30 Day Mortality Post Cardiac Event (Risk Scoring Systems)

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Disclosure;

No conflict of interest.

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August 22, 2000, Volume 102, Issue suppl 1

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This Issue

⊞ ECC Guidelines

☐ **Part 1: Introduction to the International Guidelines 2000 for CPR and ECC: A Consensus on Science**
Circulation. 2000;102:I–1–I–11, doi:10.1161/01.CIR.102.suppl_1.I–1

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Probability

- Existence of ACS

Risk

- Adverse events

TABLE 2. Patients With Chest Pain Suggestive of Ischemia: Probability of Significant CAD Based on Clinical Features and Presenting ECG

High Risk (≥1 of the Following Features)	Intermediate Risk (No High-Risk Features Plus 1 of the Following)	Low Risk (No High- or Intermediate-Risk Features Plus 1 of the Following)
Prior MI or life-threatening arrhythmia episode Known CAD	Definite clinical angina in young age	Possible angina
Definite clinical angina	Probable angina in older age	1 risk factor, not diabetes
Dynamic ST-segment changes with chest symptoms	Possible angina Diabetes 3 other risk factors	T-wave inversion <1 mm
Marked T-wave changes in anterior precordial leads	ST-segment depression ≤1 mm T-wave inversion ≥1 mm (leads with dominant R waves)	Normal ECG

CAD indicates coronary artery disease. Modified from Reference 14.

- ACI-TIPI
- Goldman Chest Pain Protocol

TABLE 3. Patients With Chest Pain Suggestive of Ischemia: Short-Term Risk of Death and Nonfatal MI

High Risk of Death or Nonfatal AMI (≥1 of the Following)	Intermediate Risk of Death or Nonfatal AMI (No High-Risk Features Plus 1 of the Following)	Low Risk of Death or Nonfatal AMI (No High- or Intermediate-Risk Features Plus 1 of the Following)
Prolonged continuing pain not relieved by rest (>20 min)	Prolonged angina (>20 min) but resolved at time of evaluation; moderately high likelihood of CAD	Angina increased in frequency, severity, or duration
Pulmonary edema related to ischemia	Rest angina >20 min or relieved with nitroglycerin	Lower activity threshold before angina
S_3 or rales		1 risk factor, not diabetes
Hypotension with angina	Age >65 y	New-onset angina >2 wk to 2 mo before presentation
Rest angina with dynamic ST-segment changes >1 mm	Dynamic T-wave changes and angina	Normal or unchanged ECG
Elevated serum troponin T or I	Pathological Q waves or ST-segment depression <1 mm multiple-lead groups	

Modified from Reference 14 and from Antman E, Fox K. Guidelines for the diagnosis and management of unstable angina and non–Q-wave myocardial infarction: proposed revisions. International Cardiology Forum. *Am Heart J.* 2000;139:461–475.

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December 13, 2005, Volume 112, Issue 24 suppl

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This Issue

⊞ **2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care**

☐ **Part 1: Introduction**
Circulation. 2005;112:IV-1-IV-5, published online before print November 28 2005, doi:10.1161/CIRCULATIONAHA.105.166550
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The TIMI Risk Score for Unstable Angina/Non–ST Elevation MI

A Method for Prognostication and Therapeutic Decision Making FREE

Elliott M. Antman, MD; Marc Cohen, MD; Peter J. L. M. Bernink, MD; Carolyn H. McCabe, BS; Thomas Horacek, MD; Gary Papuchis, MD; Branco Mautner, MD; Ramon Corbalan, MD; David Radley, MS; Eugene Braunwald, MD

AHA Guideline, 2010

Circulation

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November 2, 2010, Volume 122, Issue 18 suppl 3

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AHA 2015

- Probability Classification

- TIMI Risk Score

- ADP = Risk scoring system + 0-2 hr cTn + normal EKG

  - TIMI

  - Vancouver

Probability & Isolated Risk scoring systems

Accelerated Diagnostic Protocols

Out

In

What is challenging for ED phycians?
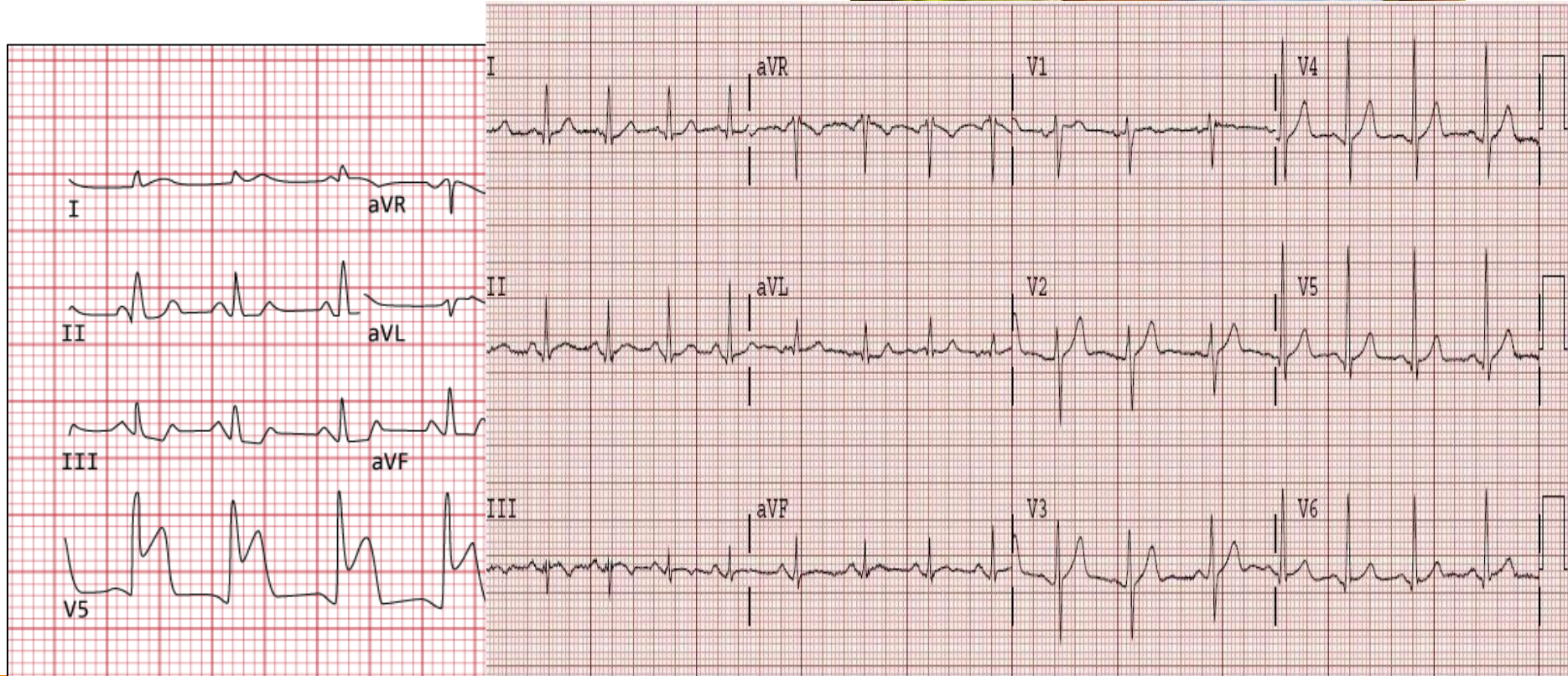
Challenge for ED Physicians?

