

Coronary CTA Technique: A How To.

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Disclosures

- Research Support: GE (Amersham), Toshiba, Bracco
- Speaker: Toshiba, Schering (Berlex)

Objectives

- Preparation
- CT Coronary Protocol
- Reconstruction and Reporting
- Indications
- Accuracy of CT and MRI
- Future Applications
- Summary

CT Coronary Angiography

- “Pretty pictures, but not much more useful than a third wheel on your bicycle.”



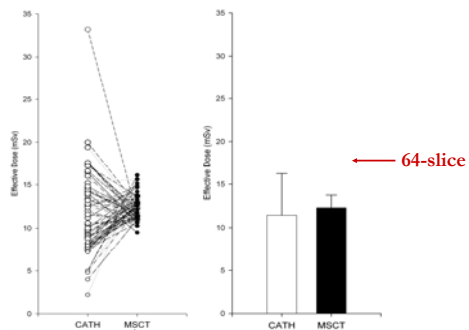
Cathy DeAngelis, Editor
JAMA Audit Commentary, July 26, 2006

Preparation

Preparation

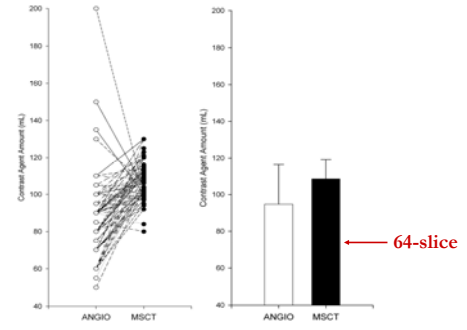
- Preparation is everything
- Sinus rhythm
- Course and duration
- Radiation and contrast agent
- 10 s breath hold (submaximum inspiration)

Effective Dose



Dewey et al. Ann Intern Med 2006

Contrast Agent



Dewey et al. Ann Intern Med 2006

10 s?

Which scanner to purchase?

Preparation

- Nitroglycerin contraindications:
 - » Inhibitors of phosphodiesterase
 - » Severe aortic stenosis
 - » Hypertrophic obstructive cardiomyopathy
 - » Hypotension (<100 mm Hg)
 - » Intolerance



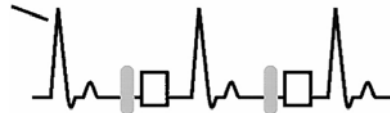
Preparation

- Beta blocker contraindications:
 - » Severe asthma
 - » Severe obstructive lung disease
 - » Bradycardia
 - » Intolerance

CT Coronary Protocol

CT Protocol

- 64 by 0.5 mm
- Sinus rhythm
- Good ECG?



CT Protocol

- 80 cc, right brachial, 4.0-5.0 flow
- Saline chaser*
- 1.3-1.7 g iodine per s
- Calculation of volume:

[Scan length (s) + 10] X Flow

*Cademartiri et al. Radiol Med (Torino) 2004

CT Protocol

- No caffeine
- No beta blockers up to 70 bpm
- Beta blocker suggestions:
 - » Esmolol (Brevibloc), IV 20-30 mg/min
 - » Atenolol, oral, 50 mg

CT Protocol

- Beta blocker complications:
 - » Hypotension
 - » Bradycardia
 - » Asthma
- Slow injection
- Have atropine on board

CT Protocol

- Always use nitroglycerin:



Dewey et al. R6Fo 2006

CT Protocol

- Nitroglycerin suggestions:
 - » 0.8-1.2 mg glycerol trinitrate
 - » 5 mg isosorbide dinitrate
- Nitroglycerin complications:
 - » Hypotension
 - » Tachycardia



