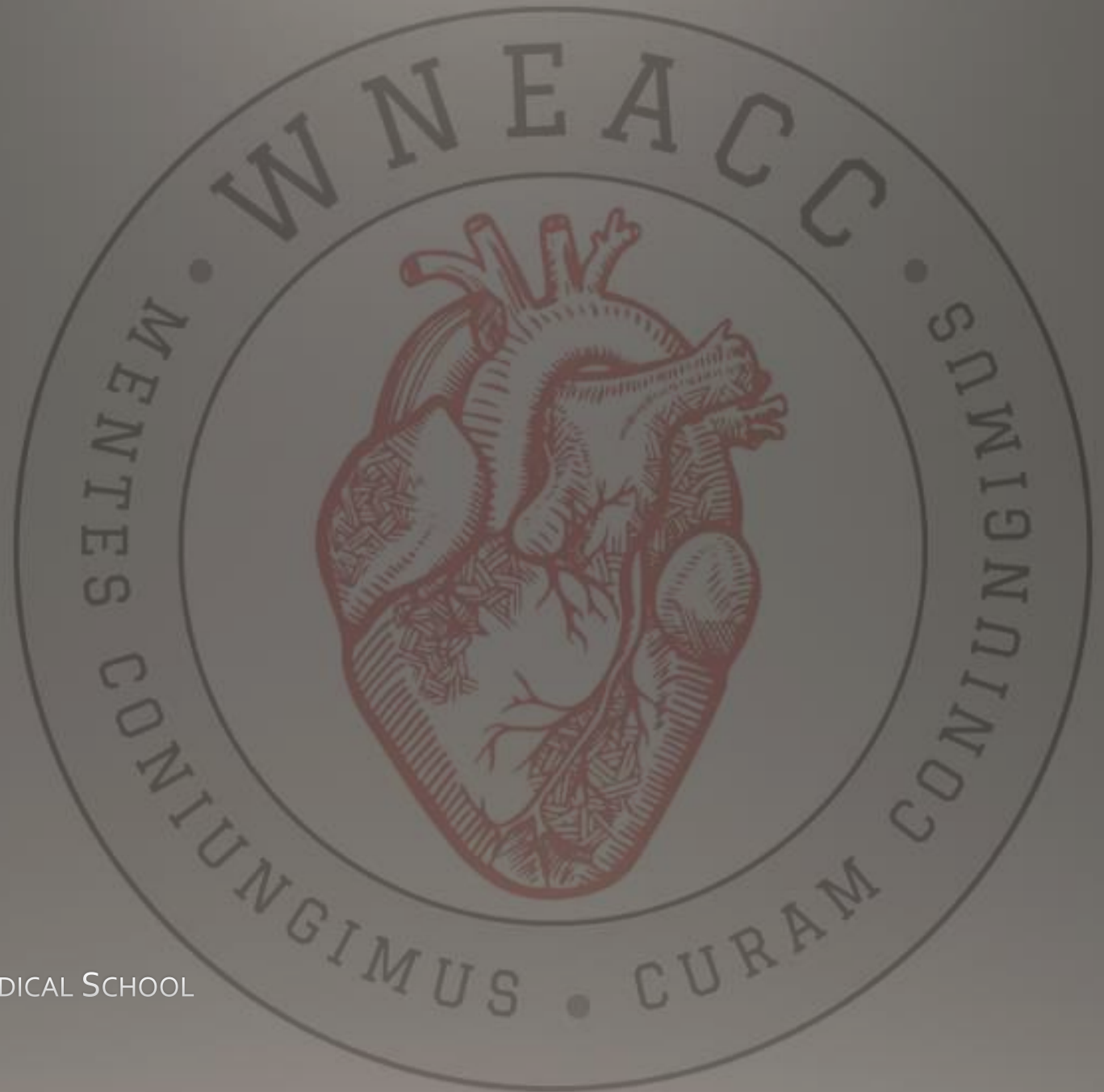




## PETER FISHMAN, MD FACEP

CHAIR, EMERGENCY MEDICINE, BERKSHIRE HEALTH SYSTEMS

ASSISTANT PROFESSOR OF EMERGENCY MEDICINE, UMASS MEDICAL SCHOOL



# NSTEMI at a Non-PCI Center

# Who Stays and Who Goes?

Peter Fishman, MD FACEP  
Chair, Emergency Medicine, Berkshire Health Systems  
Assistant Professor of Emergency Medicine, UMASS Medical School



