



**London Health Sciences Centre**

Southwest Ontario Regional Base Hospital Program



# Utility of the Pre-Hospital 12 Lead ECG

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November 4, 2011**

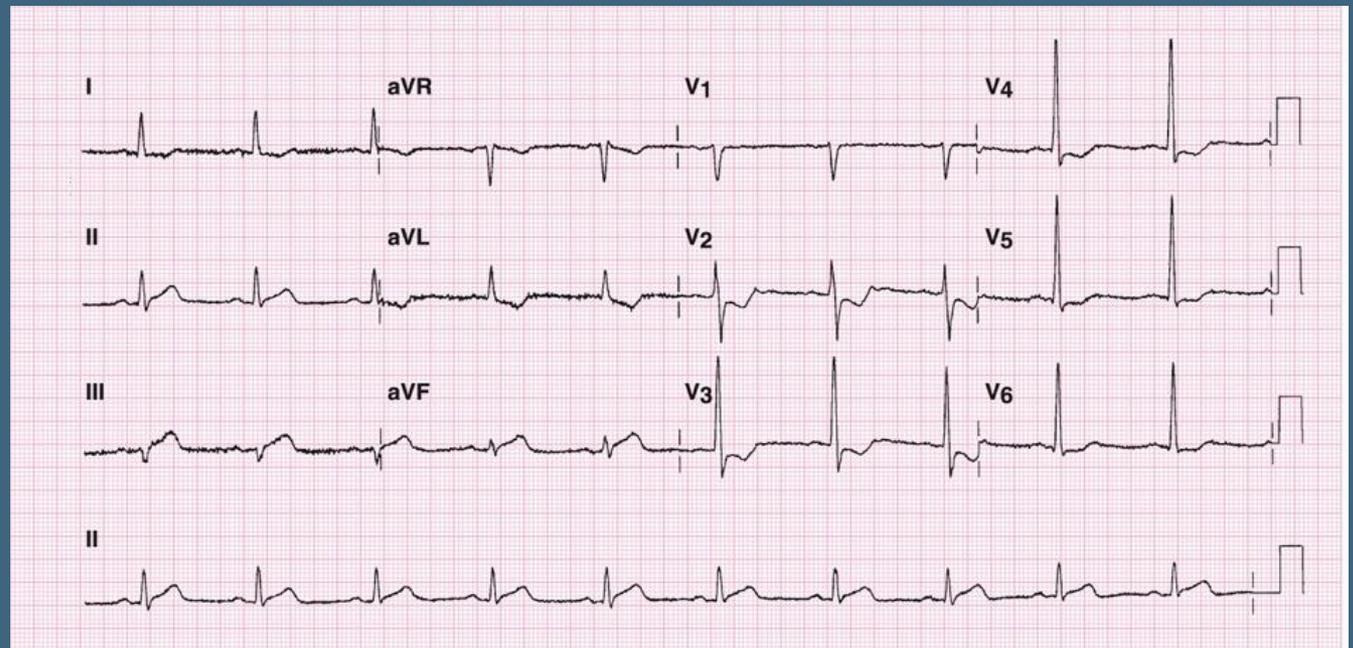
# Objectives

**At the end of this session, the paramedic will be able to:**

- **Determine appropriate situations for obtaining a prehospital 12-lead ECG**
- **Explain causes of artifact, and list remedies to obtain quality 12-lead ECGs**
- **Discuss the benefits of prehospital 12-lead ECG acquisition as presented in the 2010 AHA guidelines**
- **Describe how an organized prehospital 12-lead ECG program can reduce time to percutaneous coronary intervention in select populations**
- **Relate the impact of quality prehospital 12-Lead ECGs on Emergency Department management of patients with STEMI and ACS**

# Why Do We Do 12-Lead pECGs?

- STEMI
- Arrhythmias
- Ischemic changes (ACS)