Reconstruction and Reporting

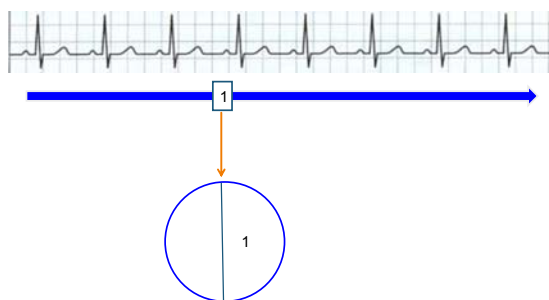
Reconstruction

- 0.5 mm slices
- 10 phases at 10% intervals
- Small FOV (max: 220 mm)
- ECG editing
- Lung/Mediastinal large windows
- Technology

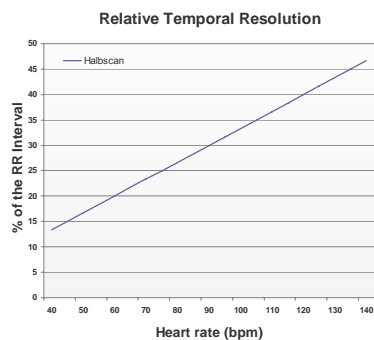
Technology

- Halfscan reconstruction
- Dual-source CT
- Multisegment reconstruction
- Lower HR better images

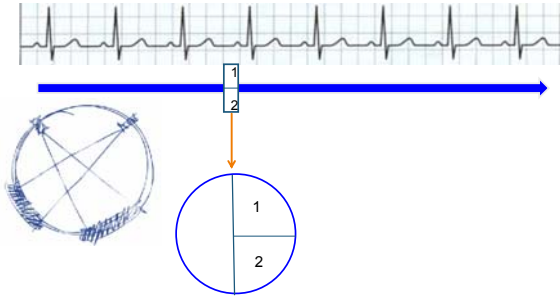
Halfscan



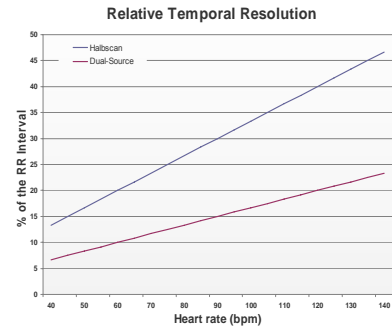
Halfscan



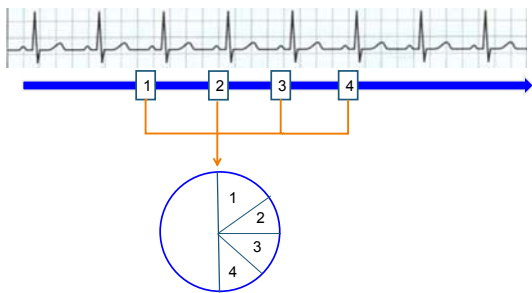
Dual-Source



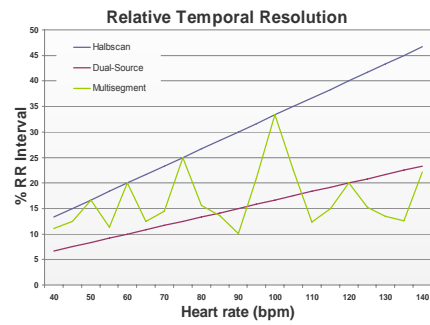
Dual-Source



Multisegment



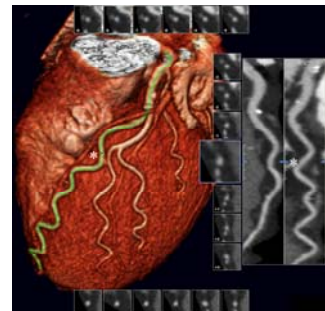
Multisegment



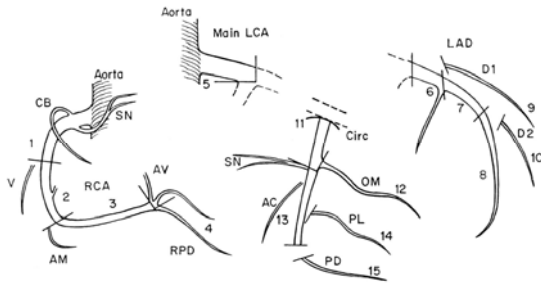
Reporting

- Axial and curved multiplanar
- 3D and angio emulation for display
- 15 segments
- Quantification of Stenoses