No Disclosures

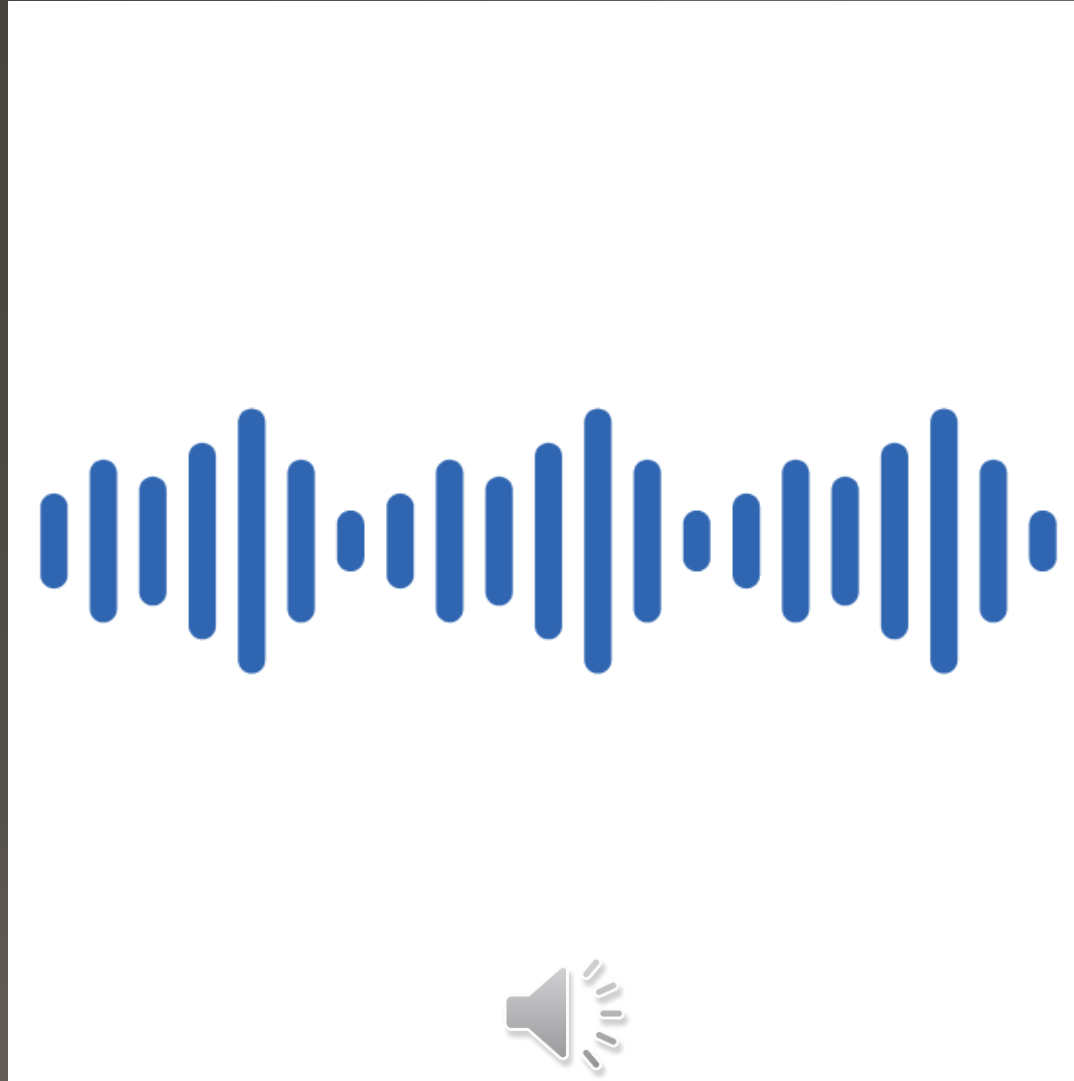


# ACC/AHA framework for invasive timing of NSTEMI

Adapted from 2025 ACC/AHA and 2023 ESC guidelines

| Clinical group            | Typical invasive timing                                             |
|---------------------------|---------------------------------------------------------------------|
| Unstable / very high risk | Immediate / as soon as possible; generally <2 h                     |
| High risk                 | Earlier angiography; <24 h reasonable                               |
| Intermediate risk         | Invasive evaluation during hospitalization; <72 h reasonable        |
| Low risk                  | Further risk stratification; routine or selective invasive strategy |

# Opening case



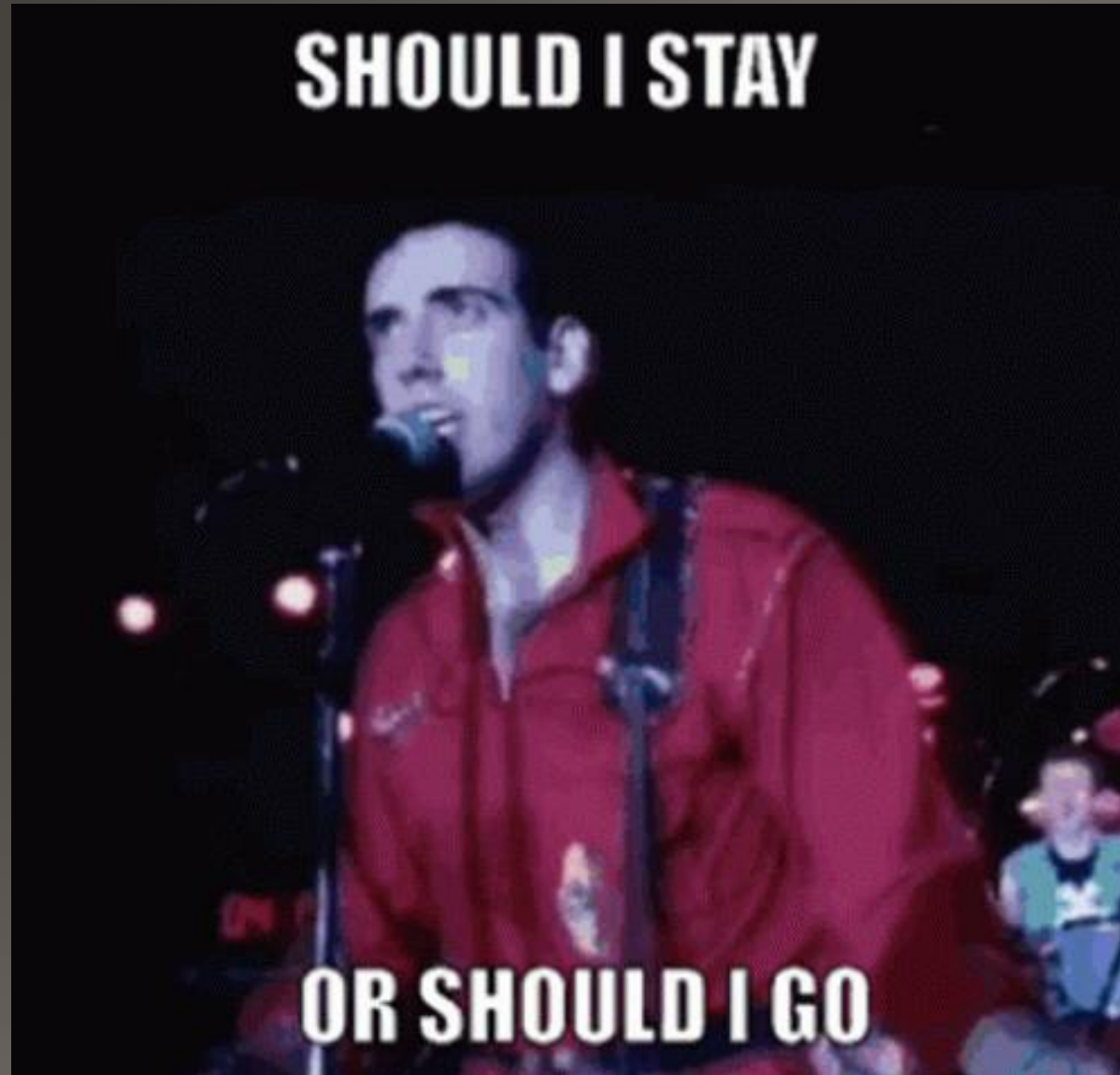
Voice actors:  
Dr. Elizabeth Karr  
Dr. Robert Wenger  
Stephanie Killeen