# When Should I Acquire a 12-Lead?

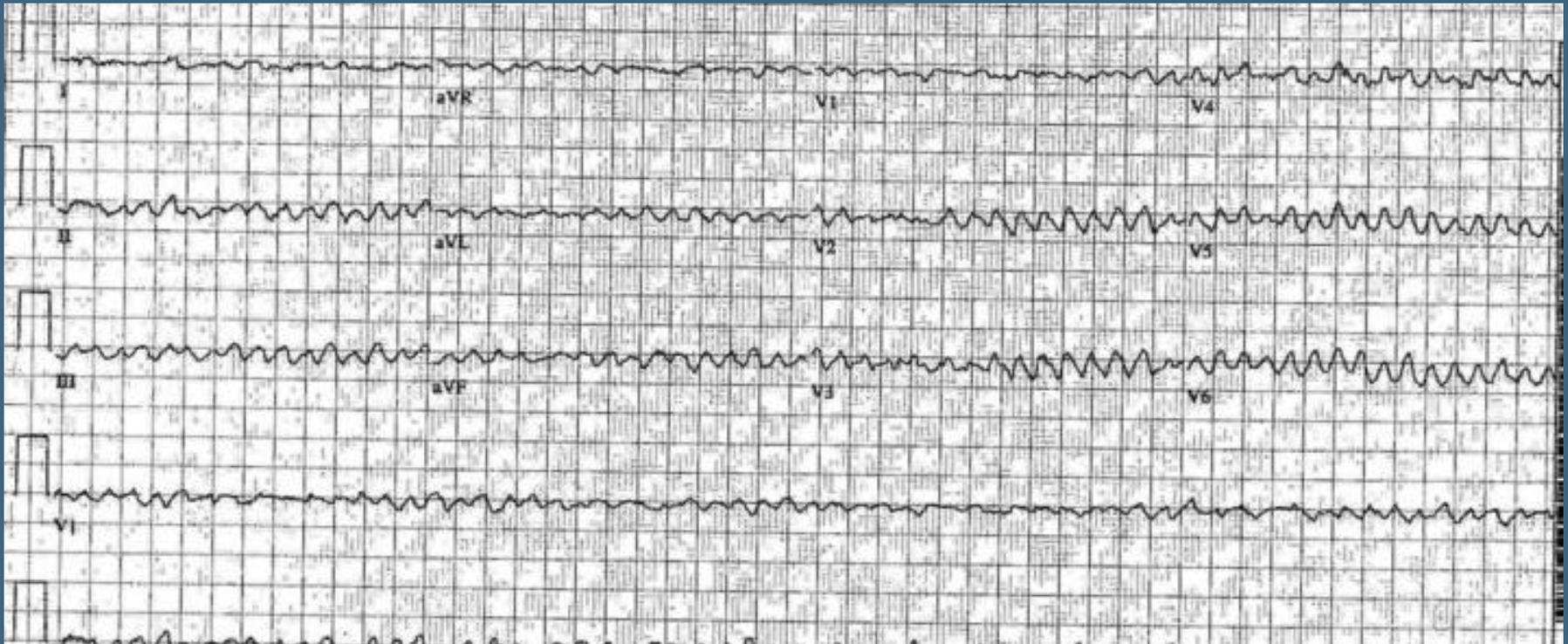
Benefit to Patient

Patient is alert  
Cardiac Ischemia  
Typical Angina  
Rhythm  
interpretation

Privacy/dignity  
Increased scene  
time  
Patient Critical

Risk to Patient

# Big Contraindication



# Comprehensive Care

- 12-Lead ECGs can be performed quickly and concurrently with other assessment and care



# A Prospective Evaluation of the Utility of the pECG to Change Management in the ED

(Davis, Lewell, McLeod, & Dukelow, 2011)

- Primary goal of determining how many pECGs change physician management in the ED
- Multiple secondary objectives, including determining number of poor quality pECGs as determined by ED physician

