ROMICAT II - Rule Out Myocardial Ischemia/Infarction Using Computer Assisted Tomography

NHLBI U01HL092040

A Multicenter Randomized Comparative Effectiveness Trial of Cardiac CTA vs. Standard Evaluation in Acute Chest Pain Patients in the Emergency Department

Udo Hoffmann, Quynh A. Truong, Hang Lee, Eric Chou, Pamela K. Woodard, John T. Nagurney, James H. Pope, Thomas Hauser, Charles White, Scott Weiner, Alexander Goehler, Pearl Zakroysky, Ruth Kirby, Douglas Hayden, Stephen D. Wiviott, Jerome Fleg, G. Scott Gazelle, David Schoenfeld, James E. Udelson
for the ROMICAT II Investigators

Disclosures

U.H.: Research/Research Grants: NIH; Siemens Medical Systems

Q.A.T.: Research/Research Grants: Qi Imaging; St. Jude Medical; NIH

T.H.: Consulting Fees/Honoraria: Astellas, Harvard Cardiovascular Research Institute.

P.K.W.: Consulting Fees/Honoraria: Medtronic; Research/Research Grants: Astellas, Lantheus, Siemens Medical Systems; Speaker's Bureau Lantheus

J.E.U.: Research/Research Grants: NIH

J.T.N.: Research/Research Grants: Alere-Biosite, Brahms-Thermo Fisher Scientific, Nanosphere, Clindevor

All other authors: None

Background

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- Chest pain (CP) suggestive of ACS - most common presentation to the ED
- Current strategies to rule out ACS are inefficient – overcrowded ED's, unnecessary admissions
- Despite a low threshold to admit patients up to 2% of pts discharged from EDs with missed ACS

Cardiac CT Angiography (CCTA)

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- Accurate noninvasive detection of significant CAD, especially high NPV
- ROMICAT I – blinded observational study of CCTA in acute CP/low-int risk of ACS:
  - Low prevalence of ACS (8%)
  - CCTA - most pts have no CAD or non-obstructive plaque
  - CCTA - very high NPV to R/O ACS

Equipoise

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- CCTA may enable earlier but safe triage, reducing hospital admissions and length of stay as compared to standard ED evaluation

- Medicare data suggest a doubling in procedures and costs after CCTA compared to functional testing

Hypothesis

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In a randomized controlled multicenter trial, ***a CCTA based evaluation strategy will improve the effectiveness of clinical decision making as compared to a standard ED evaluation*** in pts with acute chest pain suggestive of ACS.

Study Design

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Patients with Acute Chest Pain suggestive for ACS — Screening

Consent & Randomization

Cardiac CT Angiography	Standard ED Evaluation	Intervention

Discharge	*Admission*	*Admission*	*Discharge*	Triage Decision

Disposition, Diagnostic Testing , Interventions — Index Hospitalization

48-72 hour Phone Call

48-72 hour Phone Call

28-day Phone Interview

Follow-Up

Study performed at 9 US Centers

Inclusion Criteria

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- >5 minutes of CP or equivalent within 24 hours prior to ED presentation, warranting further risk stratification
- 40 to 74 years of age
- Able to hold breath for at least 10 seconds
- Sinus rhythm

Exclusion Criteria

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- New diagnostic ischemic ECG changes
- Documented or self-reported history of CAD
- >6 hours since presentation to ED to time of consent
- Body mass index >40 kg/m2
- Impaired renal function
- Troponin elevation consistent with MI
- Acute cocaine use within the past 48 hours
- Hemodynamic or clinical instability
- CT contraindications - allergy, asthma, metformin therapy, positive pregnancy test, contraindication to beta blockers

Study Endpoints

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Length of Hospital Stay (LOS)	**Primary Endpoint**
Rates of Missed ACS within 72 hours after ED Discharge *MACE* within at 28 days* *Peri-procedural Complications*	**Secondary Endpoints** **Safety**
Rates of Direct ED Discharge *Time to Diagnosis* *Resource Utilization* *Costs of Care*	**Secondary Endpoints** **Effectiveness**
Cumulative Radiation Exposure during Index Hospitalization and Follow-up	**Tertiary Endpoints**