## Why NSTEMI is different

- NSTEMI is a more diverse set of pathologies
- NSTEMI decision making is more nuanced & variable
- Non-STEMI doesn't mean non-occlusive
- Catheterization is often delayed
- At a PCI-capable hospital, decisions revolve around catheterization timing

## NSTEMI at the non-PCI hospital



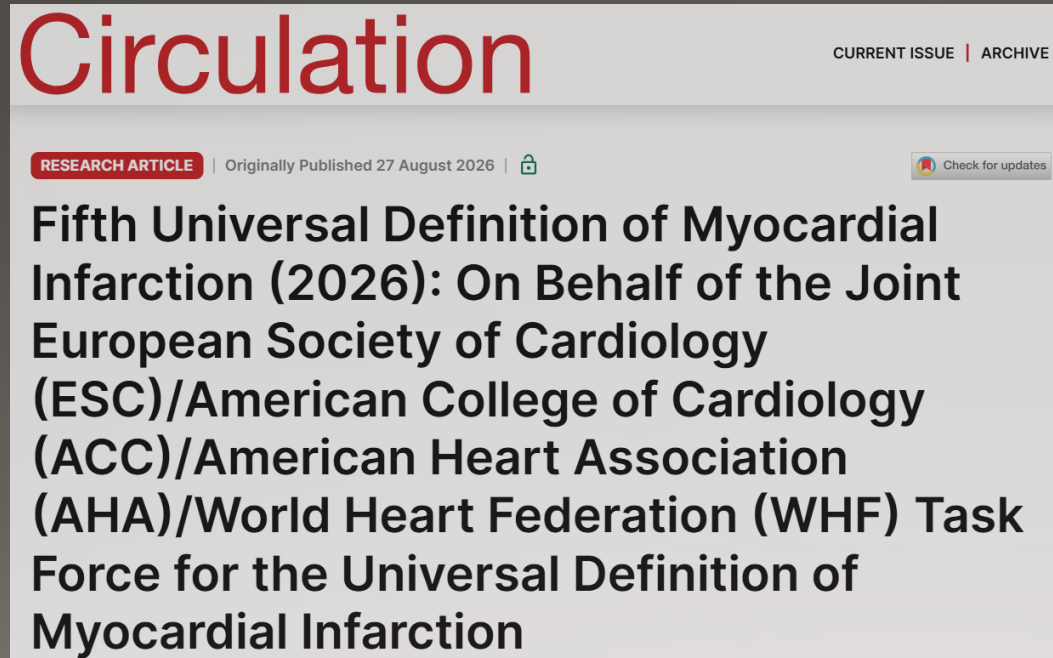
# What is an NSTEMI anyway?

- What exactly is a myocardial infarction in the age of hs-troponin?



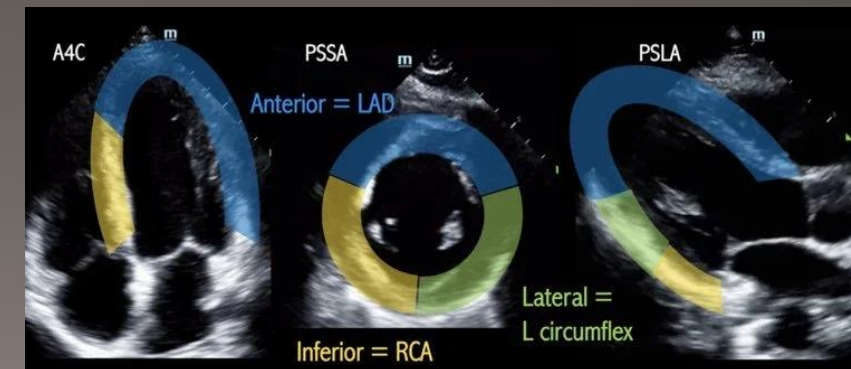
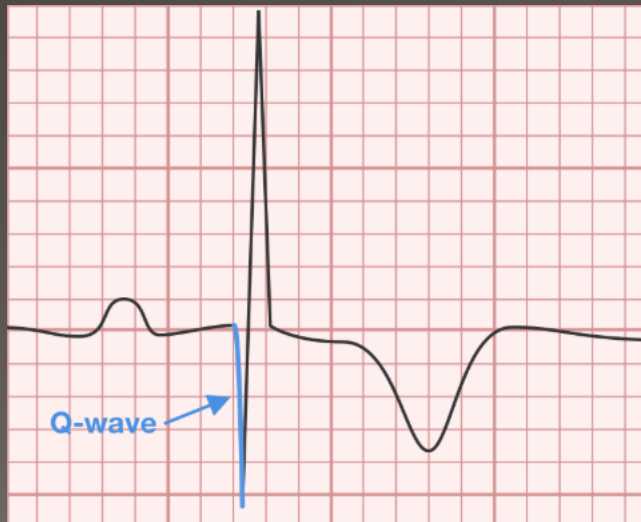
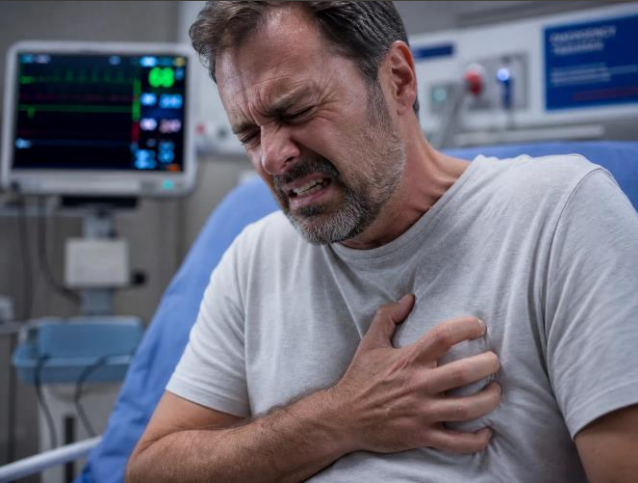
# Elevated troponin ≠ MI

- Troponins above the 99<sup>th</sup> percentile of the URL? **Myocardial injury**
- Actively rising/falling? The myocardial injury is acute
- Troponin elevation is a biochemical finding, not a diagnosis
- Why is there a myocardial injury?



