EMS & Systems of Care
The State of Jefferson experience with STEMI, Stroke & more

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45 Minute Whirlwind

• History lesson
• Systems
• EMS & Systems of Care
  STEMI
  Trauma
  Stroke
• Lessons I’ve learned
Systems

• Common Characteristics
  • Structure
  • Behavior
  • Interconnectivity

• Donabedian – Quality in Health Care
  • Structure
  • Processes
  • Outcome

• Synergy
  • The whole is greater than the sum of the parts
Systems of Care

- Medicine is a team sport
  + EMS
  + ED
  + Hospitals
  + Physicians
  + Technicians

- People, Equipment, Processes
Medical Oversight of EMS (2009)

- Published by NAEMSP
- Chapter 50 - Regionalization and Designation of Facilities
  - STEMI
  - Trauma
  - Stroke
If you’ve seen one EMS system.....
....then you’ve seen one EMS system.

If you’ve seen one STEMI system.....
....then you’ve seen one STEMI system.
(substitute trauma or stroke for STEMI)
Jackson County EMS

1 Supervising Physician

14 EMS Responding Agencies ~ 500 EMTs and First Responders
Single set of Standing Orders - updated July 1st [www.jcems.net](http://www.jcems.net)

EMS System

3 Transporting Agencies (all with 12 lead ECG)
   ASA = Ambulance Service Area
10 First Responding (non-transporting) agencies
   9 Fire Departments/Districts
   1 Jackson County Sheriff
Two 911/Dispatch/PSAP (public safety answering point)
   RVCCOM - Cities of Ashland & Medford
   SORC - rest of Jackson County
3 Hospitals (ACH, PMMC, RVMC)
Jackson County Health Department
ARES, law enforcement, non-dispatched EMS (1), Red Cross

Great Cooperation, Collaboration & Communication
Acute ST Segment Elevation Taskforce
Primary PCI
To facilitate the accurate and rapid diagnosis, treatment, & transport of patients with Acute ST Segment Elevation Myocardial Infarction (STEMI) from throughout the region to the Rogue Valley Hospital Cath Lab for Emergent Percutaneous Coronary Intervention (PCI).
EMS Cardiac Chest Pain

Oxygen
Monitor
IV
Aspirin 162 mg
Nitroglycerin
Morphine
12 lead ECG – EMT-P & if STEMI
“STEMI Activation” of cath lab & cardiologist
Rapid transport to PCI center cath lab
STEMI Protocol

Age < 86 years

AND

Clinical Setting

Cardiac Chest discomfort < 12 hours

OR

Vfib/Vtach converted to a stable rhythm

AND

12 lead ECG findings

No LBBB - No pacing

AND

ST $\uparrow$ 2 contiguous leads

2mm anterior or

1 mm inferior or lateral

OR

Lifepak 12 reading of “Acute MI Suspected”

“STEMI Activation” and rapid transport to PCI center
Continuous Quality Improvement

• Data collection, analysis & feedback
• Improving the system
  • Eliminate LBBB & pacing
  • Add Vfib/Vtach with STEMI > 5 min later
  • Eliminate IV lines
  • Single call cath lab & MD activation
  • “cheat sheet” checklists
  • 12 lead ECG report
1) Good History of Heart Equivalent Discomfort <12 hrs and < 86 y.o.

and

2a) Paramedic notes 2 mm ST Elevation in 2 Contiguous Leads V1-3
or 1 mm ST Elevation in 2 Contiguous Leads Inferiorly or Laterally

or b) LifePak-12 ECG Printout c/w Acute ST Elevation MI

(LBBB or ≥ 86 y.o. patients - evaluate initially in nearest ED)
(Nursing Home patients with STEMI will be seen at the closest hospital ED unless they are only there for a brief convalescence)

3) ASA 162 mg chewed, NTG s.l., Morphine prn

STAT ASSET Activation (“STEMI Cath Alert”)

Radio or Phone RVMC ED Com Center
- Name, Age, DOB
- ECG Findings & History
- ETA
- Cardiologist (if any)

RVMC ED will call cath team, cardiologist of record (or OnCall), Nursing supervisor & obtain old records. ED Physician will assume primary care if cardiologist delayed.

