CV RADIOLOGY: WHAT WORKS (AND WHAT DOESN'T) IN BUILDING A PRACTICE

Richard L. Hallett, MD
Section Chief, Cardiovascular Imaging
Northwest Radiology Network – Indianapolis, IN
Adjunct Assistant Professor of Radiology
Stanford University Hospital and Clinics
Stanford, CA
DISCLOSURES

• None

xraydoc97@yahoo.com

http://stanford.edu/~hallett/NASCI%202014/
BACKGROUND

• **Like** other areas of medical imaging, building an effective CV imaging practice requires:
  • Appropriate Utilization
  • Appropriate Protocols
  • Appropriate Communication: results, etc
OVERVIEW

• **Unlike** many other areas of medical imaging, effective CV imaging requires a number of specific additional considerations:
  
  • Hardware and software
  
  • Cross-Specialty Participation

Must address all areas to build successful practice!!
KEYS TO BUILDING A PRACTICE

- Resolve Turf Issues
- Educate the “consumer”
- Make ordering the appropriate exam easy
  (Make reimbursement more likely)
- Provide quality product, Communicate Results Efficiently
- Value-Added services
KEYS TO BUILDING A PRACTICE

- Resolve Turf Issues
- Educate the “consumer”
- Make ordering the appropriate exam easy
  (Make reimbursement more likely)
- Provide quality product, Communicate Results Efficiently
- Value-Added services
TURF ISSUES
TURF ISSUES

• Is there an “enemy”? If so, who (or what)?
  Cardiologist?
  Radiologist?
  Something Else?
THE COMMON “ENEMY”

- Changing healthcare landscape
  - Hospitals / Health Care systems / ACOs
    - Mergers, acquisitions, centralization
  - Government
    - Reimbursement, compliance, etc
TURF ISSUES

• Recent reimbursement cuts and hospital acquisitions of physician practices have changed dynamics

• **CVI is best done collaboratively!**

• Synergism from cardiology and radiology working together

• Support from cardiologists improves ED buy-in for CCTA
TURF ISSUES

- Collaboration – a number of advantages:
  - Less Cost
  - Less Risk
  - Less Radiation
  - More streamlined care
CVI AT ST. VINCENT HEALTH

- 2 radiologist CV imagers
  - Private practice 52 radiologist group
- 1 (soon 2) cardiologist CV imagers
  - Hospital employed cardiology group
- St. Vincent Heart Center of Indiana
  - 2 physically separate locations:
    - 100+ bed specialty hospital
    - Within 700 bed tertiary referral center
CVI AT ST. VINCENT HEALTH

• Cardiologists read most CMR and CCTA at specialty Heart Hospital
• Radiologists read most CMR and CCTA at main hospital, most non-coronary CTA/MRA throughout
• Radiologist lung over-reads for CCTA ($)
CVI AT ST. VINCENT HEALTH

- Cardiologists also maintain a clinical cardiology practice
- Radiologists do non-CV imaging also
COLLABORATION

- Physically in same room
- Mutual respect
- Synergistic expertise
- Outside projects
  - TAVI projects
  - CCTA at rural hospitals
WHAT ABOUT YOUR SITUATION?

- Unique to your place
- Try to reach common ground

**COLLABORATE FOR BEST CARE!**

- Shared billing / Lease arrangements in IR
- Hospitals interested in patient satisfaction, volume, and $$ bottom line, not as much in feelings or figuring out who is better
KEYS TO BUILDING A PRACTICE

• Resolve Turf Issues
• Educate the “consumer”
• Make ordering the appropriate exam easy
  (Make reimbursement more likely)
• Provide quality product, Communicate Results Efficiently
• Value-Added services
EDUCATING THE “CONSUMER”

Case Study: Coronary CTA
CCTA IS DISRUPTIVE TECHNOLOGY

• Referring MDs very busy - won’t spend much time to change workflow for disruptive technology like CCTA

• Most MDs do not have time (or inclination) to learn subtleties of cardiac imaging
CCTA IS DISRUPTIVE TECHNOLOGY

• Turn-around time (TAT) must be rapid, especially to ED
• Have to be able to provide 24/7 coverage if doing ED patients?
• To be successful, need to spend time/$$ for MD/RT/ clinician education, CME, in-services, decision support to build referral base
KEYS TO BUILDING A PRACTICE