# What is an MI then?

Myocardial infarction = acute myocardial injury + evidence that the injury resulted from acute myocardial ischemia

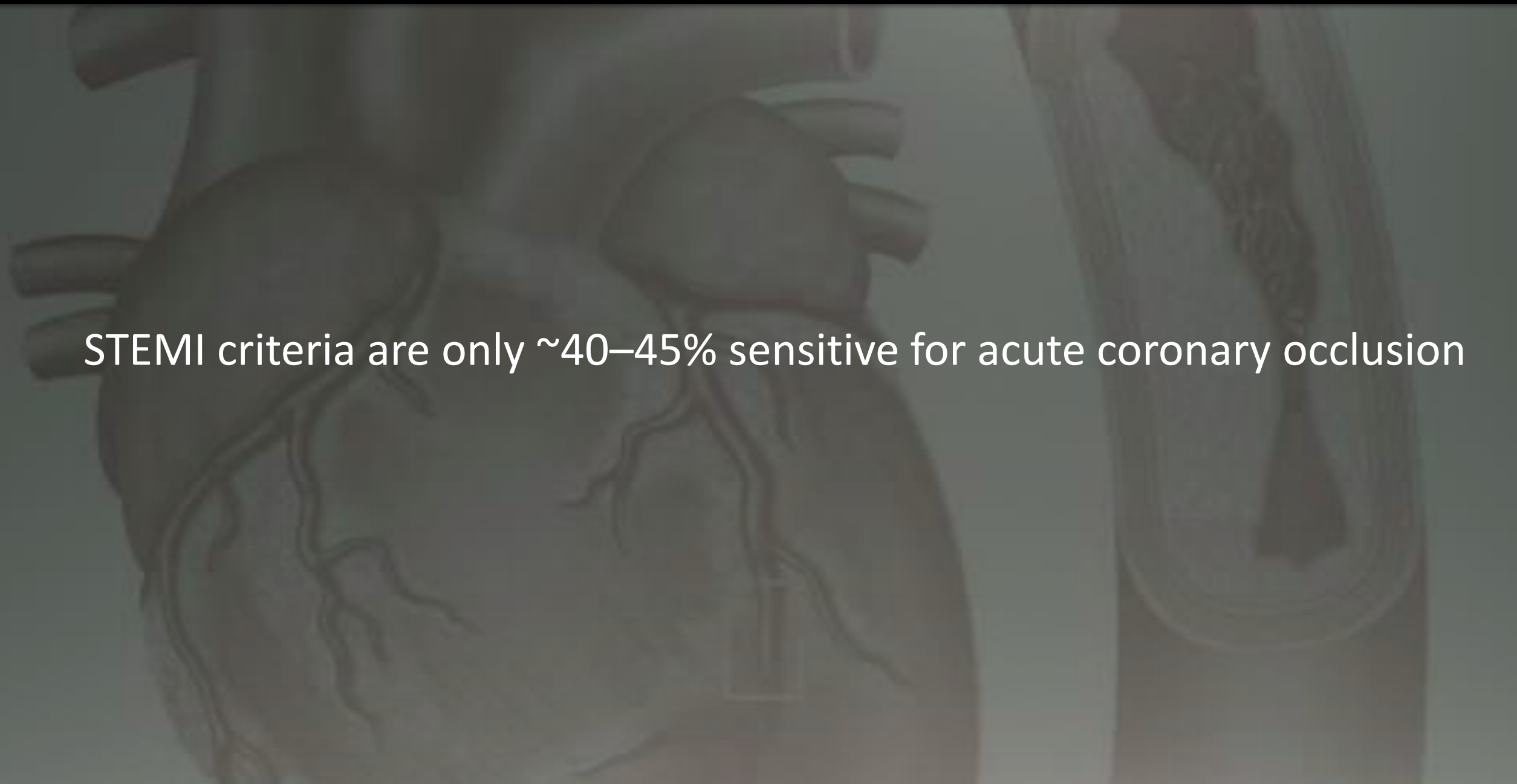


# The STEMI/NSTEMI paradigm

- The STEMI/NSTEMI paradigm
  - STEMI
    - ST elevation → immediate reperfusion
    - Minutes matter
  - NSTEMI
    - No diagnostic ST elevation → risk stratify
    - Cath may be hours to days later

# The STEMI/NSTEMI paradigm

STEMI criteria are only ~40–45% sensitive for acute coronary occlusion



# The STEMI/NSTEMI paradigm

## Systematic review and meta-analysis of diagnostic test accuracy of ST-segment elevation for acute coronary occlusion

José Nunes de Alencar Neto <sup>1</sup>  , Matheus Kiszka Scheffer, Bruno Pinotti Correia, Kleber Gomes Franchini, Sandro Pinelli Felicioni, Mariana Fuziy Nogueira De Marchi

Cardiology, Instituto Dante Pazzanese de Cardiologia, São Paulo, Brazil

Received 28 January 2024, Revised 7 February 2024, Accepted 18 February 2024, Available online 20 February 2024, Version of Record 11 March 2024.

## Prospective validation of current quantitative electrocardiographic criteria for ST-elevation myocardial infarction

Petra Hillinger <sup>a b 1</sup>, Ivo Strebel <sup>a 1</sup>, Roger Abächerli <sup>a c</sup>, Raphael Twerenbold <sup>a</sup>, Karin Wildi <sup>a d</sup>, Denise Bernhard <sup>a</sup>, Thomas Nestelberger <sup>a</sup>, Jasper Boeddinghaus <sup>a e</sup>, Patrick Badertscher <sup>a f</sup>, Desiree Wussler <sup>a e</sup>, Luca Koechlin <sup>a g</sup>, Tobias Zimmermann <sup>a e</sup>, Christian Puelacher <sup>a e</sup>, Maria Rubini Gimenez <sup>a</sup>, Jeanne du Fay de Lavallaz <sup>a</sup>, Joan Walter <sup>a</sup>, Nicolas Geigy <sup>h</sup>, Dagmar I. Keller <sup>i</sup>, Tobias Reichlin <sup>a</sup>, Christian Mueller <sup>a</sup>   for

<sup>a</sup> Department of Cardiology & Cardiovascular Research Institute Basel (CRIB), University Hospital Basel, University of Basel, Switzerland

