Preop Non-Invasive Fractional Flow Reserve Evaluation of Coronary Lesion Can Improve Care and Decrease Costs in Vascular Patients: Technique and Results

Vascular Surgeons can Now Do Cardiac Clearance

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Vascular Quality Initiative*

Open Non-ruptured AAA: In hospital Mortality (Jan 2015-May 2016)
Nationally 2%, up to 10%

Vascular Disease and Cardiac Clearance

- Vascular Surgery patients at higher risk for cardiac events
- Cardiac clearance important
- Delays and extra costs for testing
- Consistent problem for vascular providers
- Peri- and Post operative concern and long term care

Disclosures

None

President (Intellectual Property)
Fist Assist Devices, LLC

Current Cardiac Clearance Path via Cardiology

- Non-invasive stress testing
  - Exercise EKG, stress ECHO, myocardial perfusion (SPECT, PET), stress MRI
- Positive stress test – referral to coronary angiography
- Diagnostic coronary angiography (ICA)*
  - 50% of patients undergoing ICA have no prior ICA
  - Low diagnostic yield of elective ICA
    (finding of >50% stenosis in one or more coronary artery)
  - 60% negative; 40% positive
- Angiographic stenosis does not predict functional significance of coronary stenosis
  - Need to measure fractional flow reserve (FFR) at time of cath to identify patients who will benefit from stenting

Adding cost and time

*data from 400,000 patients in 650 US hospitals: Patel, NEJM 2010
What does Fractional Flow Reserve (FFR) measure?

**FFR directly measures:**
Ratio of pressure distal to stenosis vs. aortic pressure during hyperemia

**FFR represents:**
Ratio of blood flow with stenosis vs. without stenosis during hyperemia

\[
\frac{P_d}{P_a} = \frac{Q_d}{Q_a}
\]

- **e.g.** FFR is measured in 67/100 mmHg = 0.67, which means the myocardium distal to the stenosis is only receiving 67% of potential blood flow if the vessel was healthy.

FFR is a Better Measurement:
- Gold Standard for Identifying Functionally Significant CAD
- But not widely adopted
  - Invasive
  - Time consuming
  - Additional cost at time of cath

De Bruyne et al, NEJM 2012.
Tonino et al, NEJM 2009.

FFR Supported Clearance by Vascular Surgery: How to do it!

- **Coronary CT scan**
  - Non-invasive, very low radiation with new scanners
  - Accurate and reliable
    - Highly sensitive identifies the presence or absence of CAD
    - Low-moderate specificity – many false positives
  - Unnecessary invasive cath and possible stent
- **Non-invasive FFR\textsubscript{CT} analysis**
  - Accurately defines functional significance of coronary lesion
  - Identifies patients who would benefit from coronary stenting
  - Identifies patients best treated with medical therapy (statins)
  - Can inform regarding cardiac clearance for surgical procedures
  - May reduce peri-procedural cardiac complications
  - May improves long-term outcome of patients

How does it work: order coronary CT scan

Cloud based computational analysis of coronary blood flow

73 yo man, 5.7 cm AAA, smoker, no cardiac Sx
- AAA anatomy not suitable for EVAR
  - Small neck, thrombus in neck
  - Pt. wishes open repair
- Pre-op CTA and FFR\textsubscript{CT}
  - Severe 3 vessel disease
  - CABG this week
  - Open AAA January 2017

70 yo man: 8.1 cm AAA, back pain
- Smoker. HTN. hyperlipidemia; no hx chest pain or MI
- Family history of AAA
  - Pt. reviewed EVAR data on late ruptures - wanted open repair
- Pre-op coronary CT and FFR\textsubscript{CT}
  - CT: severely calcified LAD
  - Cardiology clearance for surgery, no cardiac cath
  - Successful open repair
  - FFR\textsubscript{CT} report
    - Severe, focal proximal LAD stenosis
    - Referred back to cardiology
    - Patient at risk for sudden death/MI

\* The widow maker
81 yo F, severe, asymptomatic carotid stenosis. Considering CEA.
HTN, mild exertional dyspnea with throat tightness; no hx MI

- Pre-op cardiac evaluation
  - Lexiscan MPI study: small fixed anteroseptal defect, no ischemia
  - Coronary CT and FFR<sub>CT</sub>
  - No functionally significant stenosis
  - Cleared for carotid surgery

Conclusions

- Vascular Surgical patients suffer from cardiac disease as monitored in our practices and registries
- Cardiac clearance for surgery can be addressed with coronary CT and FFR<sub>CT</sub> via new technology
  - Cost effective and clinically accurate to save time and money
- Vascular surgeons may be able to clear high risk patients for surgery in future using FFR<sub>CT</sub>
- Vascular surgeons may be able to improve long survival of our patients by diagnosing critical, asymptomatic CAD using coronary CT and FFR<sub>CT</sub>