

Δ.Δ Θωρακικού άλγους στα εξωτερικά ιατρεία

Ε.Γ.ΔΑΛΑΜΑΓΚΑ
ΚΑΡΔΙΟΛΟΓΟΣ

Διδάκτωρ Ιατρικής Σχολής ΑΠΘ
ΓΕΝΙΚΗ ΚΛΙΝΙΚΗ ΘΕΣΣΑΛΟΝΙΚΗΣ

ΕΠΙΣΤΗΜΟΝΙΚΟΣ ΣΥΝΕΡΓΑΤΗΣ Α'ΚΑΡΔΙΟΛΟΓΙΚΗΣ ΚΛΙΝΙΚΗΣ
ΝΟΣΟΚΟΜΕΙΟ ΑΧΕΠΑ

National Hospital Ambulatory Medical Care Survey: 2005 Emergency Department Summary

by Eric W. Nawar, M.H.S.; Richard W. Niska, M.D., F.A.C.E.P.;
and Jianmin Xu, M.S., Division of Health Care Statistics

Table 9. Number and percent distribution of emergency department visits with corresponding standard errors, by the 20 leading principal reasons for visit: United States, 2005

Principal reason for visit and RVC code ¹	Number of visits in thousands	Standard error in thousands	Percent distribution	Standard error of percent
All visits	115,323	5,296	100.0	...
Stomach and abdominal pain, cramps, and spasms S545	7,833	444	6.8	0.2
Chest pain and related symptoms S050	5,812	337	5.0	0.2
Fever S010	5,042	449	4.4	0.3
Cough S440	3,359	239	2.9	0.2
Headache, pain in head S210	3,104	199	2.7	0.1
Back symptoms S905	2,918	187	2.5	0.1
Shortness of breath S415	2,802	200	2.4	0.1
Pain, site not referable to a specific body system S055	2,554	158	2.2	0.1
Vomiting S530	2,535	217	2.2	0.1
Symptoms referable to throat S455	2,178	162	1.9	0.1
Lacerations and cuts - upper extremity J225	1,843	129	1.6	0.1
Accident, not otherwise specified J810	1,808	162	1.6	0.1
Earache or ear infection S355	1,707	176	1.5	0.1
Leg symptoms S920	1,568	114	1.4	0.1
Skin rash S860	1,548	135	1.3	0.1
Injury, other and unspecified type—head, neck, and face J505	1,538	127	1.3	0.1
Labored or difficult breathing (dyspnea) S420	1,530	139	1.3	0.1
Nausea S525	1,525	118	1.3	0.1
Vertigo-dizziness S225	1,524	115	1.3	0.1
Motor vehicle accident, type of injury unspecified J805	1,494	149	1.3	0.1
All other reasons	61,101	2,751	53.0	0.4

Panic attack

Thoracic spine disease

Aortic dissection

Tietze's disease

Myocardial pain

Musculoskeletal pain

Herpes zoster

Breast abscess

Subdiaphragmatic abscess

pneumothorax

Breast cancer

Blunt chest trauma

Lung cancer

empyema

Amniotic fluid embolus

Pulmonary embolus

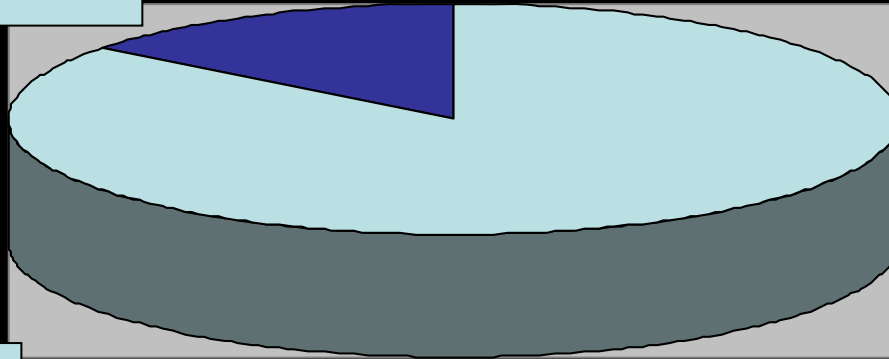
Sickle cell anemia

asthma

pneumonia

Breast implant

Mallory-Weiss



ER visits United States

100.000.000 annually

8.000.000 with chest pain (8%)

3.000.000
Non cardiac

40.000
AMIs

5.000.000
Suspected or
Actually cardiac

2.500.000
Non- cardiac
(50%)

1.000.000
AMI
(20%)

1.200.000
UA
(24%)

300.000
Sudden death
(6%)

What about *chest pain in AMI*?

- In a study of 434,877 patients with confirmed MI from 1674 US hospitals
 - *More than one third* of all patients present without chest pain
 - *Of these 63,7% were UA/NSTEMI patients*
 - Certain MI patients such as *women, elderly* and patients with *prior heart failure* are more likely to present without chest pain.

Canto GJ et al. JAMA 2000;283:3223-3229

Prevalence, Clinical Characteristics, and Mortality Among Patients With Myocardial Infarction Presenting Without Chest Pain

Table 4. Process of Care for Myocardial Infarction Patients Without and With Chest Pain*

Variable	Without Chest Pain	With Chest Pain
Initial reperfusion therapy among ideal candidates†		
Thrombolysis	18.7	56.4
Primary percutaneous coronary angioplasty	6.2	16.6
Immediate coronary artery bypass graft	0.4	1.2
Any reperfusion	25.3	74.0
Time interval (mean [median], min) from hospital arrival to		
First electrocardiogram	31.8 (19.8)	15.6 (10.2)
Thrombolysis	139.8 (73.2)	65.4 (42.0)
Primary percutaneous coronary angioplasty	282.0 (169.9)	171.6 (120.0)
Medication within 24 h		
Aspirin or other antiplatelet agent	60.4	84.5
Heparin	53.4	83.2
β-Blocker	28.0	48.0
Nitrates	31.4	68.8
Calcium channel blocker	19.1	17.1
Invasive cardiac procedures		
Coronary angiography	26.9	59.0
Any catheter-based revascularization	9.4	28.8
Coronary artery bypass graft surgery	6.2	10.9

If symptoms don't work, how about the ECG?

- The ECG isn't that sensitive
- The standard 12-lead ECG has **only 50-60% sensitivity** at diagnosing AMI as
 - the commonest mode of presentation of AMI is NSTEMI i.e. ST-depression, T-inversion, LBBB, LVH or normal ECG
 - absence of leads facing the posterior, high right anterior, lateral wall of the left ventricle and the anterior portion of the right ventricle.

Is the ECG it specific?

- 1335 suspected STEMI

Receiving emergency coronary angiography

- 187 (14%) no culprit coronary artery
- 127 (9,5%) no significant CAD
- 150 (11,2%) negative cardiac biomarkers
- 123 (9,2%) no culprit artery and negative markers

Larson DM, JAMA 2007;(23):2754-2760

MISSED DIAGNOSES OF ACUTE CARDIAC ISCHEMIA
IN THE EMERGENCY DEPARTMENT

J. HECTOR POPE, M.D., TOM P. AUFDERHEIDE, M.D., ROBIN RUTHAZER, M.P.H., ROBERT H. WOOLARD, M.D.,
JAMES A. FELDMAN, M.D., JONI R. BESHANSKY, R.N., M.P.H., JOHN L. GRIFFITH, PH.D.,
AND HARRY P. SELKER, M.D., M.S.P.H.