Prognosis of a *definite* acute coronary syndrome

Prognosis of a patient with a *probable* acute syndrome.

55 years old   Male   Chest pain

Risk Scoring Systems for Patients with Acute Syndrome

TIMI

GRACE

PURSUIT

GUSTO

Risk Scoring Systems for Patients with Probaple Acute Coronary Syndrome

- TIMI

- GRACE

- North American Chest Pain Rule

- EDACS

- HEART Score

- Vancouver Chest Pain Rule

TIMI Risk Score
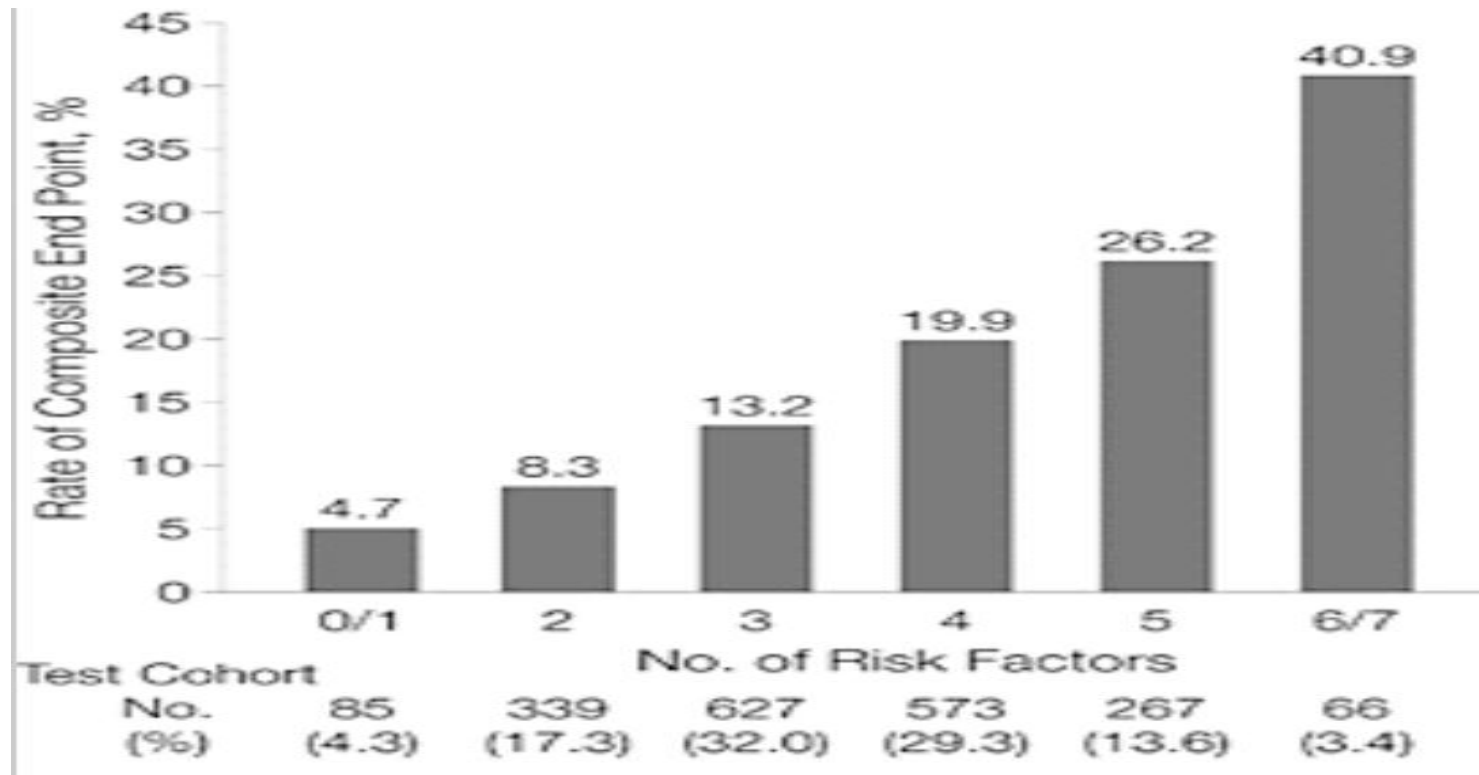
Age ≥ 65

≥ 3 CAD Risk Factors

Known CAD (Stenosis ≥ 50%)

ASA Use in Past 7 days

Severe angina (≥ 2 episodes in 24 hrs)