• Resolve Turf Issues
• Educate the “consumer”
• Make ordering the appropriate exam easy
  (Make reimbursement more likely)
• Provide quality product, Communicate Results Efficiently
• Value-Added services
EXAM ORDERING
EXAM ORDERING

• Goals:
  • Appropriate exam ordered for each patient
  • Adequate clinical history
  • Chance for appropriate reimbursement
Streamlining Clinical Decision-Making

- EDUCATE: CME talks given at each hospital
- 2007: Laminated “Cheat Sheet” given to ED and referring MDs
- 2011: Revised Cheat Sheet after new guidelines
- 2013: ED-Specific cheat-sheet
Appropriateness and Ordering

- 24/7 Imaging Assistance
- “Structured” Reporting / Wet Read Sheet
- Pre-printed order sheets
- Pre-printed Patient prep instructions
<table>
<thead>
<tr>
<th>CLINICAL SCENARIO</th>
<th>FOR THESE INDICATIONS:</th>
<th>ORDER THIS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYMPTOMATIC, NONACUTE SX (? Ischemic Eq.) NO KNOWN Heart Disease</td>
<td>•LOW Pre-test Probability: ECG uninterpretable OR unable to exercise •INTERMEDIATE Pre-Test Probability (+/- ECG interpretable, can exercise)</td>
<td>CCTA</td>
</tr>
<tr>
<td>SYMPTOMATIC, ACUTE SX (Urgent Presentation) NO KNOWN Heart Disease</td>
<td>LOW OR INTERMEDIATE: •Normal ECG and biomarkers OR ECG uninterpretable OR ECG / biomarkers non-diagnostic</td>
<td>CCTA</td>
</tr>
<tr>
<td>PRIOR TEST RESULTS</td>
<td>•NORMAL STRESS ECG TEST WITH CONTINUED SX; DUKE TREADMILL SCORE INTERMEDIATE RISK •NEW/WORSENING SX , PREVIOUS NORMAL STRESS IMAGING STUDY •DISCORDANT OR EQUIVOCAL STRESS ECG AND IMAGING RESULTS</td>
<td>CCTA</td>
</tr>
<tr>
<td>SYMPTOMATIC</td>
<td>Evaluate suspected CORONARY ANOMALIES</td>
<td>CCTA</td>
</tr>
<tr>
<td>NEW DX OR ONSET HEART FAILURE (NO PRIOR CAD)</td>
<td>LOW OR INTERMEDIATE RISK patients with reduced EF</td>
<td>CCTA</td>
</tr>
<tr>
<td>CARDIAC MASS / THROMBUS / VALVULAR DISEASES / PERICARDIAL EVAL. CONGENITAL HEART DISEASE</td>
<td>•If limited info from Echo, TEE, or MRI (problem solving) •STRUCTURE AND FUNCTION</td>
<td>Cardiac CT</td>
</tr>
<tr>
<td>RISK ASSESSMENT POST PCI OR CABG</td>
<td>•SYMPTOMATIC (ISCHEMIC EQUIVALENT) : EVALUATE GRAFT PATENCY •Prior to Re-Do CABG (assess positions and patency of bypass grafts- esp. LIMA)</td>
<td>CTA CHEST-BYPASS GRAFT</td>
</tr>
<tr>
<td></td>
<td>ASYMPTOMATIC, PRIOR LEFT MAIN STENT (&gt; 3mm)</td>
<td>CCTA</td>
</tr>
<tr>
<td>CORONARY CALCIUM SCORE</td>
<td>•INTERMEDIATE 10-YEAR RISK FOR CHD EVENTS (FRS = 10-20%) •LOW 10-YEAR RISK BUT FAMILY HISTORY OF PREMATURE CHD</td>
<td>CAC SCORE</td>
</tr>
</tbody>
</table>

CONTRAINDICATIONS to CORONARY CTA: (MOST ARE RELATIVE)
•Weight >300 lbs
•Calcium Score >500
•Iodine (Contrast) allergy (and not pre-medicated)
•Contraindication to B-blocker, NTG
•Severe Asthma or COPD
•AFIB

