## Current and Future Role of Imaging for Screening Asymptomatic CAD and Triaging ACS Patients

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# ASYMPTOMATIC SCREENING



Electron Beam Tomography The Agaston Calcium Score											
	Area = 15 mm² Peak CT = 450 Score = 15 x 4 =	60		Area = 8 mm <sup>2</sup> Peak CT = 290 Score = 8 x 2 = 16							
		Score =	Σ		-						
		Hn x-fac (Agatston	ctor Scoring)	43 YEAR OLD FEMALE	and the second						
Cr _		130-199	) 1		1						
	-	200-299	2								
	30 is	300-399	<del>)</del> 3		^						
and a		>400	4								

#### **All-Cause Mortality: Intermediate-Term**



## Near- and Long-Term Survival from 2 Cohorts – over 35,000 patients



# Pooled Analysis >20,000

Study (Year)	CACS Range	Effect	(95% CI)	Events / N							
				Higher Risk	Low Risk	P	0.01	0.1	1	10	100
Kondos (2003)	4-30.5	1.8	(0.8-3.8)	15 / 1,633	12/2,349	0.12			_ <u>†</u> ∎-	-	
	31-169	1.5	(0.7-3.2)	16 / 2,045	12/2,349	0.26			_+∎-	_	
	170-1,700	3.7	(1.9-7.3)	27 / 1,424	12/2,349	< 0.0001				╉─│	
Greenland (2004)	1-100	1.5	(0.8-2.9)	21/321	14/316	0.24			<b>∔∎</b>		
	101-299	2.0	(0.98-4.0)	15 / 171	14/316	0.053			- <b>-</b>	_	
	≥300	3.5	(1.9-6.3)	34 / 221	14/316	< 0.0001				-	
Arad (2005)	1-100	1.9	(0.8-4.3)	20 / 1,973	8/1,512	0.12			∔∎	-	
	101-399	10.5	(4.9-22.3)	38 / 686	8/1,512	<0.0001				-	
	≥400	26.5	(12.8-54.8)	63 / 450	8/1,512	<0.0001					⊢
Taylor (2005)	1-9	2.1	(0.1-43.2)	0/120	2/1,261	0.63					_
	10-44	10.5	(1.5-73.9)	2/120	2/1,261	0.003			_	-	
	≥45	25.4	(5.0-129.9)	5/124	2/1,261	< 0.0001					
Vliegenthart (2005)	101-400	3.5	(1.3-9.7)	10/425	6/905	0.008					
	401-1,000	5.6	(2.1-15.3)	10 / 269	6/905	< 0.0001			-		
	>1,000	10.8	(4.2-27.7)	14 / 196	6/905	< 0.0001				-	
LaMonte (2005)	1-16	5.5	(1.2-24.5)	3/379	4/2,780	0.012					
Women	17-112	9.2	(2.5-34.3)	5/376	4/2,780	<0.0001				_	-
	113	12.9	(3.8-44.0)	7/376	4/2,780	<0.0001				-	-
	1-38	1.1	(0.3-4.3)	6 / 4,968	3 / 2,692	0.91			_	-	
Men	39-249	12.3	(3.7-41.6)	19 / 1,382	3/2,692	<0.0001					-
	≥250	22.1	(6.8-71.9)	34 / 1,380	3 / 2,692	<0.0001					
Summary RR Ratio		4.3	(3.5-5.2)	364 / 19,039	49 / 11,815*	<0.0001					
							0.01	0.1	1	10	100

Lower Risk

Higher Risk

## Incremental Prediction of CHD in "Intermediate Risk" Patients by FRS

















## **Coronary CTA: Do we need a CAC?**











### Automated volumetric quantification of plaque



 $\begin{array}{l} r_{CACS \ and \ PQA} = 0.96 \ , \ p < .0001 \\ r_{CACS \ and \ PQA} = 0.99966 \ , \ p < .001 \\ r_{CACS- \ RCA \ and \ PQA-RCA} = 0.95 \ , \ p < .056 \\ r_{CACS- \ LAD \ and \ PQA-LAD} = 0.938 \ , \ p < .001 \\ r_{CACS- \ LCX \ and \ PQA-LCX} = 0.996 \ , \ p < .083 \\ \end{array}$ 



Min et al. AHA 2007

## Incremental Value of Non-calcified Plaque Detection?



**CCTA Predictive of Death Above and Beyond RF and CACS** 

Ostrum, JACC 2008

### Plaque Composition in Non-obstructive CAD : Non-calcified Plaque Predicts Death

Two-center study of 3,576 patients without obstructive CAD followed for 2.3



Min, preliminary data

# **CCTA for Screening**



Choi EK JACC 2008

52 (5%) subjects had >50% stenosis; 21 (2%) severe (75%) stenosis. 13 (25%) and 30 (58%) subjects with significant stenosis classified NCEP low-risk and mild coronary calcification (CACS<100), respectively. Midterm follow-up (17 months) - 15 cardiac events (1 U/A, 14 PCI)