EKG ST changes ≥ 0.5mm

Positive Cardiac Marker

Study	Sample Size	Sensitivity
ASPECT Study.	3582	%96.7
ADAPT Study.	1976	%97
Six AJ, et al. Crit Pathways in Cardiol 2013	2906	%91.8
Weisenthal et al. J Am Coll Cardiol. 2010.	2819	%80
Macdonal SP, et al. Em Med Aust.2011	1666	%95.7
Chase et al. Ann Emerg Med. 2006	1458	%82
Cullen et al. Circulation 2013	948	%96.7

Study	Sample Size	Sensitivity
Aldous et al. Acad Emerg Med. 2012.	940	%93.4
Cullen L, et al. Heart, Lung and Circulation	948	%96.6
Carlton EW, et al. Ann Emerg Med. 2015	963	%94.9
Cullen et al. APACE study. J Am Coll Cardiol. 2013.	909	%99.4
Marcoon S, et al. Crit Pathways in Cardiol 2013	8815	%2.4 Frequency (Adverse event)
Backus et al. Int J Cardiol. 2013.	2388	%2.8 Frequency (TIMI 0-1) (Adverse event)
Sun et al. *Crit Pathways in Cardiol* 2016 (Retrospective analysis of a prospective data)	8255	89.6%

Accelerated Diagnostic Protocol
(TIMI=0 + normal EKG + 0-2 hr normal Tn)

Study	Sample Size	Sensitivity	Cardiac Enzyme
ASPECT Trial	3582	99.3%	cTn
ADAPT Trial	1976	99.7%	cTn
Aldous et al. Int J Cardiol. 2014.	976	100%	hscTnI
Macdonald SP et al. EMJ. 2013	1501	99%	cTnI
Aldous et al. Acad Emerg Med. 2012.	940	99.6%	cTnI ve hsTnI
Cullen et al. APACE study. J Am Coll Cardiol. 2013.	909	100%	
Mahlen et al. Acad Emerg Med 2015 (A secondary analysis)	1140	83.9%	HsTnI and hsTnT

Conclusion

- TIMI risk score should not be used a single tool to rule out the acute coronary syndrome in patients presenting with chest pain/suggestive symptoms.

- The sensitivity of ADP (TIMI (=0) + normal EKG + 0-2 hr cTn) is between %99-100 except a study by Mahlen et al.
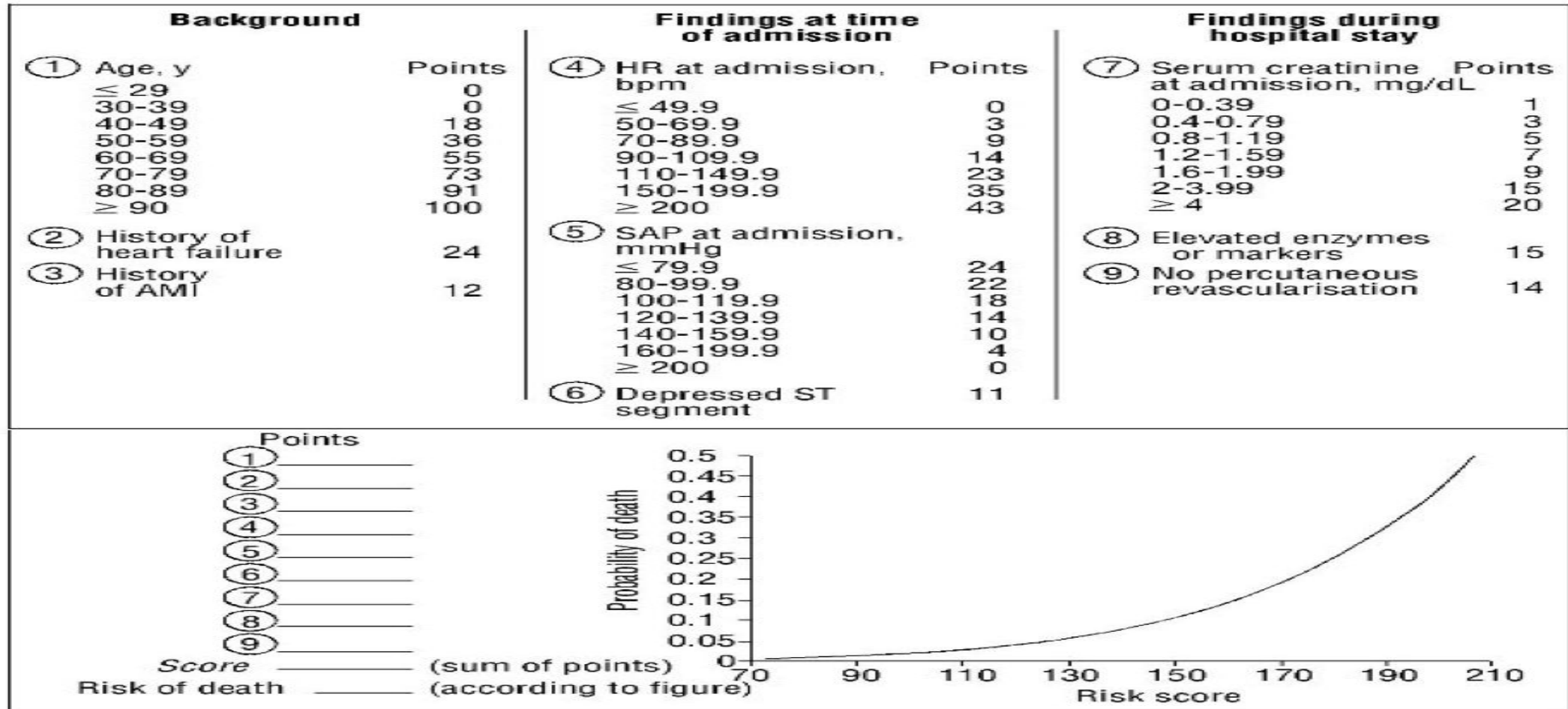
GRACE Score

GRACE Score for Probaple ACS

Study	Sample Size	Sensitivity	Frequency MACE	Score
Cullen et al. Circulation. 2013	948	%98.9		0-50
Carlton EW, et al. Ann Emerg Med. 2015	963	%100		0-50
Backus et al. Int J Cardiol. 2013.	2388	--	%2.9	0-60

Conclusion

- GRACE score should not be used as a single tool to

discharge patients from ED presenting with a probable ACS.