N Engl J Med 2000;342:1163-70.

• *Acute cardiac ischemia in the ED*

10.869 patients

17% total ACS

2,8% *mistakenly discharged*

83% some other diagnosis

(55% non cardiac)

TABLE 2. FACTORS ASSOCIATED WITH FAILURE TO HOSPITALIZE PATIENTS WITH ACUTE CARDIAC ISCHEMIA WHO PRESENTED TO THE EMERGENCY DEPARTMENT, ACCORDING TO MULTIVARIABLE MODELS.*

FACTOR	ODDS RATIO FOR DISCHARGE (95% CI)	P VALUE
All patients (n=1855)†		
Chief symptom of shortness of breath	2.7 (1.1–6.5)	0.02
Male sex ≥55 yr	3.7 (0.8–16.2)‡	0.08
Female sex <55 yr	6.7 (1.4–32.5)‡	0.02
Female sex ≥55 yr	1.9 (0.4–9.1)‡	0.40
Nonwhite race	2.2 (1.1–4.3)	0.03
Normal ECG	3.3 (1.7–6.3)	<0.001
Patients with acute myocardial infarction (n=889)§		
Nonwhite race	4.5 (1.8–11.8)	0.002
Normal ECG	7.7 (2.9–20.2)	<0.001

Cardiac biomarkers

Table 2. Elevations of Troponin in the Absence of Overt Ischemic Heart Disease

Trauma (including contusion, ablation, pacing, implantable cardioverter-defibrillator firings including atrial defibrillators, cardioversion, endomyocardial biopsy, cardiac surgery, after interventional closure of atrial septal defects)
Congestive heart failure—acute and chronic
Aortic valve disease and hypertrophic obstructive cardiomyopathy with significant left ventricular hypertrophy
Hypertension
Hypotension, often with arrhythmias
Postoperative noncardiac surgery patients who seem to do well
Renal failure
Critically ill patients, especially with diabetes, respiratory failure
Drug toxicity, e.g., adriamycin, 5-fluorouracil, herceptin, snake venoms
Hypothyroidism
Apical ballooning syndrome
Coronary vasospasm
Inflammatory diseases, e.g., myocarditis, e.g., Parvovirus B19, Kawasaki disease, sarcoid, smallpox vaccination, or myocardial extension of bacterial endocarditis
Post-percutaneous coronary intervention patients who seem to have no complications
Pulmonary embolism, severe pulmonary hypertension
Sepsis
Burns, especially if total body surface area is >30%
Infiltrative diseases including amyloidosis, hemochromatosis, sarcoidosis, and scleroderma
Acute neurological disease, including cerebrovascular accident, subarachnoid bleeds
Rhabdomyolysis with cardiac injury
Transplant vasculopathy
Vital exhaustion

Table 3. Correct Diagnosis of Acute Myocardial Infarction, According to the Time of a Single Sensitive Troponin I Assay.*

Time of Testing	Detection of Myocardial Infarction
	% of patients
On admission	
0 to <6 hr after chest-pain onset	87.7
6 to 12 hr after chest-pain onset	94.5
>12 hr after chest-pain onset	100
After admission	
At 3 hr	100
At 6 hr	100

N Engl J Med 2009;361:868-77.

- *Accurate Risk stratification*
- *Identification by exclusion of ACS and other serious conditions*

...Risk stratification

Table 1. Likelihood That Signs and Symptoms Represent an ACS Secondary to CAD

Feature	High Likelihood	Intermediate Likelihood	Low Likelihood
	Any of the following:	Absence of high-likelihood features and presence of any of the following:	Absence of high- or intermediate-likelihood features but may have:
History	Chest or left arm pain or discomfort as chief symptom reproducing prior documented angina Known history of CAD, including MI	Chest or left arm pain or discomfort as chief symptom Age >70 years Male sex Diabetes mellitus	Probable ischemic symptoms in absence of any of the intermediate likelihood characteristics Recent cocaine use
Examination	Transient MR murmur, hypotension, diaphoresis, pulmonary edema, or rales	Extracardiac vascular disease	Chest discomfort reproduced by palpation
ECG	New, or presumably new, transient ST-segment deviation (≥ 0.1 mV) or T-wave inversion in multiple precordial leads	Fixed Q waves ST depression 0.05 to 0.1 mV or T-wave inversion > 0.1 mV	T-wave flattening or inversion < 0.1 mV in leads with dominant R waves or normal ECG
Cardiac markers	Elevated cardiac Tnl, TnT, or CK-MB	Normal	Normal

Identification of **Low Clinical Risk**

- No history of CAD
- Normal or near normal ECG
- Negative initial cardiac injury markers

probability of MI < 6%

- ...*Identification by exclusion of ACS*

Low risk is not no risk!

Chest Pain Units

Accelerated Diagnostic Protocols

- **TIMI risk score**

Prospective Validation of the Thrombolysis in Myocardial Infarction Risk Score in the Emergency Department Chest Pain Population

- patients with the **lowest risk as defined by a TIMI** score of zero had a **1.7% incidence of adverse events**. Therefore, the TIMI risk score should **not** be used in isolation to determine disposition of ED chest pain patients.