<sup>b</sup> Department of Anesthesia and Intensive Care Medicine, University Hospital Innsbruck, University of Innsbruck, Austria

<sup>c</sup> Institute of Medical Engineering, Lucerne University of Applied Sciences and Arts, Horw, Switzerland

<sup>d</sup> Department of Anesthesia, Critical Care Research Group, The Prince Charles Hospital, Brisbane, Australia

<sup>e</sup> Department of Internal Medicine, University Hospital Basel, Switzerland

<sup>f</sup> Division of Cardiology, University of Illinois at Chicago, Chicago, United States

<sup>g</sup> Department of Cardiac Surgery, University Hospital Basel, Switzerland

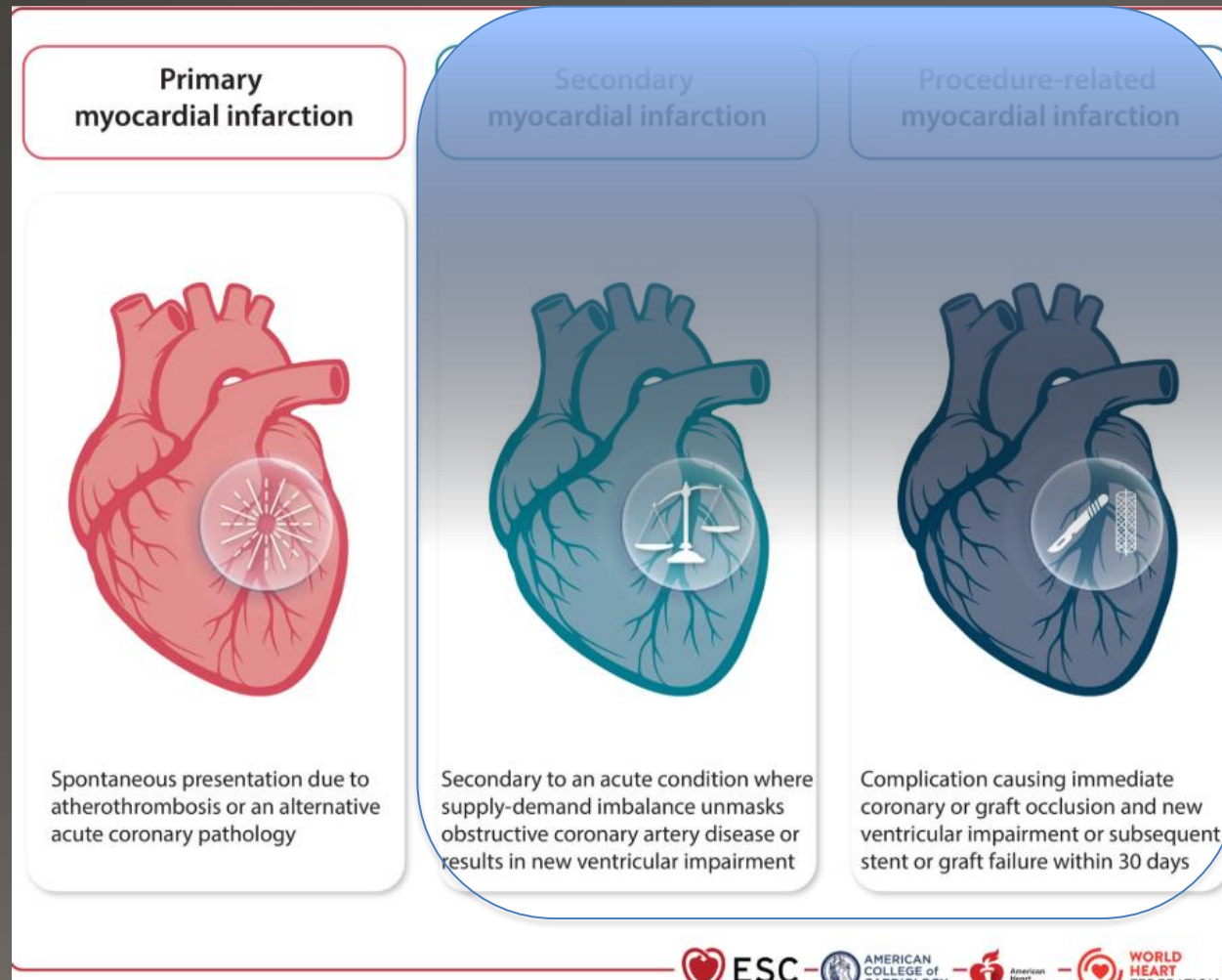
<sup>h</sup> Emergency Department, Kantonsspital Liestal, Switzerland

<sup>i</sup> Emergency Department, University Hospital Zurich, Zurich, Switzerland

Received 3 March 2019, Revised 6 April 2019, Accepted 11 April 2019, Available online 11 April 2019, Version of Record 24 July 2019.

# So back to who stays and who goes...

So how can we tell which NSTEMI is which?



## EXPERT CONSENSUS DOCUMENT

### Fifth Universal Definition of Myocardial Infarction (2026)

On behalf of the Joint European Society of Cardiology (ESC)/American College of Cardiology (ACC)/American Heart Association (AHA)/World Heart Federation (WHF) Task Force for the Universal Definition of Myocardial Infarction  
Endorsed by the European Association for Cardio-Thoracic Surgery (EACTS) and the Society of Thoracic Surgeons (STS)  
Affirmation of Value by the Society for Cardiovascular Angiography and Interventions (SCAI)

# And does it actually matter?

## *The* NEW ENGLAND JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

MAY 21, 2009

VOL. 360 NO. 21

### Early versus Delayed Invasive Intervention in Acute Coronary Syndromes

Shamir R. Mehta, M.D., M.Sc., Christopher B. Granger, M.D., William E. Boden, M.D., Philippe Gabriel Si  
Jean-Pierre Bassand, M.D., David P. Faxon, M.D., Rizwan Afzal, M.Sc., Susan Chrolavicius, R.N.,  
Sanjit S. Jolly, M.D., M.Sc., Petr Widimsky, M.D., Alvaro Avezum, M.D., Hans-Jurgen Rupprecht, M  
Jun Zhu, M.D., Jacques Col, M.D., Madhu K. Natarajan, M.D., M.Sc., Craig Horsman, B.Sc., Keith A.A. Fox, M  
and Salim Yusuf, M.B., B.S., D.Phil., for the TIMACS Investigators\*