# Results

19.5% (55/281) Poor Quality

34 Wandering Baseline

30 Artifact

11 Combination of both

1 had missing lead

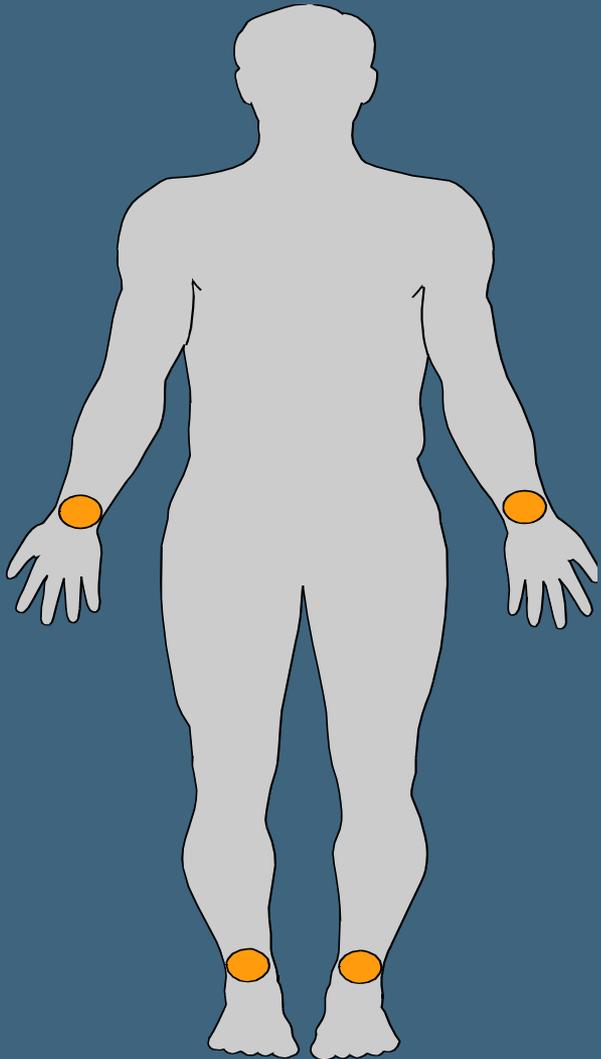
(Davis et al., 2011)

# 12-Lead Acquisition and Trouble Shooting

# Lead Placement

- Proper placement of leads critical to accurate 12-lead ECG
- If not placed correctly, the resulting ECG will exhibit changes that may not be an accurate representation and profoundly affect patient care