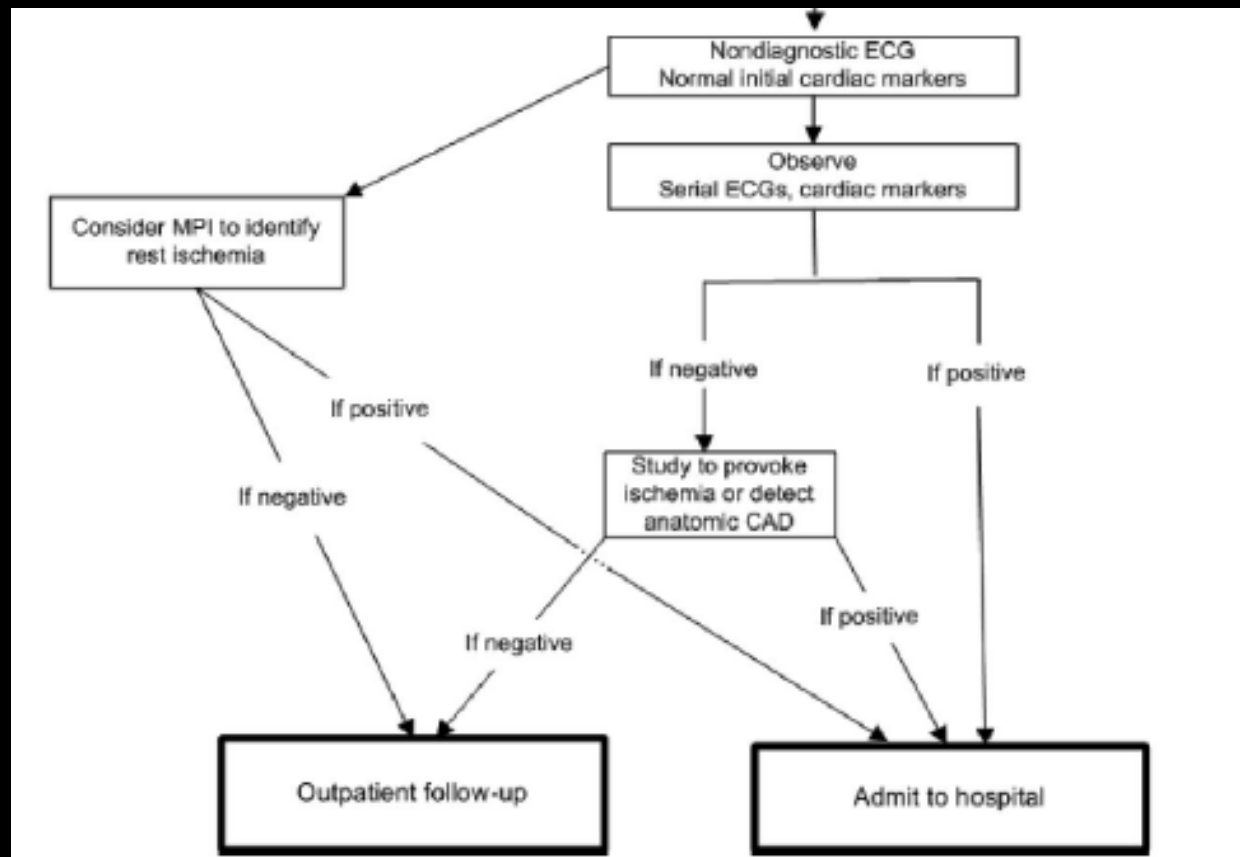
[Ann Emerg Med. 2006;48:252-259.]

- **GRACE risk score**

.....reported to accurately predict risk in an undifferentiated chest pain population.

Testing of Low-Risk Patients Presenting to the Emergency Department With Chest Pain: A Scientific Statement From the American Heart Association

Possible ACS



- Tc - 99m - labeled agents: trapped in the myocardium and do not redistribute.

- Tracer injection at rest in the ED

Patients may be transferred to the nuclear cardiology laboratory later (late images reflect MBF at the time of injection)

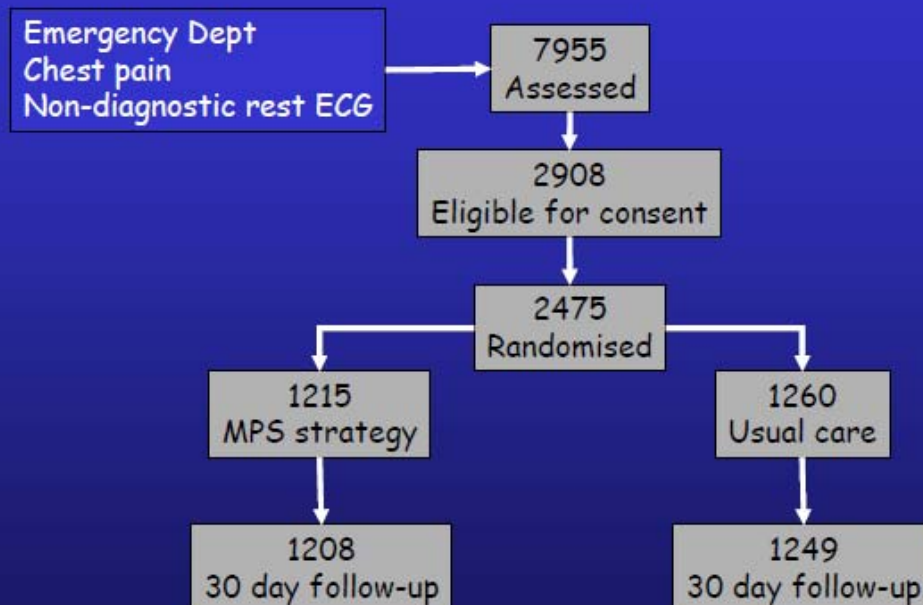
Diagnostic accuracy of sestamibi SPECT vs cardiac troponin I (cTnI)

- Among 620 pts studied 9% had AMI and 13% had a final diagnosis of significant coronary disease.
- **Sensitivity** for detecting MI was **similar** between SPECT imaging (92%) and cTnI (90%).
- **The initial cTnI value**, however, had only a **sensitivity of 39%** and serial determinations were necessary to achieve a high sensitivity.

Myocardial Perfusion Imaging for Evaluation and Triage of Patients With Suspected Acute Cardiac Ischemia