FRAMINGHAM RISK CALCULATOR:
http://www.mdcalc.com/framingham-cardiac-risk-score

### Appropriate Indications: Emergency Department Coronary CTA (2013)

<table>
<thead>
<tr>
<th>Clinical Scenario</th>
<th>For These Indications:</th>
<th>Order This:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptomatic - Nonacute SX (Ischemic Equivalent)</strong>&lt;br&gt;No Known Heart Disease</td>
<td>• Low Pre-test Probability: ECG uninterpretable OR unable to exercise&lt;br&gt;• Intermediate Pre-Test Probability (+/- ECG interpretable, can exercise)</td>
<td>CCTA</td>
</tr>
<tr>
<td><strong>Symptomatic - Acute SX (Urgent Presentation)</strong>&lt;br&gt;No Known Heart Disease</td>
<td>Low OR Intermediate:&lt;br&gt;• Normal ECG and biomarkers OR ECG uninterpretable OR ECG / biomarkers non-diagnostic</td>
<td>CCTA</td>
</tr>
<tr>
<td><strong>Prior Test Results</strong></td>
<td>• Normal Stress ECG Test with Continued SX; Duke Treadmill Score Intermediate Risk&lt;br&gt;• New/Worsening SX, Previous Normal Stress Imaging Study&lt;br&gt;• Discordant or Equivocal Stress ECG and Imaging Results</td>
<td>CCTA</td>
</tr>
<tr>
<td><strong>Symptomatic Patients</strong></td>
<td>Evaluate suspected Coronary Anomalies</td>
<td>CCTA</td>
</tr>
<tr>
<td><strong>New DX or Onset Heart Failure (No Prior CAD)</strong></td>
<td>Low OR Intermediate Risk patients with reduced EF</td>
<td>CCTA</td>
</tr>
<tr>
<td><strong>Contraindications to Coronary CTA:</strong>&lt;br&gt;(Most are Relative)</td>
<td>• Weight &gt;300 lbs or BMI &gt;35&lt;br&gt;• Calcium Score &gt;500&lt;br&gt;• Iodinated Contrast allergy (and not pre-medicated)&lt;br&gt;• Contraindication to B-blocker, NTG&lt;br&gt;• Severe Asthma or COPD&lt;br&gt;• AFIB</td>
<td></td>
</tr>
</tbody>
</table>

**Framingham Risk Calculator:**

---


NWR Imaging Assistant: 317-328-5058
Cardiac CT Order Form (Outpatient)

<table>
<thead>
<tr>
<th>Patient Name:</th>
<th>DOB: / /</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex: [ ] Male [ ] Female</td>
<td></td>
</tr>
</tbody>
</table>

- [ ] 75672 - CTTA Cardiac Structure and Venous
- [ ] 75674 - CTTA of the Coronary Arteries
- [ ] 75674 - CTTA of the Coronary Arteries and Veins
- [ ] 75673 - CTTA - Structure/Morphology in Congenital Heart

Diagnoses:

- [ ] CTTA w/Morphology
- [ ] CTTA of Coronary Arteries
- [ ] CTTA Coronary Arteries + Veins
- [ ] CTTA of Congenital Heart

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>411.1</td>
<td>Angina (unstable, progress)</td>
</tr>
<tr>
<td>412.0</td>
<td>Old Myocardial Infarct</td>
</tr>
<tr>
<td>413.0</td>
<td>Angina Decubitus</td>
</tr>
<tr>
<td>413.1</td>
<td>Pulmonary Arteritis</td>
</tr>
<tr>
<td>413.9</td>
<td>Angina (stable, exertional)</td>
</tr>
<tr>
<td>414.00</td>
<td>CAD Unspec. Vessel</td>
</tr>
<tr>
<td>414.01</td>
<td>ASHD Native</td>
</tr>
<tr>
<td>414.02</td>
<td>CAD auto vein graft</td>
</tr>
<tr>
<td>414.03</td>
<td>CAD non-auto graft</td>
</tr>
<tr>
<td>414.04</td>
<td>CAD artery graft</td>
</tr>
<tr>
<td>414.05</td>
<td>ASHD Bypass, MDS</td>
</tr>
<tr>
<td>414.06</td>
<td>ASHD coronary artery of Transplanted Heart</td>
</tr>
<tr>
<td>414.10</td>
<td>Anomalies of Heart Wall</td>
</tr>
<tr>
<td>414.11</td>
<td>Anomalies of our Vessels</td>
</tr>
<tr>
<td>414.12</td>
<td>Anomalies of our Artery</td>
</tr>
<tr>
<td>414.19</td>
<td>Other Anomalies of Heart</td>
</tr>
<tr>
<td>414.8</td>
<td>Isheamic Cardiomyopathy</td>
</tr>
<tr>
<td>426.1</td>
<td>Aortic Valve Disorders</td>
</tr>
<tr>
<td>786.66</td>
<td>Shortness of Breath</td>
</tr>
<tr>
<td>786.50</td>
<td>Unspec. Chest Pain</td>
</tr>
<tr>
<td>786.51</td>
<td>Precedural Pain</td>
</tr>
<tr>
<td>786.59</td>
<td>Other Chest Pain</td>
</tr>
<tr>
<td>784.30</td>
<td>Unspec. Abnormal</td>
</tr>
<tr>
<td>794.31</td>
<td>Abnormal ECG</td>
</tr>
<tr>
<td>792.81</td>
<td>Pre-Op CVD Exam</td>
</tr>
</tbody>
</table>