Cardiologist will contact Interventionalist

Triage directly to RVMC Cath Lab (541-789-4323) if semi-stable and team is ready… or to RVMC ED if cath lab is not ready
(ALL patients will stop briefly in ED for Registration)
EMS 12 LEAD ECG REPORT FORM

Ambulance: AFR JCFD#3 JCFD#4 JCFD#5 MFD Mercy Flights Rogue River
Unit number: EMT Name:
Cardiologist Name (if any):
EMS STEMI Activation? Yes No ASA 162 or 325 mg within 24 hours? Yes No

Initial Vital Signs
B/P _____/______, P ____, R ____, SpO₂ _____ %, Maximum pre-hospital chest discomfort _______/10

Treatments
Oxygen _____ liters NC NRB Medications
Nitroglycerin x_____, Morphine ________ mg, other________________________

Improvement after medication administration: YES NO

12 LEAD below this line

Label ECG with patient’s name and date of birth before attaching here

Leave this form and the attached ECG with the patient

12 LEAD above this line

©Jackson County EMS Revised 5/4/09
**EMS 12 Lead ECG Report Form**

**Ambulance:** AMR JFRD#3 Mercy Flights Rogue River

**Unit number:**

**EMT Name:**

**EMS STEMI Activation?** Yes No

**ASA 162 or 325 mg within 24 hours?** Yes No

**Initial Vital Signs**
- **B/P:** 240/180, **P:** 110, **R:** 20, **SpO2:** 99%
- Maximum pre-hospital chest discomfort: 10/10

**Treatments**
- Oxygen: 4 liters NC NRB

**Medications**
- Nitroglycerin: 3
- Morphine: 50 mg, other: NA

**Improvement after medication administration:** Yes No

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**12 Lead ECG below this line**

**12-Lead 1**

- HR: 111 bpm
- *ACUTE MI SUSPECTED*
- Abnormal ECG: "Unconfirmed"
- Sinus tachycardia
- QRS: 102ms
- 0.326ms/0.443ms
- Inferior infarct, possibly acute

**Heart Rate:** 111 bpm
**12-Lead ECG**

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**Heart Rate:** 111 bpm
**12-Lead ECG**
Paramedic ASSET Patients June 2003 - June 2009

Time (mean) in minutes

- Paramedic Jan-June 2009 (n=32)
  - Median 14: 16
  - Median 24: 24
  - Median 1: 10
  - Median 28: 30
  - Total Median Patient Contact-Balloon = 74 min

- Paramedic Jan-Dec 2008 (n=57)
  - Median 14: 16
  - Median 21: 21
  - Median 15: 15
  - Median 30: 30

- Paramedic Jan-Dec 2007 (n=57)
  - Median 19: 19
  - Median 22: 22
  - Median 21: 21
  - Median 34: 34

- Paramedic Jan-Dec 2006 (n=47)
  - Median 16: 16
  - Median 21: 21
  - Median 32: 32
  - Median 40: 40

- Paramedic June-Aug 2005 (n=14)
  - Median 21: 21
  - Median 46: 46

- Paramedic 18 mos June 03 - Dec 04 (n=81)
  - Median 18: 18
  - Median 22: 22
  - Median 48: 48
  - Median 42: 42

- RVMC door-cath lab
- Cath lab-wire
- Wire-Balloon *
Hospital mortality
ASSET 2003-2009

EMS 2.9%
PCI Hospital 3.3%
Referral Hospital 4.3%
ACTION Registry 5.7%
CLINICAL STUDIES

Integration of Pre-Hospital Electrocardiograms and ST-Segment Elevation Myocardial Infarction Receiving Center Networks

Impact on Door-to-Balloon Times Across 10 Independent Regions

Ivan C. Rokus, MD,* William J. French, MD,† William J. Koenig, MD,‡ Samuel J. Stratton, MD, MPH,§ Beverly Nighswonger, RN,§ Brian Strunk, MD,¶ Jackie Jewell, RN,¶ Ehtisham Mahmud, MD,¶ James V. Dunford, MD,¶ Jon Hokanson, MD,# Stephen W. Smith, MD,** Kenneth W. Baran, MD,†† Robert Swor, DO,‡‡ Aaron Herman, MD,‡‡ B. Hadley Wilson, MD,§§ Akinye O. Aitko, MD,¶¶ Brian W. Gross, MD,¶¶ Paul S. Rostykus, MD, MPH,## Angelo Salvucci, MD,### Vishva Dev, MD,### Bryan McNally, MD, MPH,#### Steven V. Manoukian, MD,##### Spencer B. King III, MD,######


