Can Cardiac CT Provide Physiological Assessment of CAD?

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Disclosures

Nothing to disclose
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Proximal coronary artery pressure

Distal coronary artery pressure

CT perfusion

CTA-FFR
Hyperemic state: pharmacological stress agent is used most common:

- Adenosine 140µg/kg/min
- Regadenoson 0.4mg
CT perfusion

- **Static CT perfusion**
  - Optimal timing is needed
  - Allows for both stress and rest acquisition

- **Dynamic CT perfusion**
  - Semi-quantification of myocardial perfusion
  - Timing is less crucial

Case courtesy of Dr. Kurata Ehime University, Japan
CT perfusion clinical exam design

- Adenosine infusion
- CAC (Coronary Artery Calcium)
- CTA (Computed Tomography Angiography)
- CTP (CT Perfusion)
- Total exam time approximately 30 minutes

Dynamic CT perfusion

- 61 year old male, typical angina.
- RF: Hypertension, family history.

- LAD (Left Anterior Descending)
- LCX (Left Circumflex)
- MO (Mid Ostial)
From TAC to MBF
Fusion of anatomy and perfusion
CT perfusion

Static CTP validated with FFR, vessel based performance

Dynamic CTP validated with FFR, vessel based performance

CTA-FFR

Computational Fluid Dynamics

CTA derived FFR

Branch of fluid mechanics involved in simulation of flow by solving numerical algorithms

CFD applied to anatomical CCTA data for computation of coronary circulation
Perpendicular to the centerlines the coronary lumen is segmented. From the coronary lumen segmentations a 3D coronary model is created.

Automatic vessel tracking places centerlines through the coronary arteries.

On-site CTA-FFR

Stenotic region Myocardial mass

The normal non-stenotic regions are computed with a reduced-order model, within the stenotic regions hybrid models are used, the stenotic regions are designated by the user.

LV segmented from the CCTA data. Resting total coronary blood flow is based on myocardial mass.
The CTA-FFR algorithm (cFFR version 1.4, Siemens; currently not commercially available) distributes resting coronary blood flow over the 3D coronary model.

64 year old male, DDD pacemaker and paroxysmal atrial fibrillation, CCTA to rule out CAD
Full model CTA-FFR

BVS

0.88

0.80

0.88

0.77

0.90

CTA-FFR

Full model, prospective studies, central supercomputer

Reduced order, retrospective studies, on-site workstation
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**CTP:** provides myocardial blood flow. Good in detecting ischemia.

**CTA-FFR:** computes FFR based on simulated coronary blood flow. Strong correlation with invasive FFR.

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Thank you for your attention

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