MICROVESE: [ ] 75671 Calcium Score ONLY

PLEASE FAX INSURANCE CARDS WITH ORDER! THANK YOU.
Outpatient Cardiac CT Patient Prep Form

**APPROPRIATE INDICATIONS**
- Chest Pain Syndrome
  1. Intermediate pre-test probability + abnormal ECG OR unable to exercise
  2. Patient with equivocal stress test
  3. Evaluation of suspected coronary anomalies
- Heart Failure – New onset heart failure, assess etiology
- Electrophysiology
  1. Pulmonary veins prior to ablation for atrial fibrillation
  2. Coronary vein mapping prior to bi-ventricular pacing
- Congenital – Evaluate congenital heart disease
- Other Indication

**INTERMEDIATE PRE-TEST PROBABILITY: (2002 ACC/AHA Criteria)**
- Any Male > 30 with atypical symptoms
- Any Male > 40 with non-anginal chest pain
- Any Female > 50 with typical Symptoms
- Any Female > 50 with atypical Symptoms
- Any Female between 30 – 50 with typical Symptoms

**PATIENT PREPARATION**
1. Beta Blocker: HR < 50 BPM, No B-Blocker
   - HR 50 - 75 BPM – 50 mg Metoprolol
   - HR 75 - 90 BPM – 100 mg Metoprolol
   Administered 2 hours prior to appointment, unit doses of Metoprolol available in MOB/NAAB offices.
2. No caffeine, tobacco or alcohol for 24 hours prior to test.
3. No erectile dysfunction (Viagra, Cialis, etc.) medications for 48 hours prior to test.
4. Instruct patient to drink 3 – 5 glasses of water prior to the test.
5. Please obtain a BUN and Creatinine for patients with renal insufficiency and pre-mEDIATE patients with contrast allergy (Prednisone 60 mg, Benadryl 50 mg the evening before and morning of the test).

**NON-OPTIMAL CONDITIONS FOR CORONARY CTA**
1. Atrial fibrillation or frequent ectopy.
2. Resting tachycardia (> 90 BPM)
3. Chronic renal insufficiency (GFR < 30)
4. Extreme obesity (> 38 kg/m²)
5. Intolerant of Beta-Blockers

---

Outpatient Cardiac CT Patient Prep Form

**ORDERING PHYSICIAN SIGNATURE:**

**Test Date:**

**Time:**

**The Heart Center of Indiana**
10580 N. Meridian
Indpls., IN 46290
(317) 583-5151
(317) 583-5442 FAX

---

**PATIENT PREPARATION**

**Referring Physician:**

**Fax number for results:**

**CCTA 10-2008**

**PLEASE FAX INSURANCE CARDS WITH ORDER! THANK YOU.**
CCTA Reporting Form
KEYS TO BUILDING A PRACTICE

• Resolve Turf Issues
• Educate the “consumer”
• Make ordering the appropriate exam easy
  (Make reimbursement more likely)
• Provide quality product, Communicate Results Efficiently
• Value-Added services
PROVIDE A QUALITY PRODUCT
PROVIDE A QUALITY PRODUCT