*** death, MI, UAP, urgent revascularization**

Sample Size Calculation

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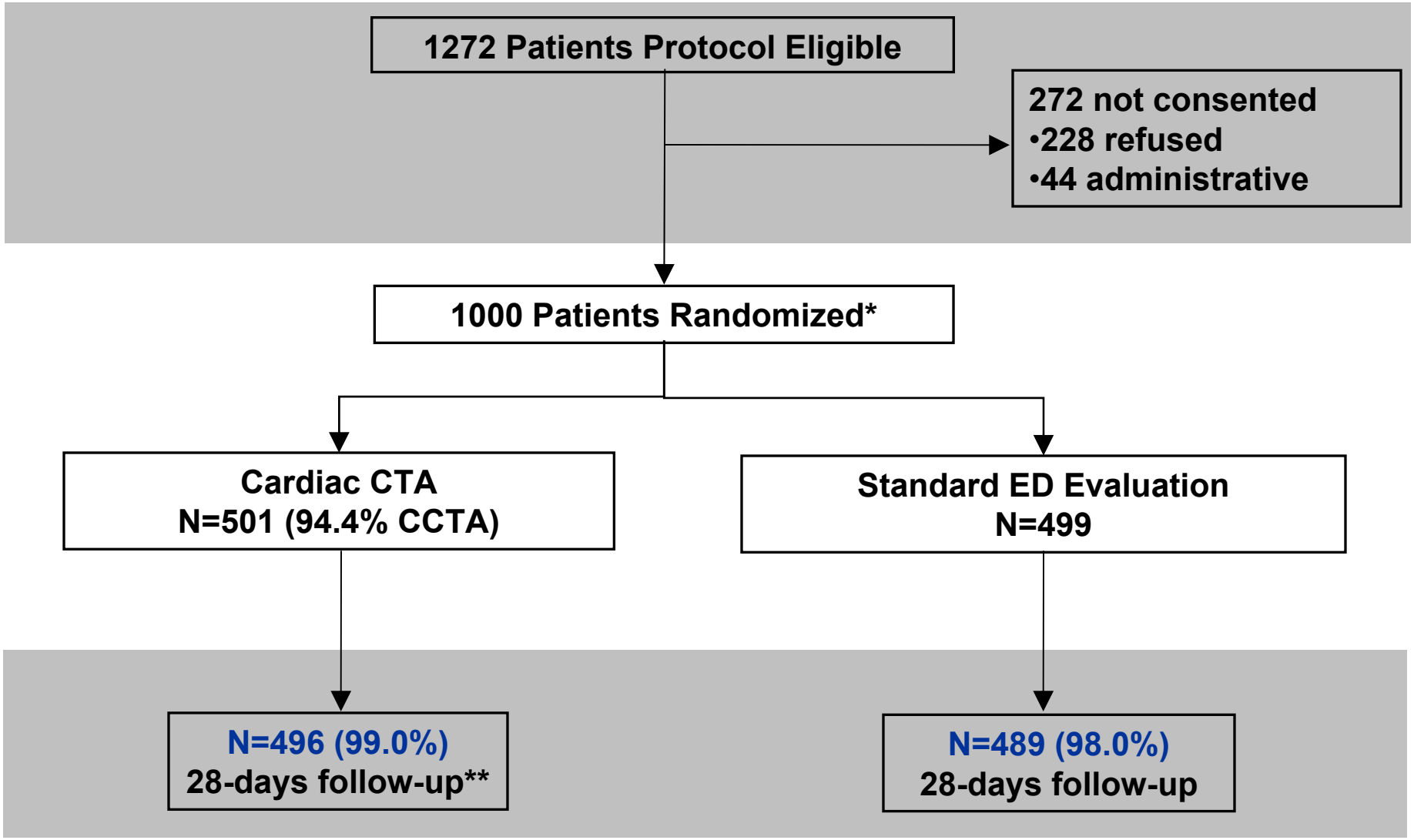
- 1000 patients to detect a difference ≥8.3 hours in mean LOS with 86% power by a two-sided t-test at p< 0.05 - based on projections from ROMICAT I

Flow of Patients Through the Trial



*Last patient randomized January 31st 2012; ** Last patient follow-up March 16th 2012

Patient Characteristics

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	CCTA (N=501)	Standard ED Eval (N=499)	p-value
Demographics			
Age (years, mean ± SD)	54±8	54±8	0.49
Female Gender (%)	47.7	45.9	0.57
Caucasian (%)	65.9	66.1	0.95
Non-Hispanic (%)	86.8	84.6	0.57
Major Cardiovascular Risk Factors			
0-1 / 2-3 / ≥4 risk factors (%)	36/54/10	39/51/10	0.68
Chief Complaint at ED Presentation (n,%)			0.47
Anginal chest pain or equivalent	444 (88.6)	451 (90.6)	
Arm/Jaw/Shoulder/Epigastric Pain	21 (4.2)	16 (3.2)	
Shortness of Breath	7 (1.4)	10 (2.0)	
Other	29 (5.8)	21 (4.2)	
Discharge Diagnosis Index ED Visit or Hospitalization			
ACS n (%)*	43 (8.6)	32 (6.4)	0.23
Unstable angina pectoris (n, %)	35 (7.0)	17 (3.4)	0.01
Myocardial infarction (n, %)	8 (1.6)	15 (3.0)	0.01