## Circulation

[CURRENT ISSUE](#) | [ARCHIVE](#) |

RESEARCH ARTICLE

| Originally Published 28 August 2018 | 

 Check for updates

### Early Versus Standard Care Invasive Examination and Treatment of Patients With Non-ST-Segment Elevation Acute Coronary Syndrome: VERDICT Randomized Controlled Trial

Klaus F. Kofoed, MD , Henning Kelbæk, MD, Peter Riis Hansen, MD, Christian Torp-Pedersen, MD, Dan Høfsten, MD, Lene Kløvgaard, RN,  
Lene Holmvang, MD, ... [SHOW ALL](#) ... , and Thomas Engstrøm, MD | [AUTHOR INFO & AFFILIATIONS](#)

# Not all NSTEMIs are created equal

JACC: CARDIOVASCULAR INTERVENTIONS  
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VOL. 16, NO. 1, 2023

## NEW RESEARCH PAPER

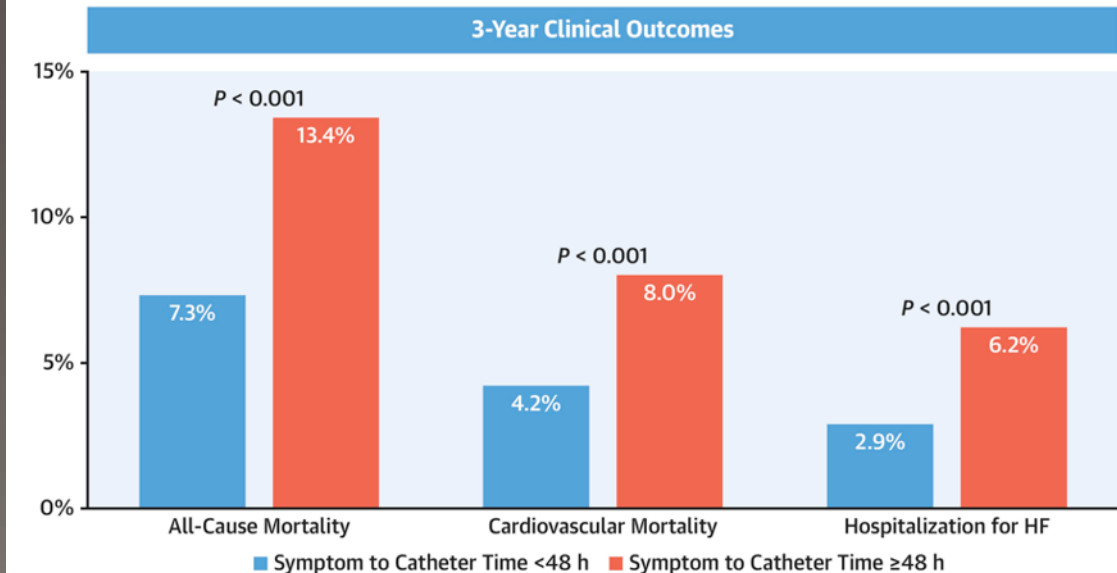
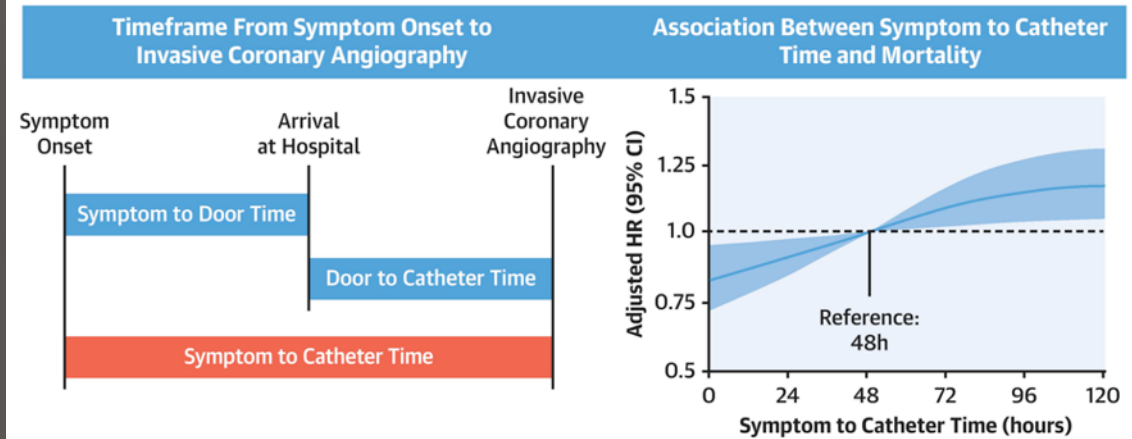
### CORONARY

## Early Invasive Strategy Based on the Time of Symptom Onset of Non-ST-Segment Elevation Myocardial Infarction

SungA Bae, MD,<sup>a,b,\*</sup> Jung-Joon Cha, MD,<sup>c,\*</sup> Subin Lim, MD,<sup>c</sup> Ju Hyeon Kim, MD,<sup>c</sup> Hyung Joon Joo, MD,<sup>c</sup> Jae Hyoung Park, MD,<sup>c</sup> Soon Jun Hong, MD,<sup>c</sup> Cheol Woong Yu, MD,<sup>c</sup> Do-Sun Lim, MD,<sup>c</sup> Yongcheol Kim, MD,<sup>a,b</sup> Woong Chol Kang, MD,<sup>d</sup> Eun Jeong Cho, MD,<sup>e</sup> Sang Yeub Lee, MD,<sup>e</sup> Sang Wook Kim, MD,<sup>e</sup> Eun-Seok Shin, MD,<sup>f</sup> Seung Ho Hur, MD,<sup>g</sup> Seok Kyu Oh, MD,<sup>h</sup> Seong-Hoon Lim, MD,<sup>i</sup> Hyo-Soo Kim, MD,<sup>j</sup> Young Joon Hong, MD,<sup>a</sup> Youngkeun Ahn, MD,<sup>a</sup> Myung Ho Jeong, MD,<sup>a</sup> Tae Hoon Ahn, MD<sup>e</sup>



### CENTRAL ILLUSTRATION: The 3-Year Outcomes in Patients With NSTEMI According to Symptom to Catheter Time From the KAMIR-NIH (Korea Acute Myocardial Infarction Registry-National Institutes of Health) Registry (N = 5,856)



Bae SungA, et al. J Am Coll Cardiol Interv. 2023;16(1):64-75.