A Randomized Controlled Trial

ERASE Trial



Udelson JE, et al. JAMA 2002; 288: 2693-700

ERASE a randomized control study

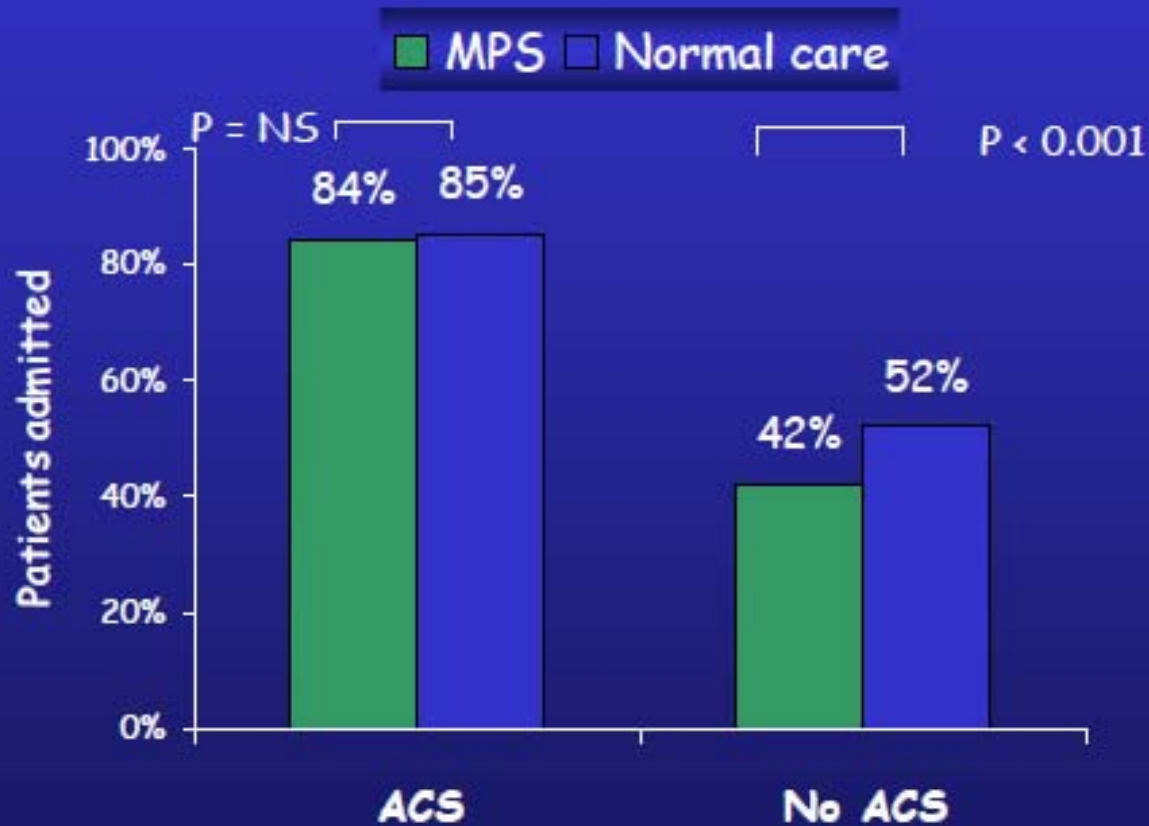
Table 1. Baseline Characteristics*

Characteristic	No. (%)		P Value
	Scan Strategy (n = 1215)	Usual Care (n = 1260)	
Age, mean (SD), y	53 (13)	53 (14)	.68
Women	566 (47)	642 (51)	.03
Race			
White	753 (62)	810 (64)	.26
Black	309 (25)	277 (22)	
Hispanic	129 (11)	150 (12)	
Asian	21 (2)	18 (1)	
Other	3 (0.3)	5 (0.4)	
Chief complaint of chest pain	1043 (86)	1081 (86)	.98
Symptoms on ED arrival	1048 (86)	1102 (87)	.41
History of coronary artery disease	162 (13)	149 (12)	.26
History of hypertension	526 (43)	538 (43)	.76
History of hypercholesterolemia	421 (35)	460 (37)	.35
History of diabetes	153 (13)	188 (15)	.10
Current smoker	345 (28)	334 (26)	.30
Final diagnosis			
Acute cardiac ischemia	165 (14)	164 (13)	.68
Acute myocardial infarction	26 (2)	30 (2)	.69
Unstable angina	139 (11)	134 (11)	.53
Not acute cardiac ischemia	1050 (86)	1096 (87)	.68

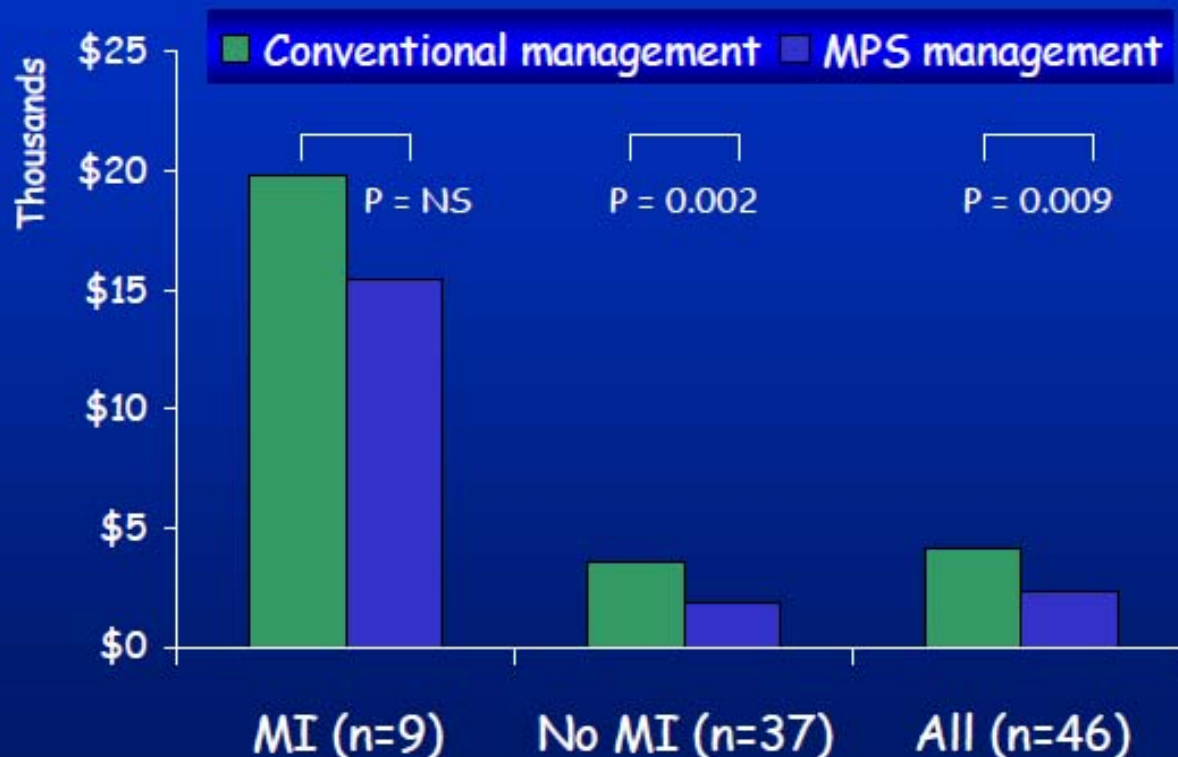
*Percentages have been rounded. ED indicates emergency department.

ERASE Trial

30 day outcome unchanged



Cost of MPS in the Emergency Dept



Stowers SA, et al. Ann Emerg Med 2000; 35:17-25
Acute CP, non diagnostic ECG, randomised management

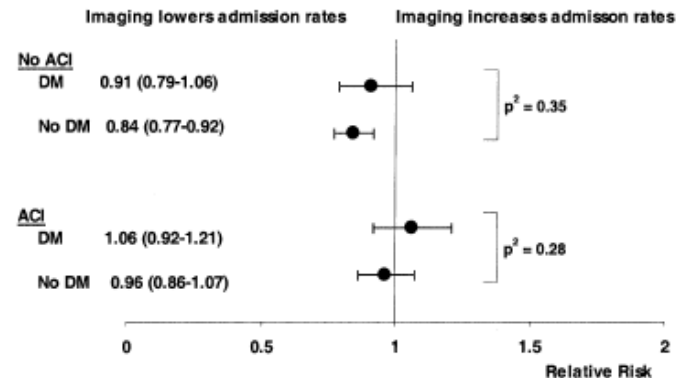
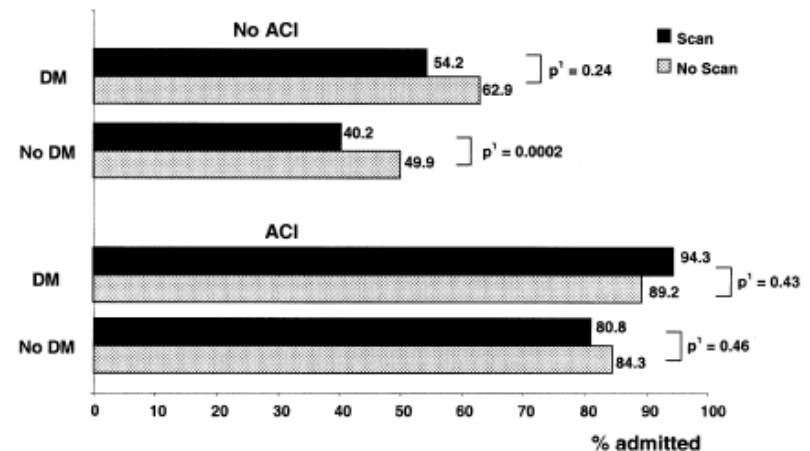
• Diabetic patients (high risk group for CAD)