Choi EK JACC 2008

# Subclinical COronary Atheroscleorosis Updated With Coronary cT Angiography (SCOUT Study)

Huk-Jae Chang, MD, PhD

Huk-Jae Chang, MD, PhD Seoul National University Bundang Hospital Sungnam-si, Kyungki-do, Korea Screening

# Coronary CT Angiography in Asymptomatic Diabetes Mellitus

Principal Investigator: Tamar Gaspar, MD Lady Davis Carmel Medical Center

> Toshiba Medical Systems Intermountain Healthcare

# TRIAGE ACS

## Acute Chest Pain 64–STAT randomized trial <u>Acute Chest Pain</u> in ED

AL

• Goldstein et al. JACC Feb 2007;49:863



## Exclusion of CAD in *acute chest pain*

Single-center trial (n=197) of low risk acute chest pain patients randomized to CCTA + SOC vs. SOC alone. CCTA immediately excluded or identified CAD as cause of CP in 75% patients (67 normal cors, 8 severe CAD).



- Reduced diagnostic time (3.4 hr vs. 15.0 hr, p<0.001)</li>
- Lower costs (\$1586 vs. 1872, p<0.001) [15%]</li>
- Fewer repeat evaluations for CP (2% vs. 7%)
  - 1 FP in CCTA arm
  - 24% required stress test (14% intermediate lesions,
- 10% nondiagnostic Nondx 5% with newer CT scans
- Both approaches 100% safe (2-years)

Goldstein et al. J Am Coll Cardiol 2007.

#### Acute Chest Pain

#### Recruiting



#### Investigator's Meeting February 18, 2007

Atlanta International Airport Executive Conference Center

**PAMI**<sup>®</sup> Coordinating Center at William Beaumont Hospital 3601 W. Thirteen Mile Rd.Royal Oak, MI 48073

#### **Acute Chest Pain**



## **CT-STAT Trial**

- Randomized trial in Acute Chest Pain
- MCT in 15 hospital centers in the U.S.
- Study design similar to 64-STAT trial.
- Total enrollment will be 750 patients randomized 1:1.
  - Enrollment to date 723; enrolling ~ 15 pts/wk.
- Enrollment completion: 4Q 2008.
  6 month FU completion: Summer 2009



## <u>Rule Out Myocardial Ischemia/Infarction</u> Using <u>Computer Assisted Tomography</u>

## **ROMICAT II**

Udo Hoffmann MD MPH

Director MGH Cardiac MR PET CT Program Massachusetts General Hospital

Associate Professor of Radiology Harvard Medical School, Boston MA



# Design

#### RCT in 1000 patients at seven sites

- 6 month initiation period
- 15 month enrollment period (~2 per week per site)

#### Compare SOC vs. SOC plus retrospective cardiac CT (plaque stenosis, LV function, and IF)



# Endpoints

### Primary endpoint

– % with CP directly discharged from the ED

#### Secondary endpoints

- -LOS
- -# of overall diagnostic tests, specifically ICA
- coronary revascularization procedures
- Outcomes are management/economically driven, assumption that health outcomes are similar between competing strategies (MACE after 30 days and six months)

# Case: 50 y/o main with no known CAD complains atypical chest pain



#### Clinical and ECG Predictors of Obstructive CAD by CCTA in Patients with Normal MPI

102 patients with normal MPI underwent CCTA (24% Obs-CAD). Obs-CAD most commonly involved single-vessel CAD. Obs-CAD had more CV RF (OR 1.84, CI 1.06-3.19, p<0.05) and higher prevalence of horizontal/downsloping ST-segment deviation (OR 2.6, CI 1.18-4.33, p=0.01), with 2X increase in relative risk for Obs-CAD for every 1 mm ST deviation



Weinsaft et al. CAD 2009

## What about intermediate plaques?



#### **BMIPP** (123I-methyliodophenylpentadecanoic acid)

Resistance to oxidation in mitochondria due to replacement of fatty acid metabolism with glucose metabolism. Identifies ischemic lesions due to coronary stenosis.



**Combination CCTA + BMIPP?** 

Nishimura JACC 2008

# Thank you.

## Comparison of FRS and CAC scores for Predicting Mortality



Shaw L et al Radiology 2003

#### Screening

# Endpoints

To evaluate the prevalence and characteristics of subclinical coronary atherosclerosis on CTA and its impact on the management in asymptomatic population.

#### Phase I study

 evaluate the impact of CTA by comparing the performance of secondary test with those who had not undergone CTA evaluation.

#### Phase II study

- recruit subjects who had significant coronary stenosis on CTA.
- undergo coronary angiography to confirm the severity of stenosis.
- coronary artery stenosis > 75% will receive PCI with DES
- Intermediate lesion, fractional flow reserve test.

All patients followed for adverse cardiac events for 5 years

# Acute Chest Pain Study Design



Recruiting