# Occlusive NSTEMI

- Occlusive NSTEMI's have worse outcomes
- STEMI: cath ~1.4 h → 1-year mortality 9.9%
- NSTEMI with occlusion: cath ~16.3 h → 1-year mortality 18.1%
- Paradoxically, you might be better off having a STEMI than an occlusive NSTEMI

# What clinical features suggest that an NSTEMI is occlusive/high-risk?

## ONGOING ISCHEMIA / POSSIBLE OCCLUSION

- Recurrent pain
- Dynamic ECG
- Shock
- Acute HF
- VT/VF/arrest
- Steep troponin rise\*

## HIGH PROGNOSTIC RISK

- GRACE >140
- Age/comorbidity
- Diabetes/CKD
- Known CAD/prior revascularization

# Intermediate risk NSTEMI

## ONGOING ISCHEMIA / POSSIBLE OCCLUSION

- Recurrent pain
- Dynamic ECG
- Shock
- Acute HF
- VT/VF/arrest
- Steep troponin rise\*

## HIGH PROGNOSTIC RISK

- GRACE >140
- Age/comorbidity
- Diabetes/CKD
- Known CAD/prior revascularization

# Intermediate risk decisions: GRACE

- GRACE >140 identifies a high-risk population
- GRACE should inform the transfer decision, not substitute for clinical judgment

The screenshot shows the GRACE ACS Risk Model calculator. The header includes the GRACE logo (Global Registry of Acute Coronary Events) and the title 'ACS Risk Model'. There are two tabs: 'At Admission (in-hospital/to 6 months)' and 'At Discharge (to 6 months)'. The 'At Admission' tab is active. Below the tabs, there are input fields for Age (Years), HR (bpm), SBP (mmHg), Creat. (mg/dL), and CHF (Killip Class). To the right of these fields are three checkboxes: 'Cardiac arrest at admission', 'ST-segment deviation', and 'Elevated cardiac enzymes/markers'. Below these checkboxes is a table showing the probability of death and death or MI. At the bottom, there are buttons for 'SI Units', 'Reset', and 'Display Score'. A footer bar contains links for 'Calculator', 'Instructions', 'GRACE Info', 'References', and 'Disclaimer'.

| Probability of | Death | Death or MI |
|----------------|-------|-------------|
| In-hospital    | --    | --          |
| To 6 months    | --    | --          |

## Intermediate-risk decisions: where it gets unscientific

- How does the patient look?
- Who is the admitting hospitalist today?
- Do we have telemetry beds? Do we have a cardiologist?
- Is our cardiologist the “we can watch him” or the “just transfer him” type?
- How full is the receiving center?
- How many ambulances are available?
- What’s the weather like?

# ACC/AHA framework for invasive timing of NSTEMI

Adapted from 2025 ACC/AHA and 2023 ESC guidelines

| Clinical group            | Typical invasive timing                                             |
|---------------------------|---------------------------------------------------------------------|
| Unstable / very high risk | Immediate / as soon as possible; generally <2 h                     |
| High risk                 | Earlier angiography; <24 h reasonable                               |
| Intermediate risk         | Invasive evaluation during hospitalization; <72 h reasonable        |
| Low risk                  | Further risk stratification; routine or selective invasive strategy |

## The lower to intermediate-risk NSTEMI: admit where?

- Guidelines tell us when angiography should occur
- At a non-PCI hospital, we also must decide where the patient should wait

# Why transfer a stable NSTEMI?

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VOL. 9, NO. 6, 2016

ISSN 1936-8798/\$36.00

<http://dx.doi.org/10.1016/j.jcin.2015.11.018>

## Immediate Versus Delayed Invasive Intervention for Non-STEMI Patients

### The RIDDLE-NSTEMI Study



Aleksandra Milosevic, MD,<sup>a,b</sup> Zorana Vasiljevic-Pokrajacic, MD, PhD,<sup>c</sup> Dejan Milasinovic, MD,<sup>a</sup>  
Jelena Marinkovic, PhD,<sup>b,d</sup> Vladan Vukcevic, MD, PhD,<sup>a,c</sup> Branislav Stefanovic, MD, PhD,<sup>a,b,c</sup>  
Milika Asanin, MD, PhD,<sup>a,b,c</sup> Miodrag Dikic, MD,<sup>a</sup> Sanja Stankovic, PhD,<sup>e</sup> Goran Stankovic, MD, PhD<sup>a,c</sup>

- Transfer while stable
- PCI capability if the patient deteriorates
- Avoid a harder, more urgent transfer later

## But transfer is not free

- System costs
  - Limited ALS/EMS capacity
  - Limited receiving beds and cath capacity
  - Every transfer competes with other emergencies
- Patient costs
  - Distance from family and local care
  - Cost, inconvenience and fragmentation
  - Angiography/PCI carry bleeding, renal and procedural risk

# When management at the non-PCI center might make more sense

- Serious competing illness
- Unlikely to benefit from angio/revascularization
- High bleeding or procedural risk
- Advanced frailty or limited life expectancy
- Patient preferences and goals of care
- Transfer burden outweighs expected benefit
- Cardiology consensus that urgent invasive management is unlikely to change care

ORIGINAL ARTICLE



## Invasive Treatment Strategy for Older Patients with Myocardial Infarction

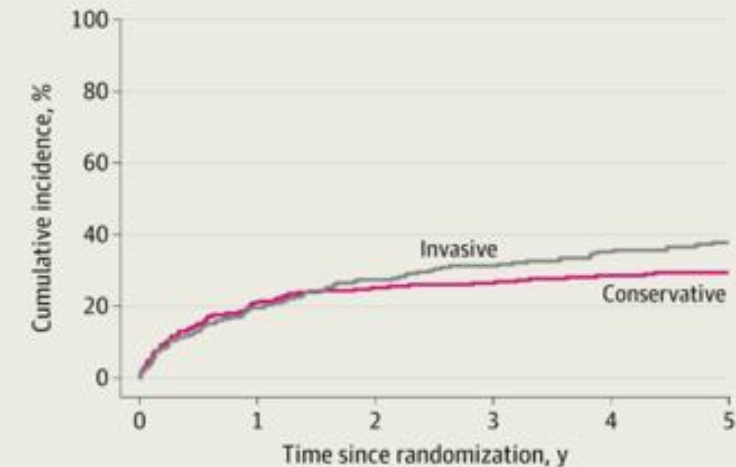
**Authors:** Vijay Kunadian, M.D. , Helen Mossop, M.Math., Carol Shields, B.T.E.C., Michelle Bardgett, M.Sc., Philippa Watts, M.A., M. Dawn Teare, Ph.D., Jonathan Pritchard, B.Sc., , for the British Heart Foundation SENIOR-RITA Trial Team and Investigators\* [Author Info & Affiliations](#)