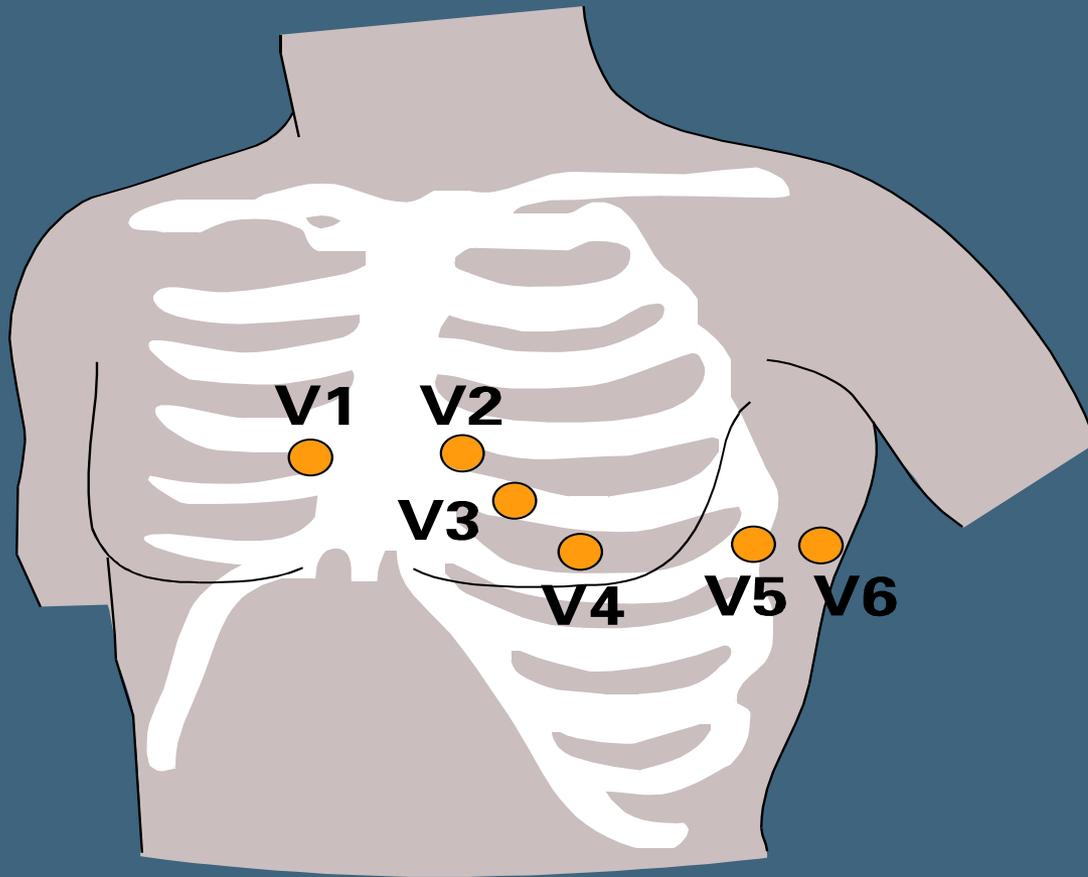
# Lead Placement



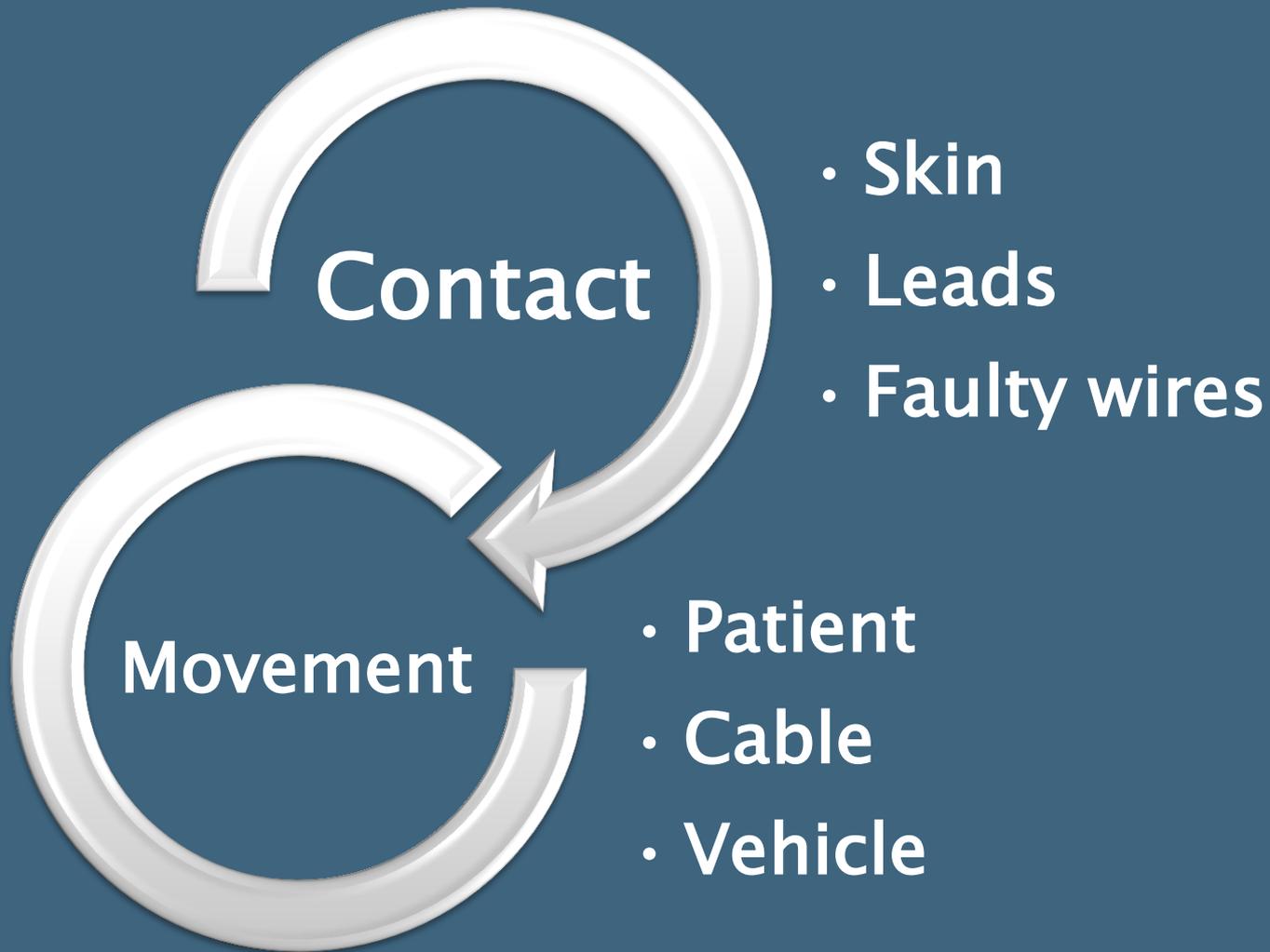
Place limb leads on the extremities anywhere above ankle and wrists