Curved MPRs

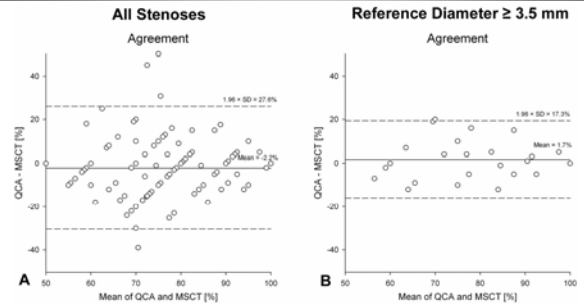


Coronary Segments



Austen et al. Circulation 1975

Quantification of Stenoses



Dewey et al. Invest Radiol 2007

Recap of the Protocol

Recap

- 64 by 0.5 mm
- Sinus rhythm
- No beta blockers up to 70 bpm
- Nitro
- 80 cc, 4.0-5.0 flow
- 10 s breath hold
- Curved MPRs

Indications

Indications

- Low to intermediate likelihood
 - » Equivocal stress test
 - » Atypical symptoms
- After CABG
- (Cardiac function, thrombus)
- (Suspected anomalies)
- (Acute coronary syndrome)
- No indication: stents, viability

Bypasses

Bypasses

- Accuracy of about 90%
- Excellent depiction of distal anastomoses

Martuscelli et al. Circulation 2005
Yamamoto et al. Ann Thor Surg 2006
Dewey et al. Ann Thor Surg 2004

Stents

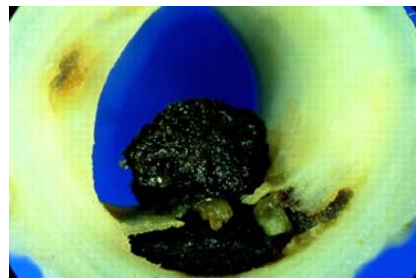
Stents

- Accuracy of about 70-80%
- Only **BIG** stents ($\geq 3,5$ mm)
- Less than 50% of the small guys

Schujf et al. Am J Cardiol 2004

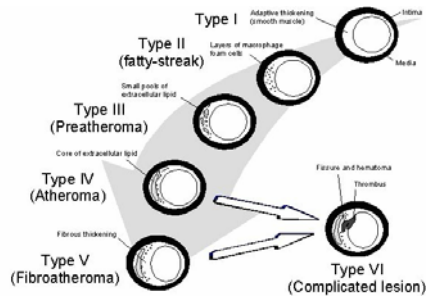
Plaques

Plaques



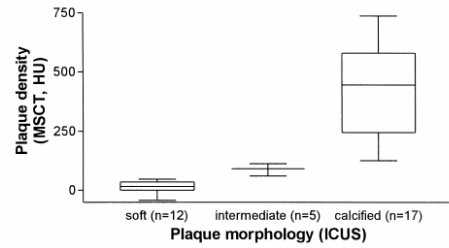
Davies et al. Heart 2000

Plaques



Dewey et al. Eur Radiol 2004 according to Starv et al. Circulation 1995

Plaques



Schröder et al. J Am Coll Cardiol 2001

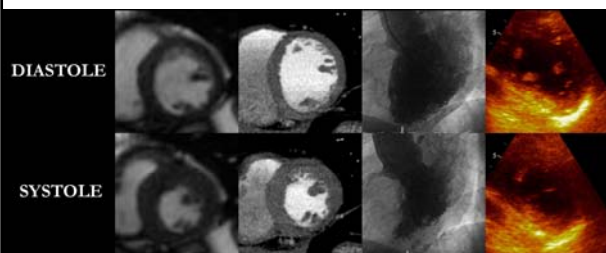
Plaques

- Sensitivity: 85-91%*
- Specificity: 92-97%*
- Prognostic implications unknown

*Leber et al. 2004 und 2006 J Am Coll Cardiol, Achenbach et al. Circulation 2004, Moselewski et al. Am J Cardiol 2004