• Accurate Results - Knowledge
  • Training Requirements / Pathways
  • NASCI, ACR CoAP, others
• 3D interrogation of data – Technology
• Communication of Results
KNOWLEDGE BASE

• Cardiovascular Imaging exams are subspecialty exams, require specific knowledge
• Cardiovascular providers are sophisticated, appreciate (and expect) subspecialty interpretation
• Radiologists: CV education as residents, fellows is inconsistent
Online CV Imaging Curriculum:
http://www.nasci.org/Education/CardiovascularImagingCurriculum/TableofContents.aspx
Cardiomyopathy

General Articles/Presentations

  J Am Coll Cardiol 2010 0: Jacc.2009.11.011

A. Hypertrophic

Case in Point
FMD CT
V. Pan, MD; P. Thavendiranathan, MD; M. Bhaduri; G. Newton, MD; N. Merchant

Case in Point
Atlantis Massif
R. Shah, MD; J. Kirsch, MD

- MRI in nonischemic acquired heart disease
  Ordovás KG, Reddy GP, Higgins CB.

- Magnetic Resonance Imaging of Hypertrophic Cardiomyopathy (Abstract)
  Cannavale, Alessandro; Ordovás, Karen G.; Rame, Eduardo J.; Higgins, Charles B.

- Hypertrophic Cardiomyopathy: Assessment with MR Imaging and Multidetector CT1
  Education Exhibits: Eun Ju Chun, Sang II Choi, Kwang Nam Jin, Hyon Joo Kim, Young Jin Kim, Byoung Wook Choi, Whal Lee, and Jae Hyung Park
  Radiographics September 2010 30:1309-1328; doi:10.1148/rg.305095074
INTERPRETATION OF DATA

- 3D interpretation - Mandatory for CVI
  - Volumetric datasets are best interpreted volumetrically
- Thin-Client or “no-client” / cloud-based options best for decentralized practices
- Output becomes essential part of exam to referring MDs
LEVERAGE TECHNOLOGY

- Need the ability to access datasets from anywhere
- “Virtual Desktop”
Applications Delivered

- Multiple PACS
- Multiple TeraRecon
- PowerScribe (review only)
- RadPeer
- Reference Materials
- Physician Scheduling
- Microsoft Office
- Internally Developed
  - launchPad
  - Simplified Sign on System

IBM BladeCenter H

- Cisco Nexus 4001I switch x 2
- Cisco Catalyst 3012 switch x 2
- Qlogic 4/8Gb FC switch x 2
- IBM HS22 server blade x 7
  - 12 cores = 2x2.53GHz
  - Intel Westmere
- 96GB RAM
- Broadcom 10GbE
- Emulex 8Gb FC

Storage

- Virtual Servers = IBM DS3524
- Virtual Desktops = NetApp FAS2040
COMMUNICATE RESULTS EFFICIENTLY

- Phone calls!!
- Reports
  - Structured reporting (consistent)
  - VR shortcuts
- Images
  - To referring Docs
  - To PACS
KEYS TO BUILDING A PRACTICE

• Resolve Turf Issues
• Educate the “consumer”
• Make ordering the appropriate exam easy
  (Make reimbursement more likely)
• Provide quality product, Communicate Results Efficiently
• Value-Added services
VALUE ADDED SERVICES

• Outside Studies
• Import into 3D system
  • Solve Problems for clinicians
  • Bill for Interpretation of Outside Films?¹
• Research Studies
  • TAVI, Endografts, etc

¹ http://webcast.jhu.edu/mediasite/Catalog/pages/catalog.aspx?catalogId=7e18b7d5-9c63-487e-aaf1-77a86f83b011
VALUE ADDED: TAVI STUDIES
SUMMARY: WHAT TO DO

- Resolve Turf Issues first
- Educate the “Consumer”
- Provide quality product and service
- Promise little, deliver much
WHAT NOT TO DO

• Go it alone
• Don’t communicate or educate
• Make entire project dependent on one person
• Promise more than you can deliver
THANKS FOR YOUR ATTENTION!

Special Thanks to:

- Phil Young, MD
- Dominik Fleischmann, MD
- Mike Walls, MD
- Mike Elliott, MD

xraydoc97@yahoo.com
http://stanford.edu/~hallett/NASCI%202014/