Avoid the torso if possible

# Chest Lead Placement



# Causes of Artifact



# Ensuring Good Contact

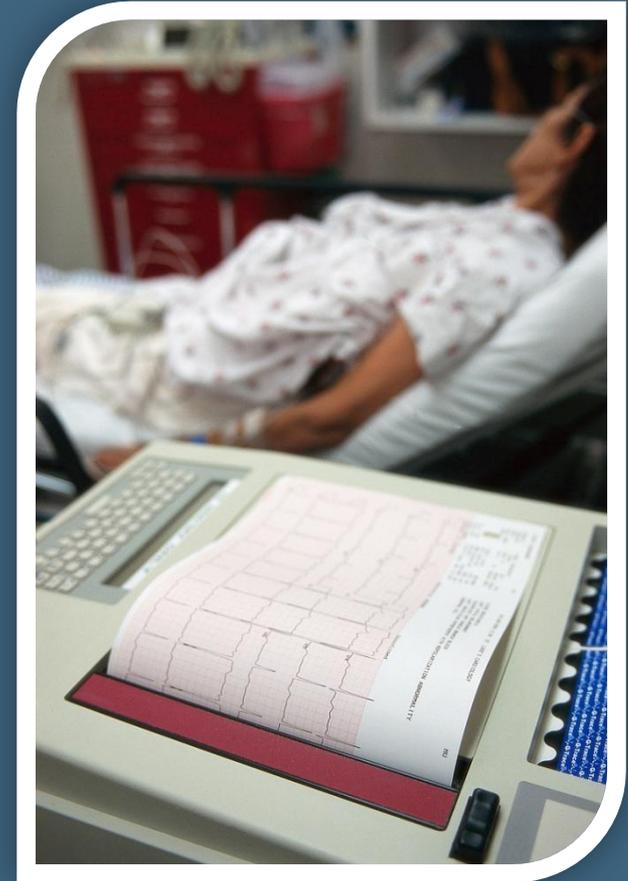
- Dry the skin if moist or diaphoretic
- Alcohol swab to remove excess skin oil
- Clip or shave excess hair
- Abrade dead skin with skin prep tape, plastic backing of 12 lead stickers or dry 4x4 gauze
- Check lead wires for damage/wear
- Ensure leads are not dried out

# Prevent Patient Movement

- Check for subtle movement:
  - Toe tapping, shivering
- Look for muscle tension:
  - Hand grasping rail, head raised to “watch”
- Coach the patient:
  - Lie still, stop talking, breath slow and quiet

# Prevent Cable Movement

- Some “slack” between monitor and patient is needed



# 2010 AHA GUIDELINES

## 12-Lead Prehospital ECG Acquisition

# Class of Evidence

- **Class I - strong evidence that the benefit substantially outweighs the potential for harm**
  - **should...**
- **Class IIa - evidence supports the action or therapy and the therapy is considered reasonable and generally useful**
  - **is reasonable...**
- **Class IIb - evidence documented only short-term benefits from the therapy or weakly positive or mixed results**
  - **May be considered...**

# Class of Evidence

- **Class III - recommendations were reserved for interventions for which the available evidence suggests more harm than good**
  - **Is not recommended...**



# Levels of Evidence

- **LOE A: Randomized controlled trials (RCTs) or meta-analyses of RCTs**
- **LOE B: Studies using concurrent controls without true randomization**
- **LOE B: Studies using retrospective controls**

# Levels of Evidence

- **LOE C: Studies without a control group (eg, case series)**
- **LOE C: Studies not directly related to the specific patient/population (eg, different patient/population, animal models)**
- **LOE C: expert opinion**

# 2010 AHA Guidelines

O'Connor RE, Brady W, Brooks SC, Diercks D, Egan J, Ghaemmaghami C, Menon V, O'Neil BH, Travers AH, Yannopoulos D (2010)

- **Speed the diagnosis**
- **Shorten the time to reperfusion**
- **EMS personnel should routinely acquire an ECG as soon as possible for all patients exhibiting signs and symptoms of ACS**
  - **(Class I, LOE B)**