*Agreement between site and independent adjudication for discharge diagnosis was excellent (96.5 %; kappa: 0.9)

Primary Endpoint - Length of Hospital Stay

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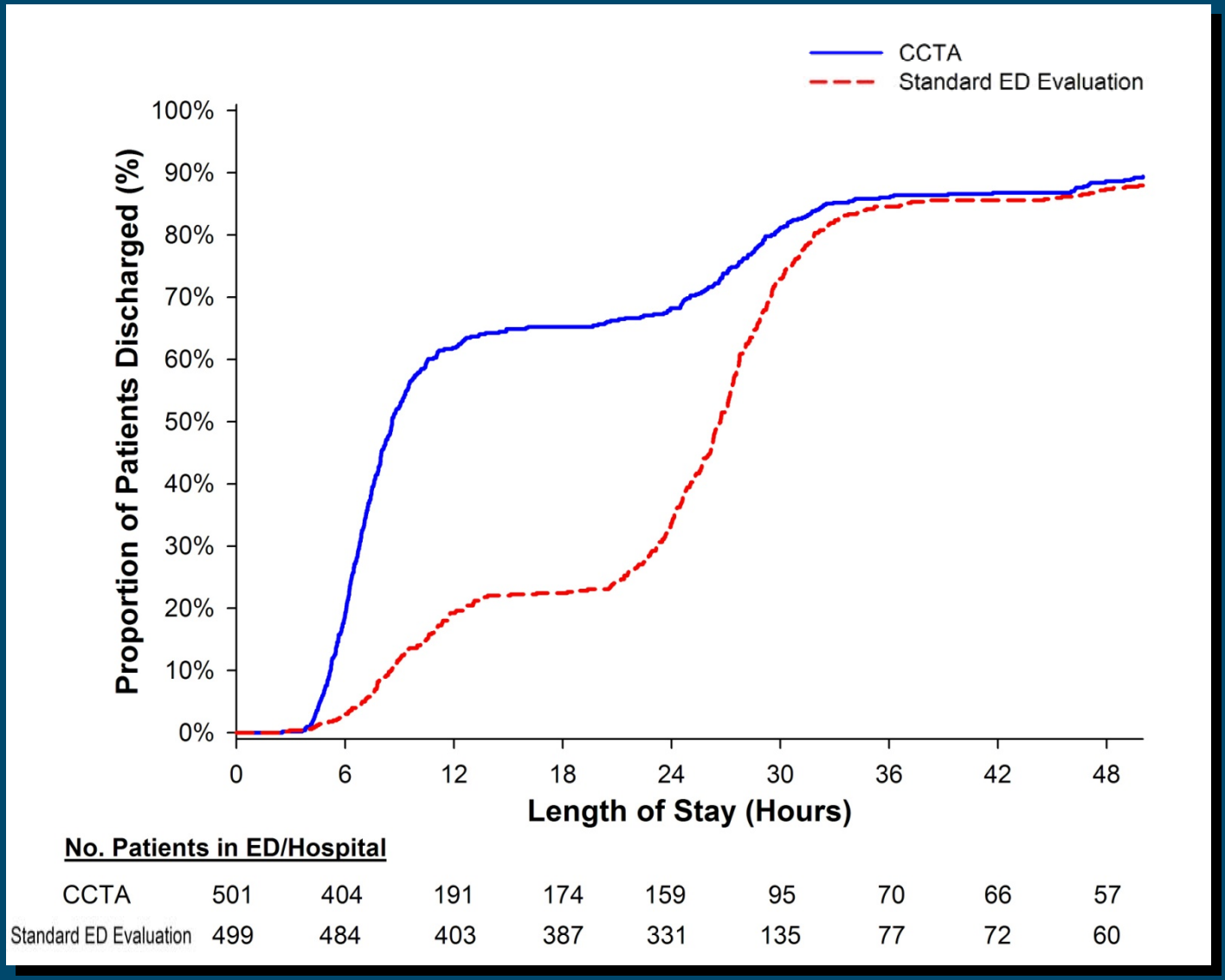
Mean LOS ± SD (hrs)	CCTA	Standard ED Eval	p-value
All	23.2 ± 37.0	30.8 ± 28.0	0.0002
Final Dx not ACS	17.2 ±24.6	27.2 ± 19.5	<0.0001
Final Dx ACS	86.3 ±72.2	83.8 ±61.3	0.87

Primary Outcome - Length of Hospital Stay



No. Patients in ED/Hospital

CCTA	501	404	191	174	159	95	70	66	57
Standard ED Evaluation	499	484	403	387	331	135	77	72	60