Acute resting myocardial perfusion imaging in patients with diabetes mellitus: Results from the Emergency Room Assessment of Sestamibi for Evaluation of Chest Pain (ERASE Chest Pain) trial

Athanasios Kapetanopoulos, MD,^a Gary V. Heller, MD, PhD,^a
 Harry P. Selker, MD, MSPH,^b Robin Ruthazer, MPH,^b Joni R. Beshansky, RN
 James A. Feldman, MD,^d John L. Griffith, PhD,^b Robert C. Hendel, MD,^e J. I
 Pope, MD,^f Ethan J. Spiegler, MD,^g and James E. Udelson, MD^{b,c}

J Nucl Cardiol 2004;11:570-7

341 diabetic pts
 Improved triage in
 symptomatic ED pts with diabetes



Diagnostic accuracy of Rest MPI in pts with acute chest pain and nonischemic ECG

Table 5. Diagnostic Accuracy of Rest MPI in Patients With Acute Chest Pain and a Nonischemic ECG

Reference	n	Radiopharmaceutical	Sensitivity, %	Specificity, %	NPV, %	Outcome
Varetto et al ¹¹¹	64	Tc-mibi	100	92	100	CAD
Hilton et al ¹¹²	102	Tc-mibi	94	83	99	CAD/AMI
Tatum et al ¹¹³	438	Tc-mibi	100	78	100	AMI
Kontos et al ¹¹⁶	532	Tc-mibi	93	71	99	AMI
Heller et al ¹¹⁵	357	Tc-tet	90	60	99	AMI
Kontos et al ¹¹⁴	620	Tc-mibi	92	67	99	AMI
Udelson et al ^{*71}	1215	Tc-mibi	96	NR	99	AMI
Schaeffer et al ¹¹⁷	479	Tc-mibi	77	92	99	ACS

NPV indicates negative predictive value; AMI, acute MI; Tc-mibi, ^{99m}Tc-sestamibi; Tc-tet, ^{99m}Tc-tetrofosmin; and NR, not reported.

Ischemic memory imaging

- Limitation of rest MPI: the ability to detect ischemia in the patient who is symptom free at, or shortly after, ED arrival.
- In the setting of acute ischemia, high energy adenosine triphosphate production shifts from fatty acid metabolism to glucose utilization. Thus suppression of fatty acid metabolism may persist long after the resolution of the perfusion abnormality and ischemia, a phenomenon that is has been referred to as ischemic memory.
- Clinical studies have demonstrated persistend reductions in BMIPP uptake long after resolution of ischemic symptoms.
- Fujibajashi Y et al, J Nucl Med 1990;31:1818-22
- Hosokawa R et al, J Nucl Med 1997;38:1857-63
- Dilsizian V, et al. Circulation 2005;112:2169-74

Highlights of the Year in *JACC* 2010

Iodofilic Acid I 123 (BMIPP) Fatty Acid Imaging Improves Initial Diagnosis in Emergency Department Patients With Suspected Acute Coronary Syndromes

A Multicenter Trial

Michael C. Kontos, MD,* Vasken Dilsizian, MD,† Fred Weiland, MD,‡ Gordon DePuey, MD,§
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Norman D. LaFrance, MD,‡‡ Ernest V. Garcia, PhD,|||| John W. Babich, PhD,‡‡
James E. Udelson, MD¶¶

*Richmond, Virginia; Baltimore, Maryland; Roseville, California; New York, New York; Houston, Texas;
Birmingham, Alabama; Kansas City, Missouri; Hartford, Connecticut; Detroit, Michigan;
Cambridge and Boston, Massachusetts; Warrington, Pennsylvania; and Atlanta, Georgia*

Iodoflitic Acid I 123 (BMIPP) Fatty Acid Imaging Improves Initial Diagnosis in Emergency Department Patients With Suspected Acute Coronary Syndromes

A Multicenter Trial

Michael C. Kontos, MD,* Vasken Dilsizian, MD,† Fred Weiland, MD,‡ Gordon DePuey, MD,§

50 centers, 448 pts

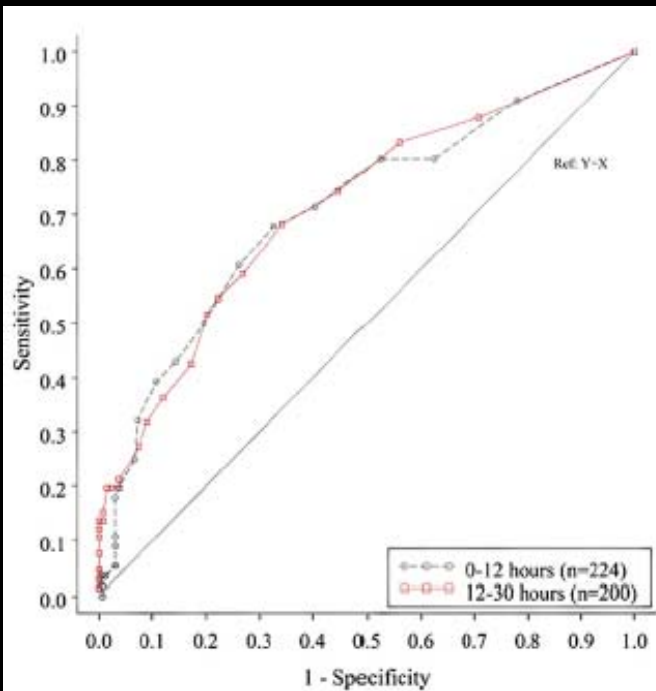


Figure 4 Receiver-Operator Characteristic Curves for Patients Imaged <12 h Versus 12 to 30 h After Symptom Resolution

Patients are divided by whether symptoms resolved 0 to 12 h before imaging (open circles) or 12 to 30 h before imaging (open squares). The area under the receiver-operator characteristic curve was similar for both groups (for <12 h, the area under the curve = 0.710; for ≥12 h, the area under the curve = 0.714).

