

# **Coronary CT Angiography**

**Cam F. Campbell MD FACC**  
**Iowa City Heart Center**

SEPTEMBER 5, 2005

www.time.com AOL Keyword: TIME

CHINESE CYBERSPIES  
COOL NEW SEARCH ENGINES

TIME

HOW TO  
STOP A  
**HEART  
ATTACK**  
BEFORE IT  
HAPPENS

Amazingly detailed new  
**HEART SCANS** help doctors  
spot trouble without  
surgery. How technology  
could save your life



Mike Fackelmann, 50,  
holds a scan of his  
heart, which revealed  
a major blockage of a  
coronary artery (arrow)

# Why Coronary CTA Now

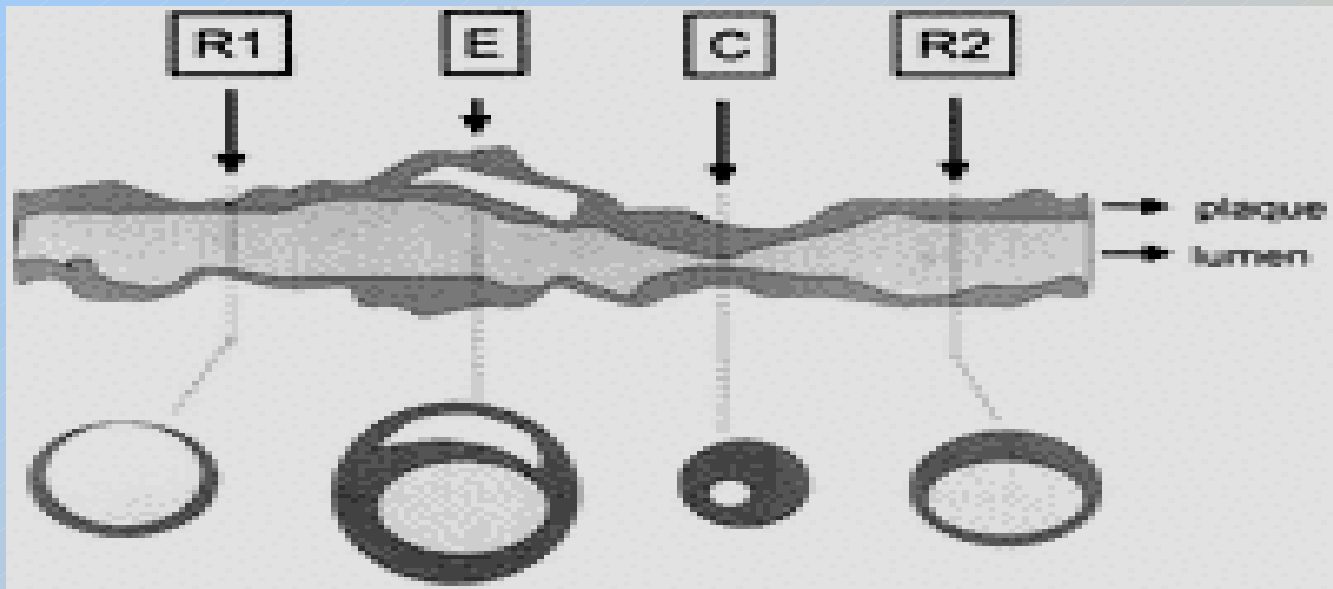
- Advancements in CT scanning technology
- Software technological advancements

# CT Basics

- Single slice
- Helical or Spiral slice
- ECG gating

# Why Coronary CTA

- Limitations of non-invasive testing
- Limitations of selective coronary angiography
- Evaluation of vessel wall and early plaque detection



# Why Coronary CTA?

- The ability of cardiac CT to rule out coronary artery disease exceeds a predictive value of 99%. This means that when the study is reported to be normal, it will be normal. This makes it a more accurate test than stress-testing, stress-echocardiography, stress-thallium and stress-perfusion MRI.

# Study Information

- Cardiac Chamber Size
- Anatomy of Great Vessels
- Venous Mapping
- Coronary Anatomy: *Hard and Soft Plaque*
- Lung anatomy: granulomas, tumor
- Each study contains 15 gigabytes of information

# Mechanics of the Study

- Performed as routine chest CT
- IV established for contrast injection
- ECG leads for cardiac gating
- 10-15 second breath hold

# CTA: Patient Selection

## *To Rule Out Coronary Artery Disease*

**The Patient is Asymptomatic :** (i.e. there are no problems, such as chest pain or breathlessness, but coronary artery disease needs to be ruled out)

- *Family history* of coronary artery disease
- *High cholesterol levels* and other high risk factors such as smoking, diabetes, etc.
- *ECG abnormalities* on a routine health check-up (LBBB)
- *Equivocal abnormalities* on a routine stress test, done prior to employment, insurance or as part of a routine health check-up

# CTA: Patient Selection

**The Patient is Symptomatic :** (i.e. there is chest pain or breathlessness, but the physician / cardiologist is not convinced that there is coronary artery disease)