Secondary Endpoints - Safety

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	CCTA N=501	Standard ED Eval N=499	p-value
Safety			
Missed ACS (n, %)	0 (0)	0 (0)	-
Peri-procedural Complications (n, %)	2 (0.4)	0 (0)	0.25
Follow-up at 28 days			
MACE (n, %)	2 (0.4)	5 (1.0)	0.37

Peri-procedural Complications

- Peri-operative bleeding after re-implantation of an anomalous coronary artery
- Increase in creatinine after renal stone and hydronephrosis

Secondary Effectiveness Endpoints

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	CCTA	Standard ED Eval	p-value
Patient Disposition (n, %)			0.001
Direct ED Discharge	234 (46.7%)	62 (12.4%)	
Admission to Obs Unit	133 (26.6%)	268 (53.7%)	
Admission to Hospital	127 (25.4%)	158 (31.7%)	
Left AMA	7 (1.3%)	11 (2.2%)	
Time to Diagnosis in hours (mean ± SD)	10.4 ± 12.6	18.7 ± 11.8	0.0001
Follow-up for recurrent CP by 28 days (n)			
Repeat ED Visits	13	19	0.29
Repeat Hospitalizations	7	7	-

Testing, Interventions, and Radiation

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	CCTA	Standard ED Eval	p-value
Dx Testing during Index Stay* (n, %) Patients with 0 tests Patients with 1 test Patients with ≥ 2 tests	 9 (1.8%) 376 (75.0%) 116 (23.2%)	 110 (22.1%) 336 (67.3%) 54 (10.6%)	<0.0001
Cumulative Invasive Coronary Angiography** (n, %)	60 (12.0%)	40 (8.0%)	0.04
Cumulative Interventions** (n, %) PCI CABG	32 (6.4%) 27 (5.4%) 5 (1.0%)	21 (4.2%) 17 (3.4%) 4 (0.8%)	0.16
Cumulative Radiation Exposure** (CCTA + SPECT + ICA: mean ± SD per patient in mSv)	14.3 ± 10.9	5.3 ± 9.6	<0.0001

* includes CCTA, SPECT, Echo, ETT, and ICA

** includes index hospitalization and 28 day follow-up

Costs of Care

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Costs*	CCTA mean ± SD	Standard ED Eval mean ± SD	% Diff	p-value
ED#	2,053 ± 1,076	2,532 ± 1,346	-19%	<0.0001
Hospital	1950 ± 6,817	1,297 ± 5,316	+50%	0.17
Total	4,004 ± 6,907	3,828 ± 5,289	+5%	0.72

* cost per patient (dollars) in a subset of 650 patients from 5 centers
# includes observation unit

Summary

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- In ED pts with CP suggestive of ACS an evaluation strategy incorporating CCTA early on
  - Significantly reduces length of stay and time to diagnosis
  - Increases direct ED discharge rates without apparent increase in missed ACS
  - No increase in costs of care despite more diagnostic testing in the CCTA arm

  when compared to current standard ED evaluation

Limitations

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- Enrollment limited to weekday business hrs, but two week 24/7 screen for pts eligible outside enrollment hrs showed no differences in age, gender, ethnicity, and potential study eligibility
- Lack of statistical power to determine differences in health outcomes

Conclusions

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First prospective multicenter randomized controlled trial to demonstrate that CCTA incorporated early into an ED evaluation strategy improves clinical decision making for ED triage compared to a standard ED evaluation for pts with CP suggestive of ACS

Thank you!

National Heart, Lung, and Blood Institute (NHLBI)

Data Safety and Monitoring Board (DSMB)

CLINICAL COORDINATING CENTER (CCC)
Udo Hoffmann, MD MPH
James Udelson, MD

DATA COORDINATING AND STATISTICAL CENTER (DCSC)
David Schoenfeld, PhD

Center for Cost-Effectiveness and Decision Analysis (DACE)
Scott Gazelle, MD MPH PhD

Clinical Events Committee (CEC)
Stephen D. Wiviott, MD

Steering Committee
Jerome Fleg, MD (NIH – PO)
Ruth Kirby (NIH)
Quynh Truong, MD MPH

External Advisory Committee
Eugene Braunwald, MD - Chair

Clinical Sites
Principal Investigator

Beth Israel Deaconess Medical Center, Boston, MA
(Thomas Hauser)

Baystate Medical Center, Springfield, MA
(J. Hector Pope)

Kaiser Foundation Hospital – Fontana, CA
(Eric Chou)

Washington University, St. Louis, MI
(Pamela Woodard)

Tufts Medical Center, Boston, MA
(Scott Weiner)

University of Maryland Medical Center, Baltimore, MD
(Charles White)

Massachusetts General Hospital, Boston, MA
(J. Toby Nagurney)

Cleveland Clinic, Cleveland, Ohio
(Frank Peacock)

Northwestern University Feinberg School of Medicine
(Peter S. Pang & Issam Mikati)