HEART Score

Chest pain in the emergency room: value of the HEART score.

Six AJ[1], Backus BE, Kelder JC.

HEART score for chest pain patients		Score
History	Highly suspicious	2
	Moderately suspicious	1
	Slightly suspicious	0
ECG	Significant ST depression	2
	Nonspecific repolarisation disturbance	1
	Normal	0
Age	≤65 year	2
	45-65 year	1
	<45 year	0
Risk factors	≥3 risk factors or history of atherosclerotic disease	2
	1 or 2 risk factors	1
	No risk factors known	0
Troponin	>2x normal limit	2
	1-2x normal limit	1
	≤normal limit	0

Studies	Sample Size	Sensitivity	Frequence of MACE	
Six AJ, et al. Neth Heart J.	120	96.5%		0-3 points
Marcoon S, et al. Crit Pathways in Cardiol 2013	8815	--	3.6%	
Six AJ, et al. Crit Pathways in Cardiol 2013	2906	96.3%		
Backus et al. Int J Cardiol. 2013.	2388	--	1.7%	0-3 points
Carlton EW, et al. Ann Emerg Med. 2015	963	93.7%		0-3 points
Mahler SA, et al. Int J Cardiol. 2013.	991	99.1%		Score of 0-3 points and 0-3 hr Tn.
Willems MNI, et al. Neth Heart J. 2014	89	100%		hsTnT

Studies	Sample Size	Sensitivity	Frequence of MACE	
Bodopati et al. Emerg Med Aust 2016 (Retrospective analysis)	678	99%		cTn
Melki et al. Crit Pathways in Cardiol 2013 (Retrospective analysis)	410	96.6%	7.3%	cTn
Backus et al. Crit Pathways in Cardiol 2010 (Retrospective analysis)	880	98.1%	17.95%	cTnT and cTnI
Leite et al. BMC Cardiovascular Disorders 2015. (Retrospective analysis)	223	90.0%		
Sun et al. Crit Pathways in Cardiol 2016 (Retrospective analysis of a prospective data)	8255	85.8%		
Mahler et al. Crit Pathw Cardiol. 2011	1070	58.3%		Ultrasensitive TnI

The HEART Pathway Randomized Trial:
Identifying Emergency Department Patients With Acute Chest Pain for Early Discharge

Simon A. Mahler, MD, MS, Robert F. Riley, MD, Brian C. Hiestand, MD, MPH, Gregory B.

- **Patient**: Patients whom obtained EKG and Tn because the physician suspected the patient to have ACS.

- **Intervention**: HEART score of 0-3 & Baseline and 3 hr Tn levels are within normal limits; discharge the patient.

- **Comparison**: Usual care

- **Outcome**: Thirty day mortality, MI and revascularisation

The HEART Pathway Randomized Trial:
Identifying Emergency Department Patients With Acute Chest Pain for Early Discharge

Simon A. Mahler, MD, MS, Robert F. Riley, MD, Brian C. Hiestand, MD, MPH, Gregory B.

- **141 vs 141 patients**

- **No difference for MACE**

- **Early discharge: %39.7 vs %18.4**

- **Median length of ED stay 9.9 vs 21.9 hours**

HEART score and clinical gestalt have similar diagnostic accuracy for diagnosing ACS in an unselected population of patients with chest pain presenting in the ED