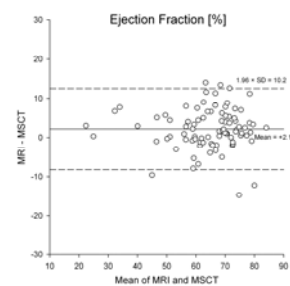
Cardiac Function

Cardiac Function



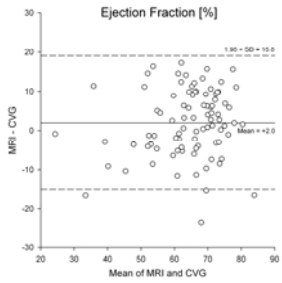
Dewey et al. J Am Coll Cardiol 2006

MSCT vs. MRI



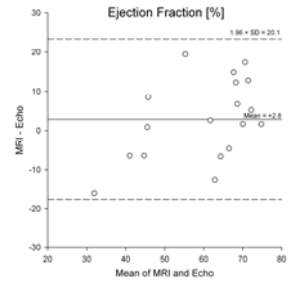
Dewey et al. J Am Coll Cardiol 2006

CVG vs. MRI



Dewey et al. J Am Coll Cardiol 2006

Echo vs. MRI

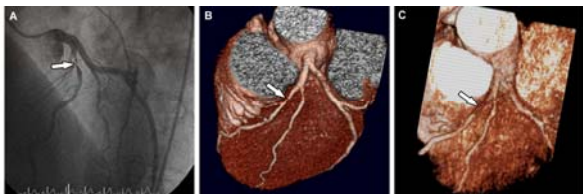


Dewey et al. J Am Coll Cardiol 2006

Accuracy for CAD

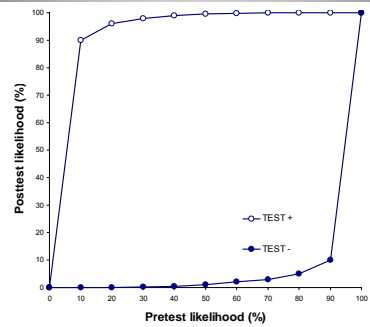
MSCT or MRI

MSCT or MRI?

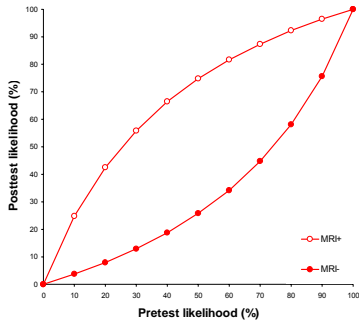


Dewey et al. Ann Intern Med 2006

MSCT or MRI?

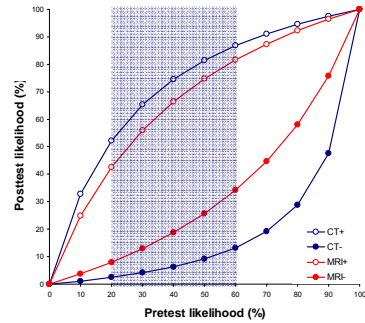


MSCT or MRI?



Dewey et al. Ann Intern Med 2006

MSCT or MRI?



Dewey et al. Ann Intern Med 2006

Some things to keep in mind ...

Keep in mind ...

- Pretest likelihood determines utility
- CT better than MRI
- CT good for 20-60% likelihood

Future Applications

Future Applications

- SPECT/CT and PET/CT*
- 4D-CT**

*Hacker et al. Eur J Nucl Med Mol Imaging 2006

**Kondo et al. JCAT 2005

Patient preference

Summary

Summary

- Rule out CAD
- MSCT > MRI
- Sinus rhythm
- No betablockers up to 70 bpm
- Dual-source or Multisegment
- Patients prefer CT