Table 3

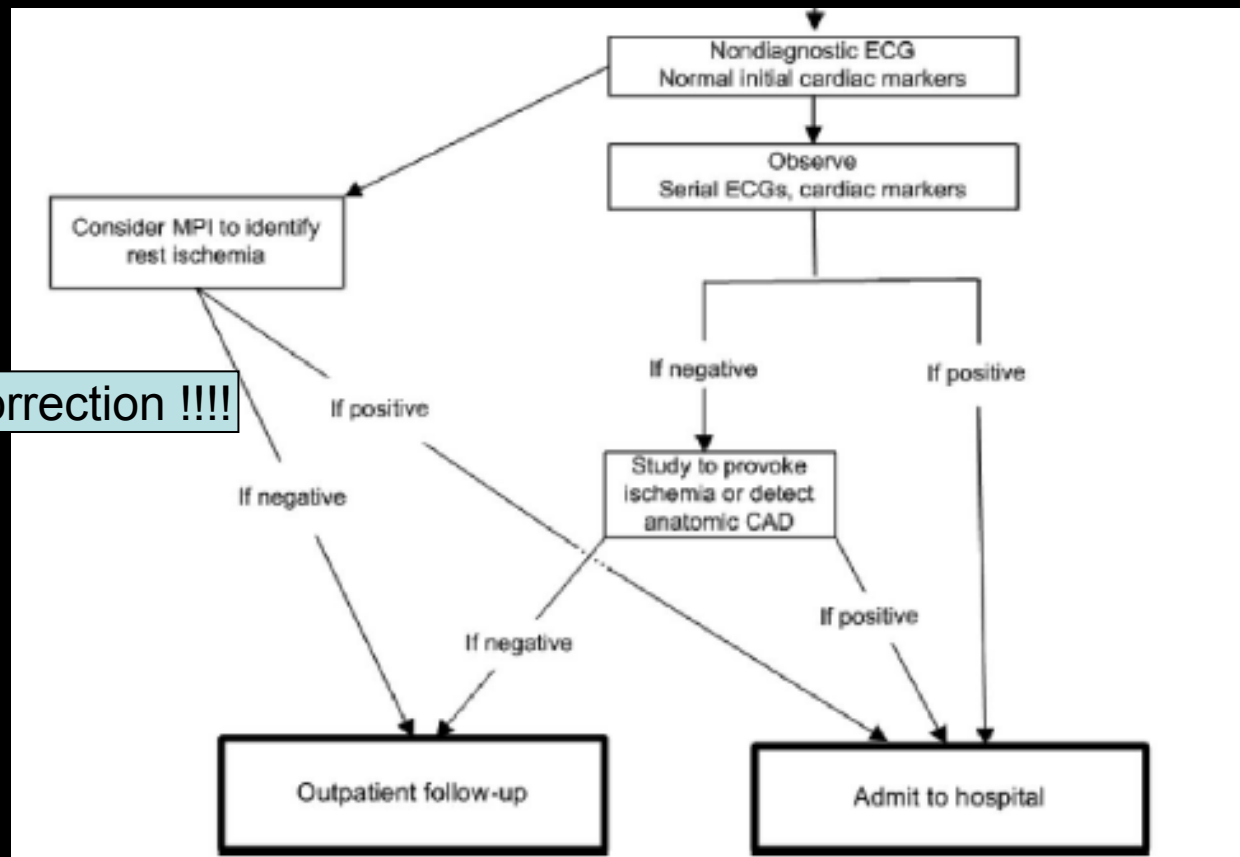
Performance Characteristics for the Initial Clinical Diagnosis Alone, Results With BMIPP Alone, and the Combination of the Initial Clinical Diagnosis and BMIPP SPECT Imaging (Patients With Majority Read for BMIPP SPECT) (n = 416)

Diagnostic Mode	ACS Positive (n = 188), Negative (n = 298) (Negative ACS and ACS Intermediate Likelihood)			
	Sensitivity	Specificity	NPV	PPV
InDx	42.9 (35.0–50.9)	60.9 (54.7–67.1)	62.3 (56.1–68.6)	41.4 (33.7–49.1)
BMIPP alone	73.0* (65.9–80.1)	63.2 (57.1–69.4)	78.4* (72.5–84.3)	56.1† (49.2–63.0)
InDx + BMIPP	81.0* (74.7–87.3)	61.7 (55.5–67.8)	83.4* (77.8–89.0)	57.6* (51.0–64.3)

J Am Coll Cardiol 2010;56:290–9

Testing of Low-Risk Patients Presenting to the Emergency Department With Chest Pain: A Scientific Statement From the American Heart Association

Possible ACS



Attenuation correction !!!!

Confirmatory Test Selection

- Exercise Treadmill Testing

- Myocardial Imaging

Myocardial perfusion imaging

Echocardiography

± stress (pharmacological or exercise)

- Coronary Artery Imaging

Computed Tomography Coronary Angiography

Exercise Treadmill Testing

2011 ACCF/AHA Focused Update Incorporated Into the ACC/AHA 2007 Guidelines for the Management of Patients With Unstable Angina/Non–ST-Elevation Myocardial Infarction

*A Report of the American College of Cardiology Foundation/
American Heart Association Task Force on Practice Guidelines*

Table 3. ETT: Patient Selection, Procedure, and End Points

Patient selection criteria

- Able to exercise
- ECG: Normal or minor ST-T changes
- Hemodynamically stable, no arrhythmia
- Negative cardiac injury markers

Procedure

- Bruce or modified Bruce protocol

End points

- Symptom-limited
- Ischemia (≥ 0.10 mV of horizontal ST depression or elevation)
- Decreased blood pressure (≥ 10 mm Hg systolic) during exercise test

Result

- Positive: ≥ 0.10 mV of horizontal ST-segment depression*
- Negative: No exercise-induced abnormalities at 85% MPHR
- Nondiagnostic: $< 85\%$ MPHR with no ECG evidence of ischemia

ETT without imaging should be performed as the initial test in low- to intermediate- risk patients who present with ischemic symptoms and can exercise, do not have significant baseline ECG changes and are not taking digoxin.

Exercise Treadmill Testing

Table 4. Studies of ETT in ADPs*

Reference	No. of Patients	Positive Tests, %†	Negative Predictive Value, %‡	Positive Predictive Value, %‡	Adverse Exercise Test Events
Tsakonis et al ⁷⁸	28	18	100		0
Kerns et al ⁷⁹	32	0	100		0
Gibler et al ⁸⁰	782	1	99	44	0
Gomez et al ⁶⁹	100	7	100	0	0
Zalenski et al ⁸¹	224	8	98	16	0
Polanczyk et al ⁸²	276	24	98	15	0
Kirk et al ⁸³	212	13	100	57	0
Diercks et al ⁸⁴	747	3	99	37	0
Sarullo et al ⁸⁶	190	30	99	77	0
Amsterdam et al ⁷⁷	1000	13	89	33	0
Ramakrishna et al ⁸⁵	125	27	100	8	0

Echocardiography

- ***Rest Echocardiography***

...a normal ECHO like a normal ECG is an indicator of low clinical risk, it may be **insufficiently sensitive** for detection of RWMAAs

- ***Stress Echocardiography***

excellent negative predictive value

Computed Coronary Artery Imaging

Cardiac CT 2009

- Rule out coronary artery stenosis

Clinically most reasonable in low-likelihood situations

Stable atypical chest pain

Unclear ischemia test results

Low risk emergency room

Prior to non-coronary surgery

- Selected patients after revascularization (stent, CABG)
- Anomalies
- Prior to interventions
- Prior to EP interventions

**Coronary Computed Tomography Angiography For Early Triage
of Patients with Acute Chest Pain - The Rule Out Myocardial
Infarction Using Computer Assisted Tomography (ROMICAT) Trial**