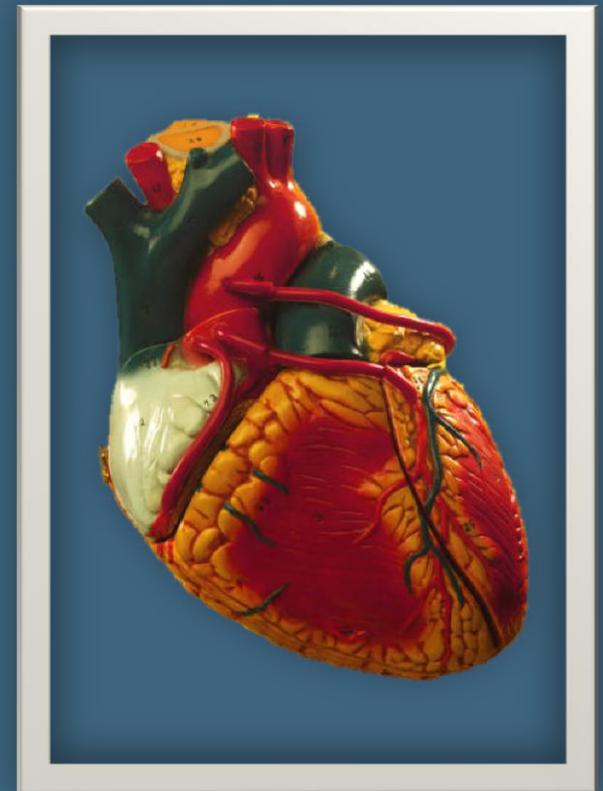
# 2010 AHA Guidelines

- **Implementation of 12-lead ECG diagnostic programs with concurrent medically-directed QA is recommended**
  - **(Class I, LOE B)**

