**Non-invasive assessment of blood flow and lesion significance from coronary CT scans**

**Fractional Flow Reserve (FFR<sub>CT</sub>)**

*Will it work in other arterial beds?*

Christopher K. Zarins, MD

**Disclosure**

Employment and equity interest in HeartFlow, Inc

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**Fractional Flow Reserve**

**Defines lesion-specific ischemia**

- Measured with pressure wire during coronary angiography
- Pressure gradient during maximal hyperemia (adenosine)

**Treatment of Coronary Stenosis**

**Importance of Assessing Ischemia**

- **Angio visual-guided therapy vs best medical**
  - COURAGE, BARI 2D
  - No difference: PCI vs medical
- **FFR-guided therapy vs visual**
  - DEFER, FAME, FAME 2
  - Improved clinical outcome
  - Reduced costs
- **European and US guidelines**
  - FFR-guided therapy: The standard of care
- **However, FFR used in <10% of PCI in USA**

**Non-invasive Fractional Flow Reserve (FFR<sub>CT</sub>)**

*Determines functional significant of coronary lesions*

- 3D map of FFR<sub>CT</sub> derived from coronary CTA

**Non-invasive FFR<sub>CT</sub>**

- 3 prospective clinical trials: FFR<sub>CT</sub> vs FFR
  - 609 patients, 1050 vessels
  - High diagnostic accuracy of FFR<sub>CT</sub>
- **CE mark Europe 2011**
- **FDA clearance, November 2014**
- **2015 FFR<sub>CT</sub> introduced into clinical practice**
  - Europe, USA and Japan
**Case examples**

**Case 1**
- LAD stenosis
- FFR = 0.62
- LES specific ischemia
- ICA and FFR

**Case 2**
- RCA stenosis
- FFR = 0.87
- No ischemia
- ICA and FFR

**FFR<sub>CT</sub> from coronary CTA**
- Standard CTA acquisition protocol, β-blocker, NTG
- No additional imaging or radiation
- No adenosine

**HOW HEARTFLOW WORKS**
- Send data
- HeartFlow analysis
- Receive results

**FFR<sub>CT</sub> Analytic Process**
- Computational Model based on coronary CTA
  - 3-D quantitative anatomic model from coronary CTA
  - Physiologic models:
    - Myocardial demand
    - Morphometry-based boundary conditions
    - Effect of adenosine on microcirculation
- Blood Flow Solution
  - Blood flow equations solved on supercomputer
- Calculate FFR<sub>CT</sub>
  - 3D FFR<sub>CT</sub> map computed
  - FFR<sub>CT</sub> = 0.72 (can select any point on model)

**Clinical decision making**

**FFR<sub>CT</sub> RIPCORD Study – decision analysis, n=200**
- Initial Decision – CT Angiography only
- Final Decision – Post FFR<sub>CT</sub>
  - More information needed
  - 44% of patients had decisions altered after physicians incorporated FFR<sub>CT</sub>
- Change in disease management pathway for 36% of patients
- Change in vessel assigned to PCI for an additional 8% of patients

Curzen, et al, EuroPCR 2015
Treatment Planning

Future applications

- Aorta and peripheral vasculature
- Carotid and cerebral circulation
- Renal artery stenosis
- Mesenteric circulation

Summary

- Computational analysis of blood flow from CTA is a clinical reality
- Non-invasive FFR<sub>CT</sub> can improved diagnosis of CAD
  - Can differentiate patients with lesion-specific ischemia from those with no functional stenosis
  - Helps physicians make better treatment decisions
- Potential for improved clinical outcomes with reduction in healthcare costs

Thank you