- Chest pain at least five minutes in duration

- HEART score vs clinical gestalt

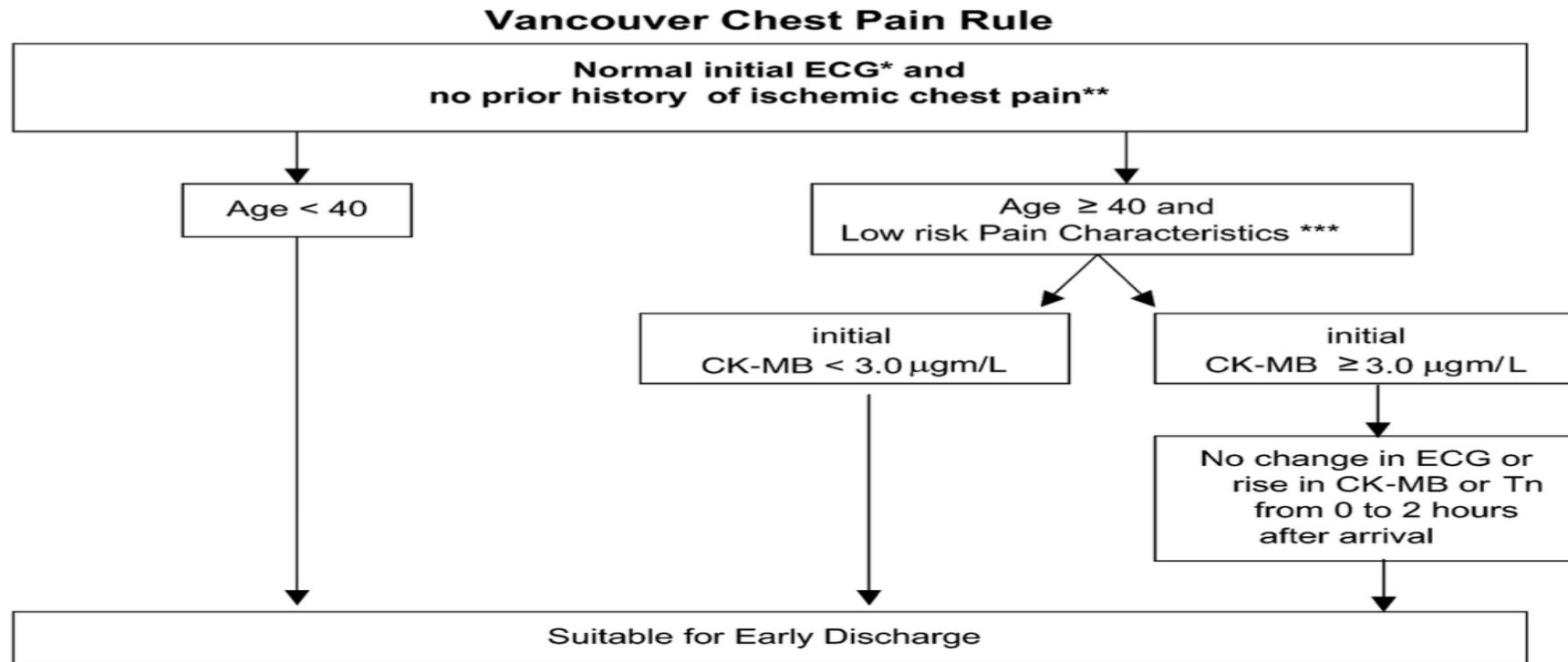- Outcome: MI or adverse cardiac event

- 255 patients

- Outcome: %93 vs %87

Conclusion

- HEART score should not be used as a single tool for early discharge of patients.

- However, combining HEART score with 0-3 hr normal cTn levels may shorten the length of ED stay.

Vancouver Chest Pain Rules

Christenson J, et al. A clinical prediction rule painfor early discharge of patients with chest pain. Ann Emerg Med. 2006;47:1-10.

Vancouver Chest Pain Rule

Normal initial ECG* and
no prior history of ischemic chest pain**

Age < 40

Age ≥ 40 and
Low risk Pain Characteristics ***

initial
CK-MB < 3.0 µgm/L

initial
CK-MB ≥ 3.0 µgm/L

No change in ECG or
rise in CK-MB or Tn
from 0 to 2 hours
after arrival

Suitable for Early Discharge

- T-wave flattening is the only acceptable ST-T abnormality
- ** Prior ischemic chest pain is defined as a past known diagnosis of MI or angina, previously prescribed nitroglycerine or a clear history of effort-related angina
- ***Low risk Pain Characteristics is defined as pain not radiating (arm/neck/jaw) OR increasing with a deep breath OR increasing with palpation
- Note: patients with suspicion of other causes for chest pain (eg pulmonary embolus, aortic dissection) should be investigated independent of this clinical prediction rule
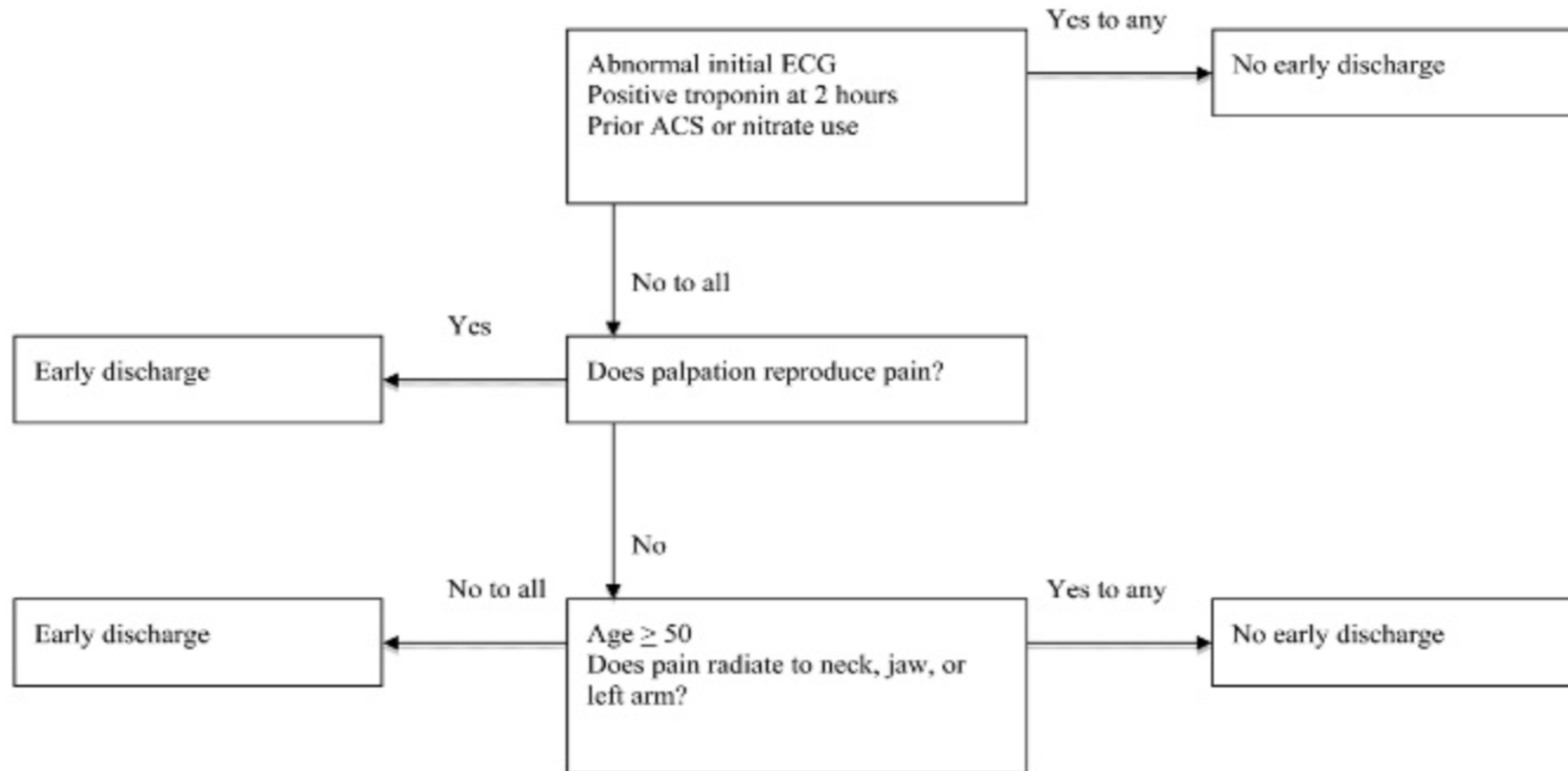
Vancouver Chest Pain Rules

Figure 2. Vancouver Chest Pain Rule. ACS = acute coronary syndrome; ECG = electrocardiogram.

