• Pre-hospital thrombolytics? Other treatments?

# Acknowledgements/Questions

Captain Shawn Koser: Continuous Quality Improvement Officer for The Columbus Division of Fire