JACC 2009

Large single center study

368pts, 53±12 years, 61% men

low to intermediate likelihood of ACS

-50% no CAD

-31% non obstructive CAD

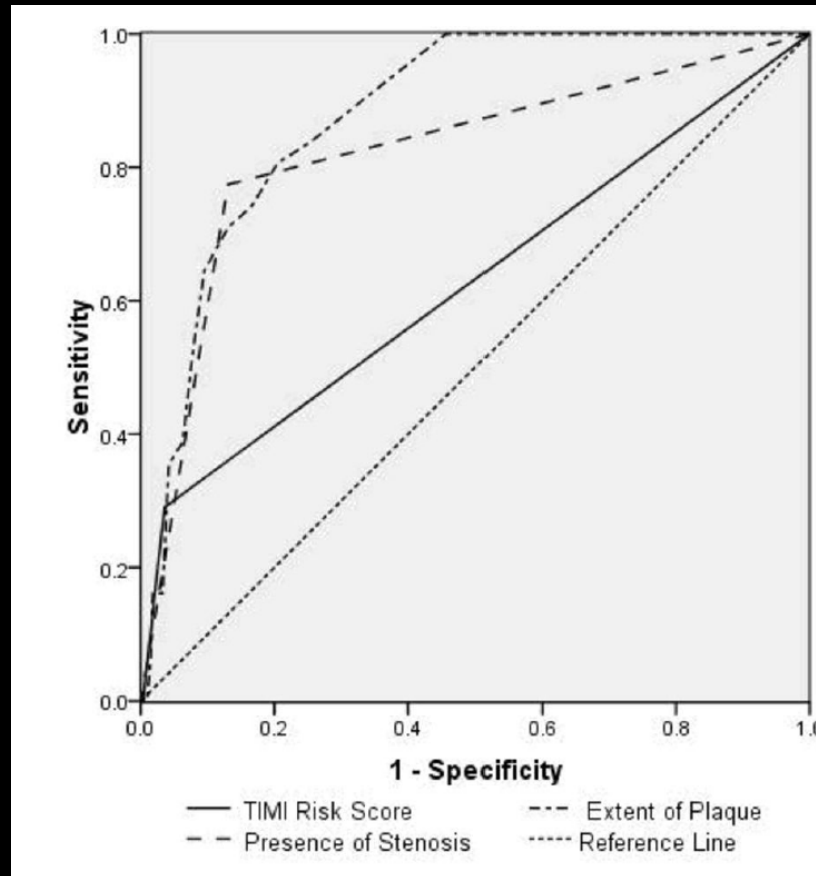
-19% obstructive CAD

Diagnostic accuracy of Coronary CTA for the Detection of Acute coronary Syndrome and Myocardial Infarction during Index Hospitalization among pts with acute chest pain based on the presence of any coronary plaque or the presence of coronary artery stenosis (>50% luminal narrowing)

Coronary CTA finding	sensitivity	specificity	PPV(95%CI)	NPV(95%CI)
Acute coronary syndrome				
Any plaque	89%-100%	49%-60%	12%-23%	98%-100%
Coronary stenosis	59%-90%	83%-90%	24%-48%	95%-99%
Myocardial infarction				
Any plaque	63%-100%	46%-56%	2%-8%	98%-100%
Coronary stenosis	24%-91%	78%-86%	2%-16%	97%-100%

AUCs for the detection of acute coronary syndromes during index hospitalization

JACC 2009



Areas under the receiver-operating curves (AUCs) were higher for both plaque and stenosis as compared to the Thrombolysis In Myocardial Infarction (TIMI) risk score.

Coronary Artery Imaging

Impact of 64-Slice Cardiac Computed Tomographic Angiography on Clinical Decision-Making in Emergency Department Patients With Chest Pain of Possible Myocardial Ischemic Origin

Ronen Rubinshtein, MD^a, David A. Halon, MBChB^a, Tamar Gaspar, MD^b, Ronen Jaffe, MD^a, Jacob Goldstein, MD^a, Basheer Karkabi, MD^a, Moshe Y. Flugelman, MD^a, Asia Kogan, MD^c, Reuma Shapira, MD^c, Nathan Peled, MD^b, and Basil S. Lewis, MD^{a,*}

Am J Cardiol 2007;100:1522–1526

Patient characteristics (n = 58)	
Characteristic	Value
Mean age ± SD (yrs)	56 ± 10
Known CAD	22 (38%)
Previous percutaneous coronary intervention	15
Previous bypass surgery	4
Previous surgery and percutaneous intervention	2
Previous coronary angiography (no revascularization)	1
History of myocardial infarction	14 (24%)
Diabetes mellitus	12 (21%)
Systemic hypertension	33 (57%)
Hyperlipidemia	32 (55%)
Current smoker	22 (38%)
Average TIMI risk score (range)	1.3 (0–3)