Studies	Sample Size	Sensitivity	Algorithm	Outcome
Christenson J et al. Ann Emerg Med. 2006.	769	98.8%	Previous Algorithm (Main Article)	MI and USAP
Jalili M, et al. Acad Emerg Med. 2012	593	95.1%	Previous Algorithm	MI and USAP
Cullen et al. Am J Emerg Med. 2013.	1635	93.4%	Previous Algorithm	MI
Scheuermeyer FX et al. CJEM 2014	763	100%	New Algorithm Main Article Derivation Set	MI and USAP
Scheuermeyer FX et al. CJEM 2014	906	99.2%	New Algorithm Main Article Validation Set	MI and USAP
Cullen et al. Am J Emerg Med. 2014.	1635	99.1 hsTnI% 98.8 cnTnI%	New Algorithm	MI and USAP
Carlton EW, et al. Ann Emerg Med. 2015	963	100%	New Algorithm hsTnI	AMI

Conclusion

- The previous algorithm does not have a sufficient sensitivity.

- The current one

  - Sensitivity is between 98.8% and 100% with cTn.

  - Sensitivity is 100% with hsTnI (only one study)

EDACS

RESEARCH

EMA

Development and validation of the Emergency Department Assessment of Chest pain Score and 2 h accelerated diagnostic protocol

Box 3. *EDACS and EDACS-ADP*

EMERGENCY DEPARTMENT ASSESSMENT OF CHEST PAIN SCORE (EDACS)

Clinical Characteristics	Score
a) Age (Please Circle SINGLE Best Answer)	
18–45	+2
46–50	+4
51–55	+6
56–60	+8
61–65	+10
66–70	+12
71–75	+14
76–80	+16
81–85	+18
86 +	+20
b) Male sex (Please circle if true)	+6
c) Aged 18–50 years and either:	
(i) known coronary artery disease or	+4
(ii) ≥3 risk factors	
d) Symptoms and signs (Circle each if present)	
Diaphoresis	+3
Radiates to arm or shoulder	+5
Pain† occurred or worsened with inspiration	−4
Pain† is reproduced by palpation	−6
EDACS Total (Please Add all circled figures and enter to right)	_____

EDACS-ACCELERATED DIAGNOSTIC PROTOCOL (EDACS-ADP)

Low risk*	(i) EDACS <16
	(ii) No new ischaemia on ECG
	(iii) 0 and 2 h troponin both negative
Recommendation	Patient safe for discharge to early outpatient follow-up investigation (or proceed to earlier inpatient testing)
Not low risk	(i) EDACS ≥16
	(ii) New ischaemia on ECG
	Either 0 or 2 h‡ troponin positive (see footnote)
Recommendation	Proceed with usual care with further observation and delayed troponin

RESEARCH

EMA

Development and validation of the Emergency Department Assessment of Chest pain Score and 2 h accelerated diagnostic protocol

- Data from the ADAPT trial was used.

- **Patient**: Chest pain at least five minutes in duration and planned to have further analysis for a possible ACS

- **Outcome**: 30 days adverse cardiac events.

RESEARCH

EMA

Development and validation of the Emergency Department Assessment of Chest pain Score and 2 h accelerated diagnostic protocol

Table 3. Accuracy of the preliminary clinical prediction rule and EDACS-ADP

	Preliminary ADP		EDACS-ADP	
	Derivation	Validation	Derivation	Validation
Participants (n)	1974	608	1974	608
MACE				
Not low risk	302	78	302	79
Low risk	3	1	3	0
Sensitivity	99.0 (96.9–99.7)	98.7 (97.9–99.6)	99.0 (96.9–99.7)	100.0 (94.2–100.0)
No MACE				
Not low risk	788	198	836	217
Low risk	881	331	833	312
Specificity	52.8 (50.6–55.0)	62.6 (58.7–66.4)	49.9 (47.4–52.3)	59.0 (54.6–63.2)
Per cent low risk†	44.6 (42.4–46.8)	54.4 (50.5–58.4)	42.2 (40.1–44.5)	51.3 (47.7–55.4)

†Low risk of MACE within 30 days. ADP, accelerated diagnostic protocol; EDACS, Emergency Department Assessment of Chest pain Score; MACE, major adverse cardiac events.

Effectiveness of EDACS Versus ADAPT Accelerated Diagnostic Pathways for Chest Pain: A Pragmatic Randomized Controlled Trial Embedded Within Practice

Martin P. Than, MBBS*; John W. Pickering, PhD; Sally J. Aldous, MBChB, PhD; Louise Cullen, MBBS, PhD;
Christopher M. A. Frampton, PhD; W. Frank Peacock, MD; Allan S. Jaffe, MD; Steve W. Goodacre, PhD; A. Mark Richards, MD, PhD;
Michael W. Ardagh, PhD; Joanne M. Deely, PhD; Chris M. Florkowski, MBBS, MD; Peter George, MBBS; Gregory J. Hamilton, PhD;
David L. Jardine, MBChB, DCH; Richard W. Troughton, MBChB, PhD; Pieter van Wyk, MBChB; Joanna M. Young, PhD;
Laura Bannister, MBBS; Sally J. Lord, MBBS

Annals of Emergency Medicine 2016

Patient: Eligible patients were aged 18 years or older and presenting acutely from the community to the ED with possible cardiac symptoms suggestive of acute myocardial infarction for which the attending clinician(s) intended to perform serial troponin analysis to investigate for possible acute myocardial infarction.