- *Atypical chest pain*
- *Suspected syndrome X* in a pre-menopausal woman
- *Suspected dilated cardiomyopathy*
- *Anomalous coronary arteries*, ectasia or aneurysms
- *Post-bypass*: assessing the status of bypass grafts.
- *Tumors*: assessing cardiac neoplasms
- *EP evaluation* prior to BI-Ventricular pacer insertion

# Effective Dose Values for Common Imaging Examinations

Examination	Effective dose(mSv)
• Head CT	1-2
• Chest CT	5-7
• Abdomen and Pelvis CT	8-11
• Selective Coronary Angiogram	3-5
• A/P and Lateral CXR	0.04-0.06
• Ave. Ann. Background Radiation	3.6

# Effect of CAC Scores 2005

jacc

CAC score	Sens	Spec	PPV	NPV
0 - 100	94	95	94	95
101-400	100	88	90	100
401-1804	93	67	93	67

# Effect of Obesity

## jacc 2005

BMI	Sens	Spec	PPV	NPV
< 25	100%	100%	100%	100%
25 – 29.9	100%	91%	93%	100%
> 30	90%	86%	91%	86%

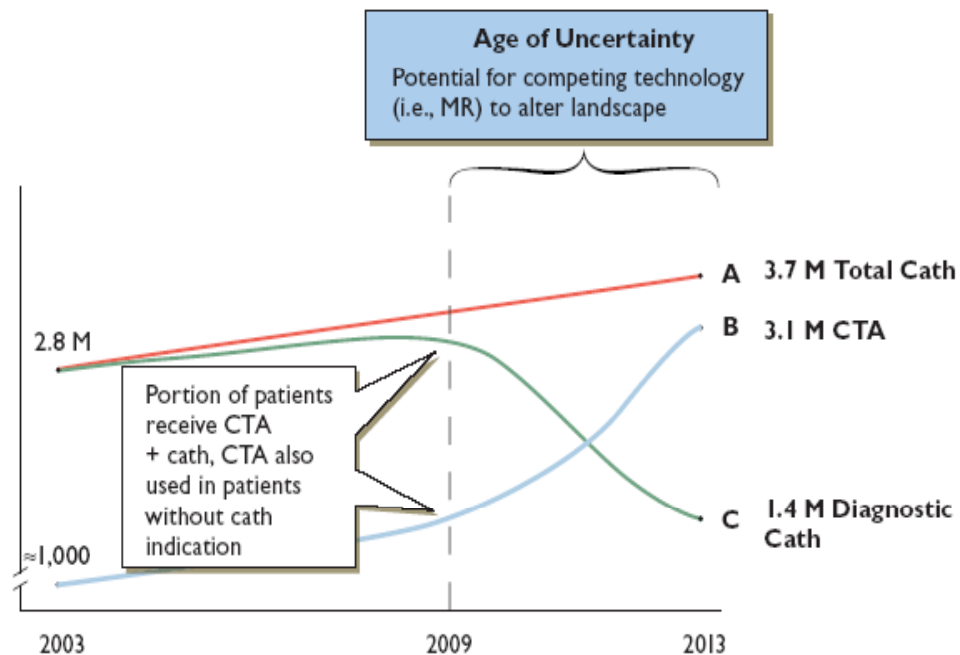
# Collaborative Efforts of CTA

- Radiology  
CT experience  
Availability/Proximity  
Non-cardiac findings
- Cardiology  
Coronary anatomy experience  
Patient management

# Projected MSCT Diagnostic Angiography Volumes

CTA Becomes Dominant Modality in Next Decade  
with Diagnostic Cath Retaining Share

All Procedures, 2003–2013



## ASSUMPTIONS

- A. Outpatient, inpatient diagnostic coronary caths (74 percent standalone, 26 percent with intervention) absent CTA; assumes previous growth rate of 2.6 percent remains constant
- B. 85 percent penetration of standalone diagnostic cath procedures or 2.3 M cases, an additional 0.8 M cases from more liberal upstream use (primarily in place of nuclear imaging) and emergency evaluation of chest pain
- C. 15 percent standalone diagnostic caths retained, 100 percent concomitant procedures retained

Source: Innovations Center interviews and analysis.

# NEJM 2001

Currently, between 20 to 40 percent of all diagnostic invasive coronary angiograms reveal no clinically significant stenosis.

Noninvasive coronary angiography has the ability to eliminate a substantial fraction of these “negative” invasive angiograms.

# Limitations of CTA

- Breath hold
- Afib/PVC/PAC/Arrhythmia
- HR
- CAC
- Obesity
- Stents
- Patient cooperation/Claustrophobia

# Conclusions

- Coronary CTA is a highly accurate non-invasive diagnostic modality for the assessment of coronary artery disease and its severity
- CTA is a useful imaging modality for the EP cardiologist and cardiac surgeon
- Coronary CTA allows for the assessment of vessel wall morphology

# Conclusions

- Coronary CTA bridges a very large gap in diagnostic testing between traditional stress testing and selective coronary angiography
- The extremely high negative predictive value of coronary CTA should reduce the number of normal cath

# **Coronary CT Angiography**

Cam F. Campbell MD FACC

Iowa City Heart Center

December 14, 2005