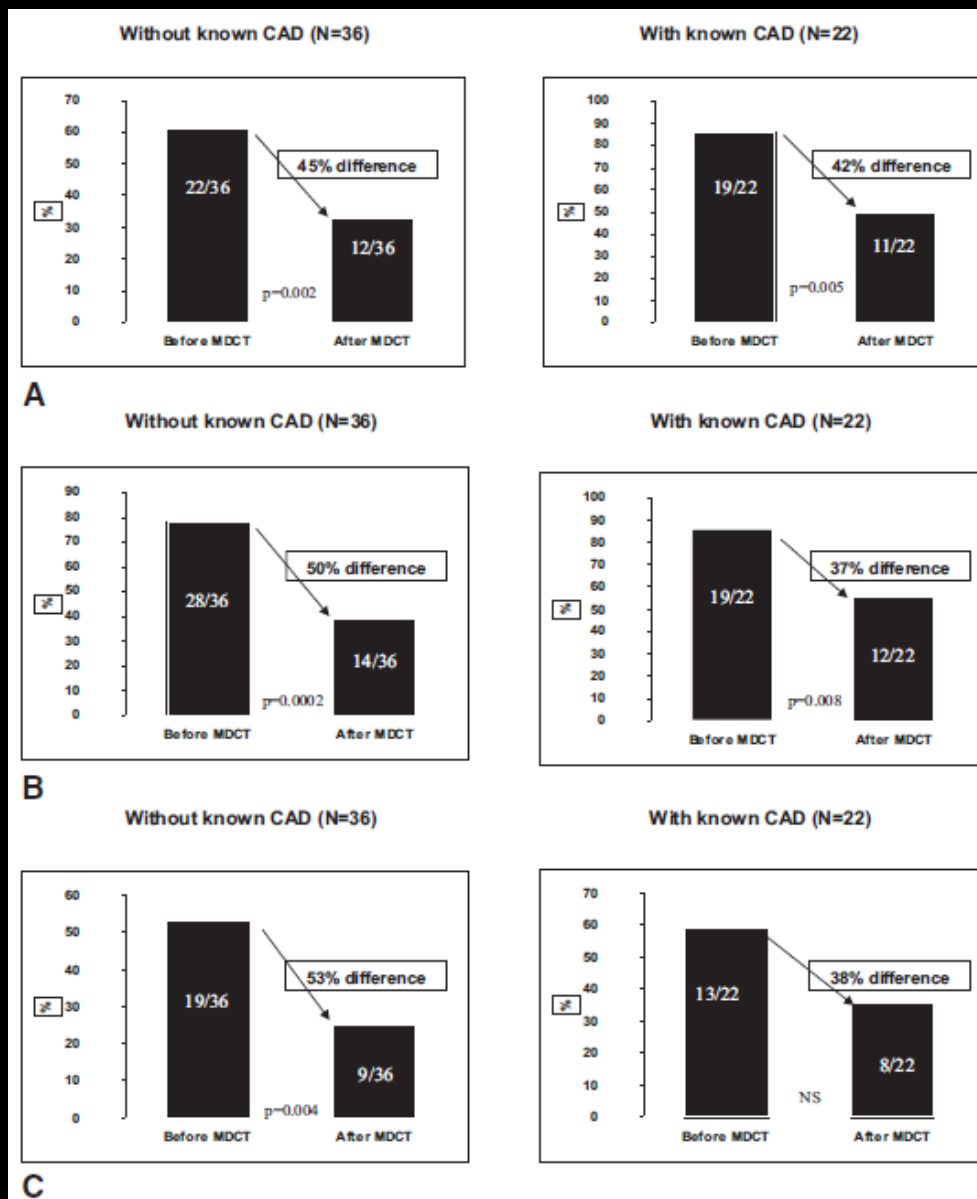


Figure 1. Impact of MDCT findings on diagnosis of ACS (A), decision to hospitalize (B), and strategy planning in patients with and without known CAD (C). Impact of MDCT findings on clinical decision-making was greater in patients without known preceding CAD.

Computed Tomography Coronary Angiography

- CTCA has the potential for major clinical utility in the *triage of selected low-risk patients* presenting to the ED with chest pain because of its *very high negative predictive value*.
- The *positive predictive* value of the method is more limited than the negative predictive value , which can lead to *unnecessary invasive* angiography in a significant number of patients.

....**ROMICAT II trial**

- **Prognostic Value of CT Angiography for Major Adverse Cardiac Events in Patients With Acute Chest Pain From the Emergency Department**
- **2-Year Outcomes of the ROMICAT Trial**
- Christopher L. Schlett, MD*, Dahlia Banerji, MD*, Emily Siegel, BA*, Fabian Bamberg, MD, MPH , Sam J. Lehman, MBBS*, Maros Ferencik, MD, PhD* , , Thomas J. Brady, MD*, John T. Nagurney, MD, MPH , Udo Hoffmann, MD, MPH*, Quynh A. Truong, MD, MPH*, *

Am Coll Cardiol Img, 2011; 4:481-491

CT coronary and functional features predict MACE and have incremental prognostic value beyond clinical risk score in ED patients with acute chest pain.

The **absence of CAD on CT provides a 2-year MACE-free warranty period**, whereas coronary stenosis with RWMA is associated with the highest risk of MACE.

Usefulness of Comprehensive Cardiothoracic Computed Tomography in the Evaluation of Acute Undifferentiated Chest Discomfort in the Emergency Department (CAPTURE)

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59 pts

Similar diagnostic yield (?)

Did not reducethe length of stay

.....rate of subsequent testing

.....costs

“triple rule out” protocol

Clinical end points				
Variable	Overall (n = 59)	Comprehensive (n = 29)	Dedicated (n = 30)	p Value
Length of stay (hours: minutes)				0.79
Median	8:02	8:12	7:38	
Interquartile range	5:19, 29:20	5:19, 30: 05	5:23, 28:14	
Interval from emergency department presentation to computed tomography (hours: minutes)				0.56
Median	3:34	3:25	3:42	
Interquartile range	2:50, 4:38	2:50, 4:26	3:08, 4:46	
Interval to exclusion of acute event (hours: min)				0.64
Median	6:12	6:29	5:15	
Interquartile range	4:11, 20:26	4:17, 18:19	4:05, 20:26	
Direct hospital discharge (n)	41 (69.5%)	20 (69%)	21 (70%)	0.99
Cost of stay (\$)				0.16
Median	1809	1898	1724	
Interquartile range	1424, 4877	1554, 5116	1277, 4208	

ACR Appropriateness Criteria[®] on Chest Pain, Suggestive of Acute Coronary Syndrome

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 J. Jeffrey Carr, MD, MSCE^d, James P. Earls, MD^e, Robert C.
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 U. Joseph Schoepf, MD^k, Charles S. White, MD

J Am Coll Radiol 2011;8:12-18.

Table 1. Chest pain, suggestive of ACS

Radiologic Procedure	Rating	Comments	RRL
SPECT MPI rest and stress	8	Intermediate to high likelihood for CAD. There is abundant literature available on clinical utility.	☆☆☆☆
Arteriography coronary	8	Gold standard; invasive.	☆☆☆
SPECT MPI rest only	7	In the setting of ongoing chest pain, high negative predictive value. Technetium-99m is the most commonly used radionuclide agent for this test. RRL may be higher if ²⁰¹ Tl is used.	☆☆☆
Ultrasound echocardiography transthoracic stress	7	When resting echocardiographic findings and cardiac enzymes are normal.	○
Ultrasound echocardiography transthoracic resting	6	Primarily for evaluating wall motion abnormalities and aortic dissection.	○
CTA coronary arteries	6	For those with low to intermediate likelihood for CAD, in the absence of cardiac enzyme elevation and ischemic ST changes.	☆☆☆☆
X-ray chest	5	Primarily a survey for noncardiac etiologies of chest pain.	☆
CT chest with contrast	5	Primarily for noncardiac etiologies such as pulmonary embolism and aortic dissection.	☆☆☆
MRI heart with stress with or without contrast	5	Limited experience in the clinical setting and lack of availability. See statement regarding contrast in text under "Anticipated Exceptions."	○
PET heart stress	4	Lack of widespread use and availability.	☆☆☆
MRI heart function and morphology with or without contrast	4	Primarily for the possibility of aortic dissection. See statement regarding contrast in text under "Anticipated Exceptions."	○
Ultrasound echocardiography transesophageal	3	Relative contraindication for ACS.	○
CT coronary calcium	2	Not validated in the acute setting.	☆☆☆
MRA coronary arteries	2	Technically challenging and lack of widespread use and protocol availability.	○
CTA coronary arteries with advanced low dose techniques	No consensus	Lack of data in the acute setting.	☆☆☆

Note: Rating scale: 1, 2, and 3 = usually not appropriate; 4, 5, and 6 = may be appropriate; 7, 8, and 9 = usually appropriate. ACS = acute coronary syndrome; CAD = coronary artery disease; CTA = CT angiography; MPI = myocardial perfusion imaging; MRA = MR angiography; RRL = relative radiation level; SPECT = single photon-emission CT.

- A number of **imaging modalities (myocardial perfusion scanning, CCTA, and echocardiography)** may be utilized in evaluating stable patients with chest pain suggestive of ACS who are not selected for urgent cardiac catheterization.

Diagnostic accuracy



Prognostic importance



compare different **imaging modalities**
compare different **diagnostic strategies**

....improve confidence regarding the safety of **discharge** from the emergency department.

Influence of medications

(β blockers, nondihydropyridine calcium channel blockers)

..the rate of nondiagnostic ETT was twice that in the group not taking them...**(61%) had a diagnostic ETT**

....adequate functional capacity ≥ 5 METS with **no** exercise induced **abn** consistent with **low clinical risk**

....**vasodilator stress MPI**