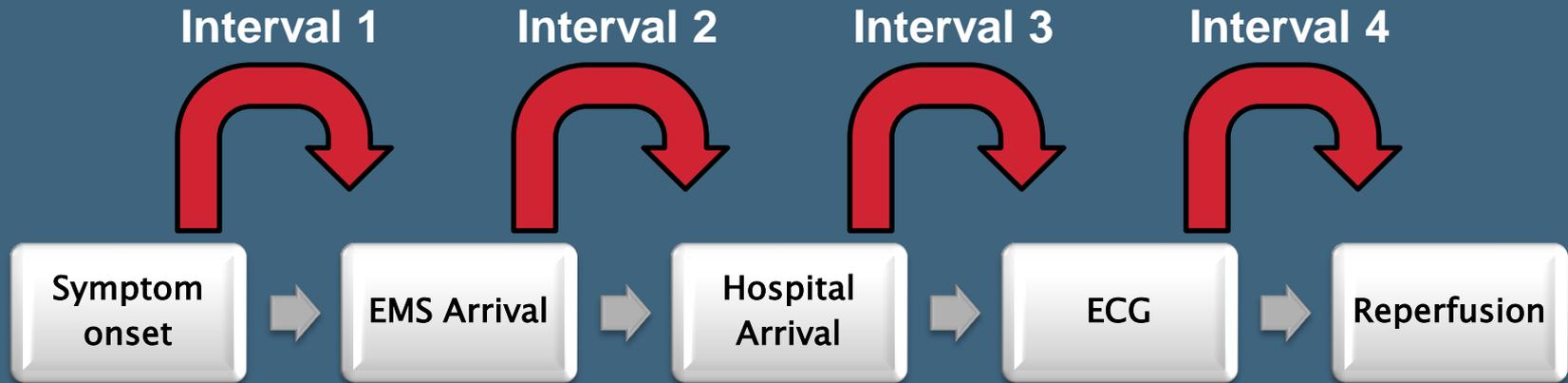
# STEMI

## pECG

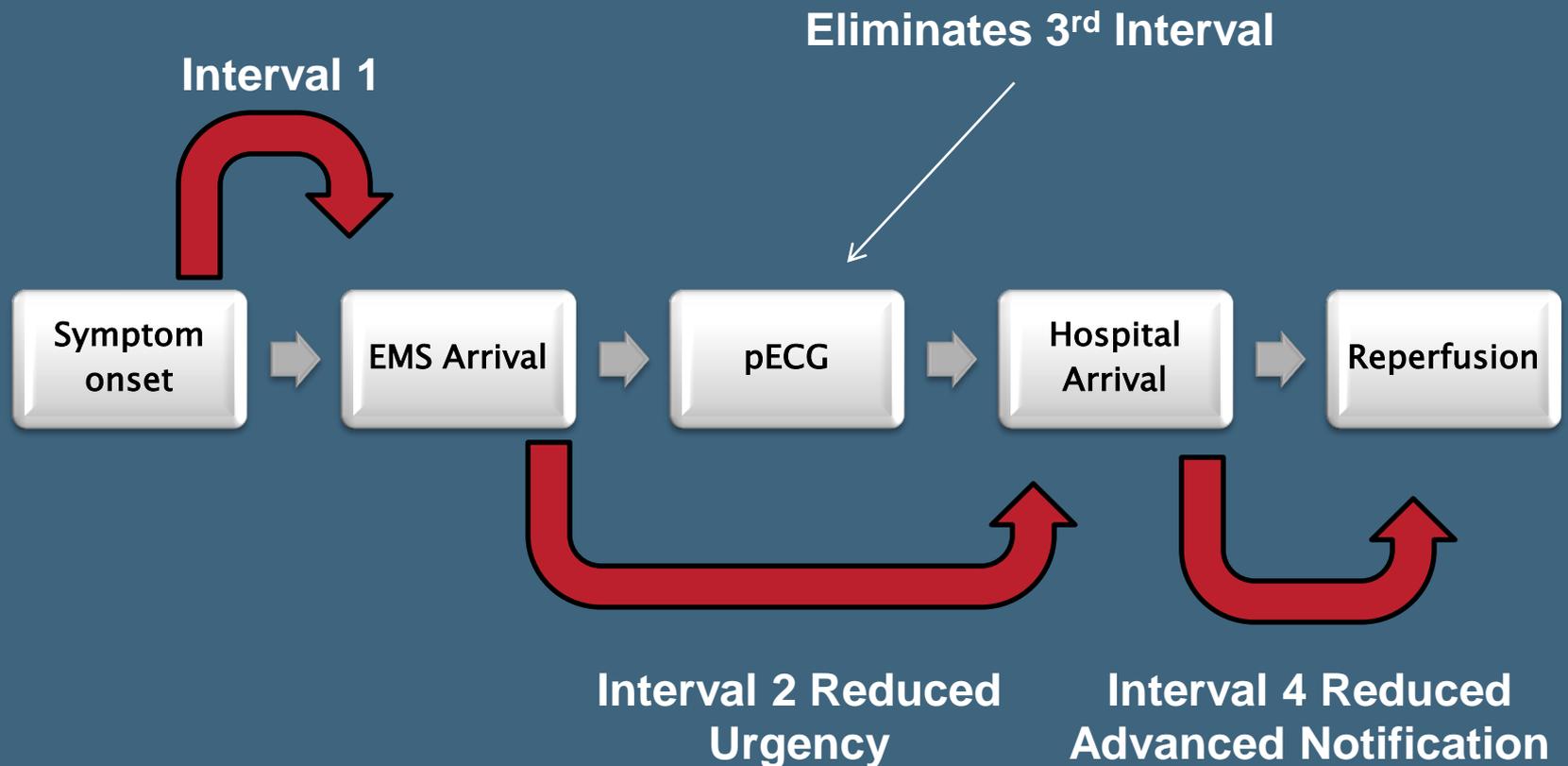
- Speeds the diagnosis
- Shortens the time to reperfusion
  - Fibrinolytics
  - Percutaneous coronary intervention
- **TIME IS MUSCLE**



# No pECG System in Place



# pECG System in Place



# **Prehospital 12-lead Electrocardiography Impact on Acute Myocardial Infarction Times and Mortality: A Systematic Review**

**Morrison, Brooks, Sawadsky, & McDonald (2006)**

# What is a Systematic Review?

- Identifies, appraises, selects and synthesizes the best available evidence that addresses a well-defined clinical question
- Uses quantitative methods to summarize the results

# Results

- 5 studies met inclusion criteria
- pECG and advance ED notification increased the weighted mean on-scene time by 1.2 minutes (95% confidence interval [95% CI] = -0.84 to 3.2)
- The weighted mean door-to-needle interval was shortened by 36.1 minutes (95% CI = 9.3 to 63.0)

Morrison et al. (2006)

# Results

- One study reported all-cause mortality, with a statistically non significant reduction from 15.6% to 8.4%.