An Approach to Shorten Time to Infarct Artery Patency in Patients With ST-Segment Elevation Myocardial Infarction

Brian W. Gross, MD,§§§ Kent W. Dauterman, MD,§§ Mark G. Moran, MD, Todd S. Kotler, MD, Stephen J. Schnugg, MD,§§ Paul S. Rostykus, MD, MPH, Amy M. Ross, PhD, RN, CNS, and W. Douglas Weaver, MD

American Journal of Cardiology 2007;99:1360-1363
Primary Percutaneous Coronary Intervention (PCI) is the most complex, multi-disciplinary, and time-sensitive therapeutic intervention in the world of medicine today.

The **Process** is measured in **Minutes**

The **Outcomes** are measured in **Mortality**

**Teamwork** and smooth **Transitions** are essential!
What Makes ASSET Work?

- Common interest – best patient care
- Limited geography – State of Jefferson
  - Single PCI Center
- “Natural” referral patterns
- All players at the table equally
  - EMS, ED, hospitals, physicians
- Physician champion – Dr. Brian Gross
EMS Impact Medal

“...substantial contribution ... to develop a statewide EMS System.”

Brian Gross, MD
Heart Clinic & Jackson County EMS
What Makes ASSET Work?

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Challenges
- New PCI center
- 12 lead ECG by EMT-B or EMT-I
- Incorporate best practices – induced hypothermia
Induced Hypothermia

- Cardiac Arrest with ROSC and neurological compromise
- Cool to 32-34°C (89.6-93.2°F) for 24-48 hours
- Cath & PCI availability?
- Outcomes improved
- Initiated by EMS? ED? ICU?
  - Iced saline? Cooling blanket? Winter air?
- Must be part of a system of care
The Challenge is to Synchronize all the Individual Components
Oregon Trauma System

- Started 1985
- Get patients to appropriate level of care
- Oregon State Law
  ORS – 431.607 – 431.671
  OAR – 333-200-0080
  Exhibit 2 – EMS Trauma Entry Criteria
  Exhibit 3 – Hospital Trauma Entry Criteria
- Designated Hospital Trauma Levels (1-4)
- State Trauma Area Advisory Board (STAB)
- 7 Area Trauma Area Advisory Boards (ATAB)
Oregon Trauma System
Jackson & Josephine Counties

ATAB 5

Two Level 4 – ACH & TRCH
Two Level 3 – PMMC & RVMC (Medford)
Designated trauma hospital of the day
(Red/Green)
EMS takes trauma to trauma hospital
Chest, OB, peds → RVMC
What Makes Trauma Work?

• Common interest – best patient care
• Government mandate
  • ORS & OAR
• Regional cooperation – State of Jefferson
• Communication via ATAB

Challenges
  Incorporating best practices
  Updating laws & regulations
  Physician shortages
Acute Stroke System of Care
A work in progress
Acute Stroke Care remains challenging

- STEMI has diagnostic test – 12 lead EKG
  Stroke has many mimics
- Cardiac recanalization works
  PCI (cath) > IV-TPA
- Cardiology literature is more developed
- Longer window for STEMI (12 hr vs 3-4.5 hr)
- More STEMI centers than stroke centers
- Many more cardiologists than neurologists
  Need physician champions for systems of care
EMS Stroke Protocol

- Localized weakness, numbness or paralysis
- Duration < 3 – 4.5 hours since last seen normal
- No contraindications
  - Age < 80 years
  - No anticoagulant therapy
  - No seizure activity
EMS Stroke Protocol

• Cincinnati Stroke Score
  Facial droop?
  Arm drift?
  Abnormal speech?
  “You can’t teach an old dog new tricks”

• CBG – treat hypoglycemia

• OMI

• Rapid transport to hospital if TPA candidate
  Stroke hospital designation?
  How determined?
Acute Stroke System of Care Challenges

• Intervention – Who, When, Where, What, How
• Best treatment – research vs real world
• Regional resources vary greatly
• Balance technology vs family
• Coordination, Collaboration, Cooperation
EMS & Systems of Care
What works?

✓ Communication x 3
✓ Use “natural” referral patterns
  ✓ Regionalization (via ATABs?)
✓ All players at the table
✓ KISS – o’dark hundred & raining
✓ Continue to learn & develop (PDCA)
✓ Oversight to guide process
✓ Physician champion