Published September 1, 2024 | N Engl J Med 2024;391:1673-1684 | DOI: 10.1056/NEJMoa2407791

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### FINDINGS

An invasive strategy did not reduce the composite outcome of cardiovascular death or nonfatal myocardial infarction compared with a conservative strategy



### Cumulative incidence:

37.7% (87 of 231) with invasive strategy  
29.4% (70 of 238) with conservative strategy  
(HR, 1.21; 95% CI, 0.88-1.67;  $P = .20$ )

## Local experience: Berkshire ED, July 2023 – June 2026

**7,126**

chest-pain  
presentations

**410**

NSTEMI  
diagnoses

**286**

transferred to  
PCI center

**124**

admitted  
locally

**5.8% of chest-pain presentations were diagnosed as NSTEMI.**

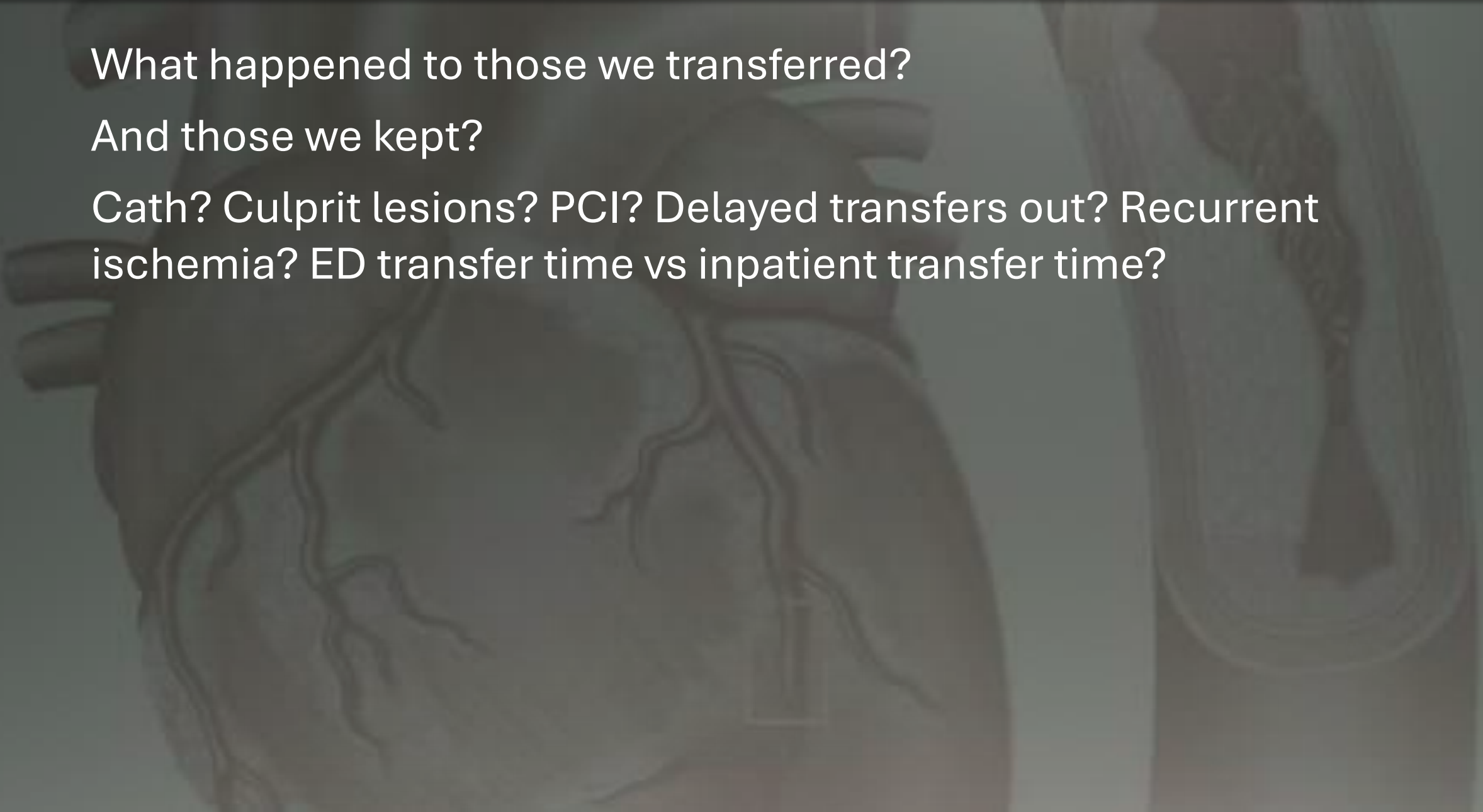
**69.8% of NSTEMIs were transferred; 30.2% were admitted locally.**

## What would be useful to know next?

What happened to those we transferred?

And those we kept?

Cath? Culprit lesions? PCI? Delayed transfers out? Recurrent ischemia? ED transfer time vs inpatient transfer time?



# Bringing it together: three practical groups

## TRANSFER NOW

Ongoing ischemia • instability • HF • VT/VF • suspected occlusion

## TRANSFER SOON

Stable primary NSTEMI likely to need invasive evaluation (timing based on GRACE, clinical trajectory, comorbidity and local system capability)

## STAY / REASSESS

Secondary MI/injury • low expected invasive benefit • competing risk/goals

## Back to the opening case



## Bringing it home

NSTEMI transfer is not just about who needs an emergency cath

Good regional coordination can reduce both unnecessary delay and unnecessary transfer

The goal isn't more transfers or fewer transfers  
It's the right patient, at the right facility, at the right time



QUESTIONS???



Berkshire  
Medical Center  
BERKSHIRE HEALTH SYSTEMS

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