Intervention: ADAPT = TIMI-0 and 0-2 hr normal cardiac enzymes and normal EKG.

Comparison: EDACS-ADP: EDACS < 16, 0-2 hr normal cardiac enzymes and normal EKG.

Outcome: The primary outcome was successful discharge, defined as discharge from the hospital within 6 hours of ED arrival and without major adverse cardiac event within 30 days.

Table 3. Outcomes.

Outcome	Total Cohort (n=558) (%)	Control ADP (ADAPT) (n=279) (%)	Experimental ADP (EDACS) (n=279) (%)	Difference, % (95% CI)
Negative ECG and troponin results, and either TIMI score 0 or EDACS <16	223 (38.6)	90 (32.3)	133 (47.7)	15.4 (7.0 to 23.8)
Negative ECG and troponin results, and TIMI score 0 or EDACS <16 and no red flag (low risk)	201 (34.8)	85 (30.5)	116 (41.6)	11.1 (2.8 to 19.4)
Low-risk patients successfully discharged within 6 h*	137 (24.6)	64 (22.9)	73 (26.2)	3.2 (−4.3 to 10.7)
Primary outcome: patients successfully discharged within 6 h[†]	186 (33.3)	96 (34.4)	90 (32.3)	−2.1 (−10.3 to 6.0) P=.65

Performance of the EDACS-accelerated Diagnostic Pathway in a Cohort of US Patients with Acute Chest Pain

Jason P. Stopyra, MD,* Chadwick D. Miller, MD, MS,* Brian C. Hiestand, MD,* Cedric W. Lefebvre, MD,* Bret A. Nicks, MD,* David M. Cline, MD,* Kim L. Askew, MD,* Robert F. Riley, MD,† Gregory B. Russell, MS,‡ James W. Hoekstra, MD,* and Simon A. Mahler, MD, MS*

A secondary analysis of HEART Pathway study outlined before.

- The EDACS-ADP identified 188/282 patients (66.7%, 95% CI: 60.8%–72.1%) as low risk.

- EDACS-ADP was 88.2% (95% CI: 63.6%–98.5%) sensitive for MACE, identifying 15/17 patients with MACE

Conclusion

- EDACS-ADP is a promising scoring system due to the findings of

  the main study.

  - However, further prospective data is still needed to validate

    the EDACS-ADP.

North American Chest Pain Rule

Development of a Clinical Prediction Rule for 30-Day Cardiac Events in Emergency Department Patients With Chest Pain and Possible Acute Coronary Syndrome

Erik P. Hess, MD, MSc, Robert J. Brison, MD, Jeffrey J. Perry, MD, MSc, Lisa A. Calder, MD, MSc,
Venkatesh Thiruganasambandamoorthy, MD, MSc, Dipti Agarwal, MBBS, Annie T. Sadosty, MD,
Marco L. A. Silvilotti, MD, MSc, Allan S. Jaffe, MD, Victor M. Montori, MD, MSc,
George A. Wells, PhD, Ian G. Stiell, MD, MSc

North American Chest Pain Rule*

A patient with chest pain and possible acute coronary syndrome can be safely discharged from the ED without additional diagnostic testing if NONE of the following four criteria are met:

(1) New ischemia on initial ECG†

(2) History of coronary artery disease

(3) Pain is typical for acute coronary syndrome‡

(4) Initial cardiac troponin is positive

AND

(5) Age ≤ 40 years

OR

Age 41–50 years and repeat troponin at least 6 hours from symptom onset is negative.§

Figure 3. North American Chest Pain Rule.*

North American Chest Pain Rule

- **Patient**: Anterior chest pain patients whom obtained cTn by the physician. STEMI patients excluded.

- Standard cTn levels were measured.

- **Outcome**: 30 days adverse cardiac event.

Table 3. Prognostic accuracy of clinical decision rule for 30-day cardiac events in 2,718 patients with chest pain and possible acute coronary syndrome.

A, Age cutoff 50 years or younger

Decision Rule	Cardiac Event Within 30 Days	No Cardiac Event Within 30 Days
Yes	336	1,885
No	0	497

Sensitivity 100.0% (95% CI 97.2% to 100.0%); specificity 20.9% (95% CI 16.9% to 24.9%); positive predictive value 15.1% (95% CI 13.7% to 16.7%); negative predictive value 100.0% (95% CI 99.0% to 100.0%); stress testing proportion 81.7% (95% CI 80.2% to 83.1%).

B, Age cutoff 60 years or younger

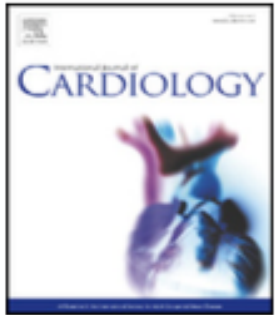| Decision Rule	Cardiac Event Within 30 Days	No Cardiac Event Within 30 Days
Yes	332	1,581
No	4	801

Sensitivity 98.8% (95% CI 95.4% to 100.0%); specificity 33.6% (95% CI 28.9% to 38.1%); positive predictive value 17.4% (95% CI 15.7% to 19.1%); negative predictive value 99.5% (95% CI 98.6% to 99.8%); stress testing proportion 70.4% (95% CI 68.6% to 72.1%).
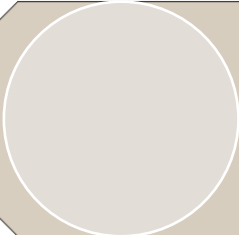
Identifying patients for early discharge: Performance of decision rules among patients with acute chest pain☆