Morrison et al. (2006)

# False Negative STEMI

- ~ 5 false negative ECGs in the last 2 years in the London database
- If concerned about STE (or any concerns about ECG):
  - Make concern known to RN who can show it to MD
  - Document your concern on ACR

# NOT JUST FOR STEMI!

# FREQUENCY OF NON-ST-SEGMENT ELEVATION INJURY PATTERNS ON PREHOSPITAL ELECTROCARDIOGRAMS

Turnipseed, Amsterdam, Laurin, Lichty, Miles, & Diercks (2010)

- pECGs were obtained for 322 of 340 chest pain patients
- non-ST-segment elevation injury patterns (ST depression/TWI/LBBB) accounted for 53 (17%, 95% CI 12.6–20.9) of the total 322 pECGs

# Bottom Line

- **Suggest the potential of pECGs to facilitate early triage in these high risk chest pain patients who present to overcrowded EDs**

Turnipseed et al. (2010)

# The Utility of the Prehospital Electrocardiogram in the Emergency Department

Davis, M., Dukelow, A., McLeod S. Rodriguez, S., Lewell, M. (in press)

- Medical record review of 110 charts
- 25% of pECGs had abnormalities not present on ED ECG
- 19% of pECGs had abnormalities which could potentially change management

# Prospective pECG Study at LHSC

## Hypothesized that

- pECGs show abnormalities that are NOT captured on initial ED ECGS
- information that the pECG provides can change management of patients in the ED

Davis et al. (in press)

# Prospective pECG Study at LHSC

- Prospectively collected data on all patients who have a pECG and brought to Victoria Hospital and University Hospital
- Physician's interpreted the pECG then completed a questionnaire determining if the pECG changed their management

# What was Discovered...

- 35 of 281 (**12.5%**) with changes on pECG not apparent on ED ECG
  - 11 ST depression
  - 5 with T wave inversion
  - 2 with ST depression and T wave inversion
  - 2 with ST depression and arrhythmia
  - 12 with arrhythmia
  - 2 with ST elevation
  - 1 unknown

Davis et al. (in press)

# What was Discovered....

- 51 of 281 (**18.1%**) influenced management
  - 10 immediate treatment
  - 6 consultation to outpatient service
  - 33 consultation to inpatient service
  - 8 laboratory investigations
  - 2 outpatient testing
  - 9 other (STEMI activation, no ECG)

Davis et al. (in press)

# What was Discovered....

- 30 of 281 (**10.7%**) instances where the ED physician was willing to consult an inpatient service based on findings from the pECG, regardless if the initial ED ECG was normal

Davis et al. (in press)

# Take Home Message

- **The 12-lead pECG is a valuable tool for ED physicians**
- **Can influence and change management**
  - **Diagnostic**
  - **Treatment**
  - **Disposition**

# The Paramedics Role

## Important to:

- Identifying appropriate patient population
- Obtain a quality pECG
- Identify any significant findings when patching receiving facility
- Provide a hard copy to ED

# Summary

- EMS personnel should routinely acquire an ECG as soon as possible for all patients exhibiting signs and symptoms of ACS
- Speeds the diagnosis and shortens the time to reperfusion

# Summary

- **Important to obtain 12-leads of good quality**
  - **pECGs often show changes not captured on the ED ECG**
  - **Potential to change the management of the patient in the ED**

# References

- Davis, M., Dukelow, A., McLeod, S., Rodriguez S., Lewell, M. (in press). The utility of the 12-lead prehospital electrocardiogram in the emergency department. *Accepted for publication in CJEM.*
- Davis, M., Lewell, M., McLeod, S., Dukelow, A. A prospective evaluation of the utility of the pECG to change management in the ED. *Manuscript in preparation.*
- O'Connor, R. E., Brady, W., Brooks, S.C., Diercks, D., Egan, J., Ghaemmaghami, C., Menon, V., O'Neil, B. H., Travers, A. H., Yannopoulos, D. (2010). Part 10: Acute coronary syndromes: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation.* 2010;122 (suppl 3):S787-S817.
- Morrison, L. J., Brooks, S., Sawadsky, B., McDonald, A. (2006, Jan). Prehospital 12-lead Electrocardiography Impact on Acute Myocardial Infarction treatment time: a systematic review. *Academy of Emergency Medicine,* 13(1):84-9.
- Turnipseed, S. D., Amsterdam, E. A., Laurin, E. G., Lichty, L. L., Miles, P. H., Diercks, D. B. (2010, Jan-Mar). Frequency of non-ST-segment elevation injury patterns on prehospital electrocardiograms. *Prehospital Emergency Care,* 14(1):1-5.

# Questions?

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