Simon A. Mahler [a,*,1], Chadwick D. Miller [a,1], Judd E. Hollander [b,1], John T. Nagurney [c,1], Robert Birkhahn [d,1], Adam J. Singer [e,1], Nathan I. Shapiro [f,1], Ted Glynn [g,1], Richard Nowak [h,1], Basmah Safdar [i,1], Mary Peberdy [j,1], Francis L. Counselman [k,1], Abhinav Chandra [l,1], Joshua Kosowsky [m,1], James Neuenschwander [n,1], Jon W. Schrock [o,1], Stephen Plantholt [p,1], Deborah B. Diercks [q,1], W. Frank Peacock [r,1]
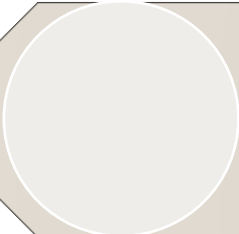
A secondary analysis of prospectively collected data (MIDAS study)
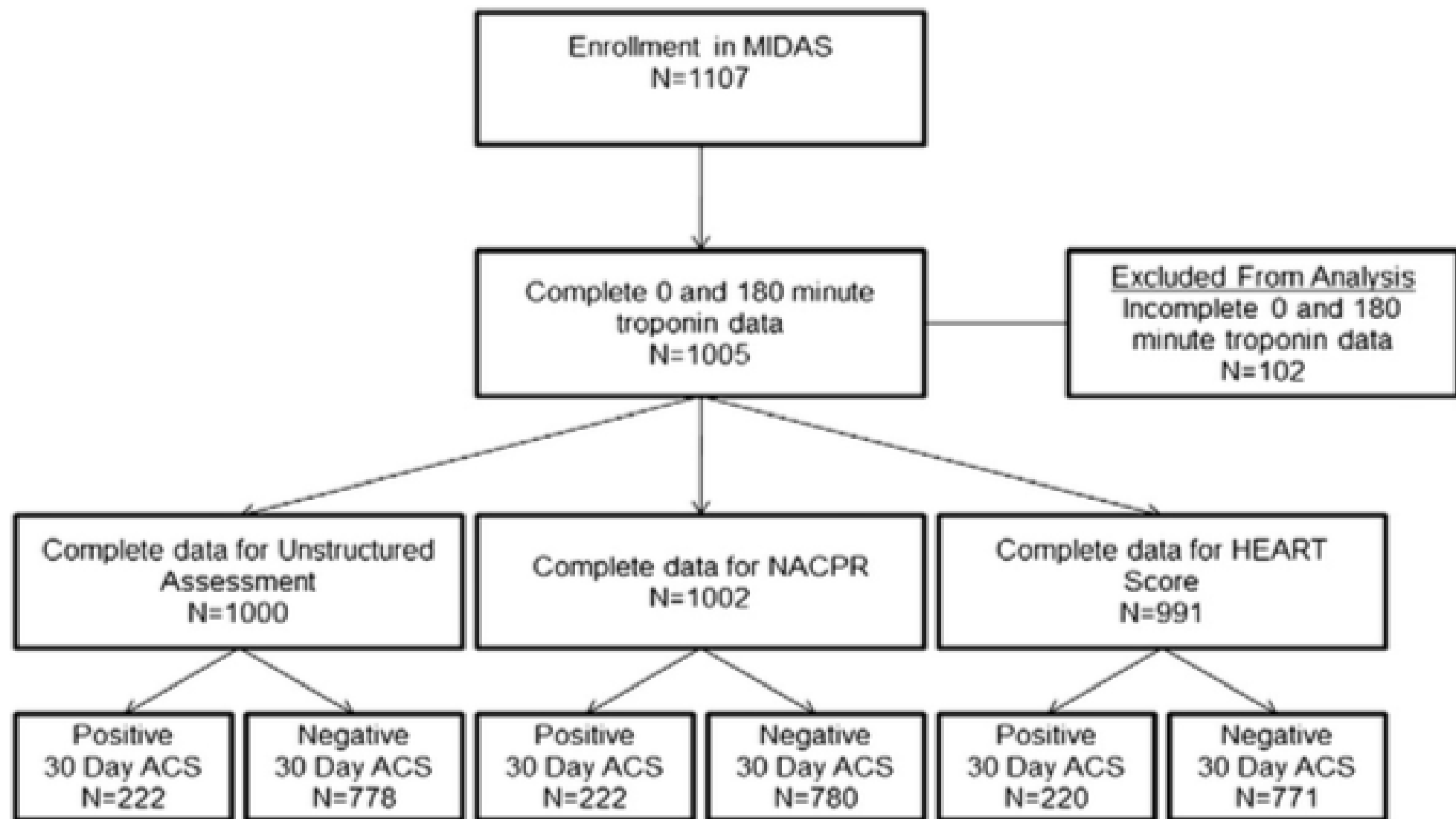
Clinical Gestalt (Likert Scale ≤ 1, 0-3 hr Tn

North American Chest Pain Rule (0-3 hr Tn)

HEART Score (score of 0-3 and 0-3 hr Tn)

Risk stratification strategy	Early discharge (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)	− LR (95% CI)	AUC (95% CI)
Unstructured	13.5% (11.5–15.8%)	97.7% (94.7–99.2%)	16.7% (14.3–19.5%)	0.14 (0.06–0.33)	0.57 (0.56–0.59)
NACPR	4.4% (3.3–5.7%)	100% (98.0–100%)	5.6% (4.2–7.5%)	0 (0–0.55)	0.53 (0.52–0.54)
HEART	20.2% (17.8–22.8%)	99.1% (96.5–100%)	25.7% (22.7–28.9%)	0.04 (0.01–0.14)	0.62 (0.61–0.64)

Conclusion

- North American Chest Pain Rule is a sensitive tool for ruling out adverse cardiac events in patient presenting with symptoms associated with an acute coronary syndrome.

Pitfalls in Studies Trialing the Risk Scores

- Differences among the outcomes (diversies in adverse cardiac events)

- Variations in Troponin measurements (cTn vs hsTn, TnI vs TnT)

- Variations in selection of study samples

- Patients included to the studies ignoring the onset of sypmtoms. At this case, chest pain with a so early onset (within one hour) should be observed more.

Any Questions or Comments?