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

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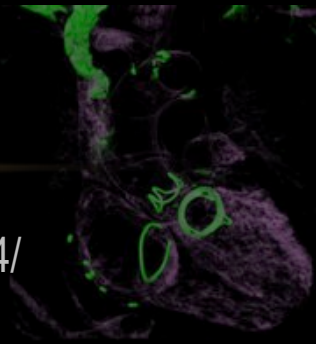
DISCLOSURES

- None

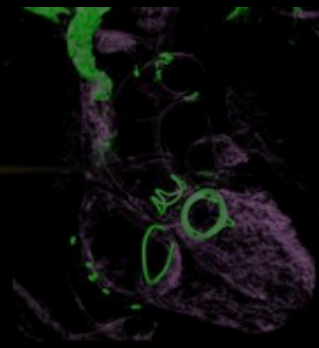


xraydoc97@yahoo.com

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

BACKGROUND

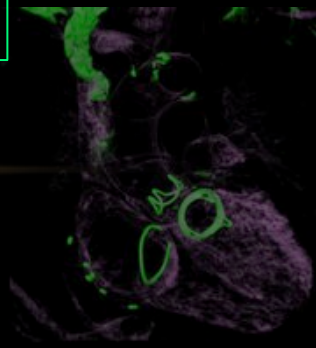
- Like other areas of medical imaging, building an effective CV imaging practice requires:
  - Appropriate Utilization
  - Appropriate Protocols
  - Appropriate Communication: results, etc



OVERVIEW

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

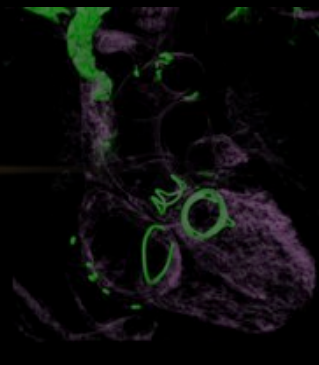
Must address all areas to build successful practice!!



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



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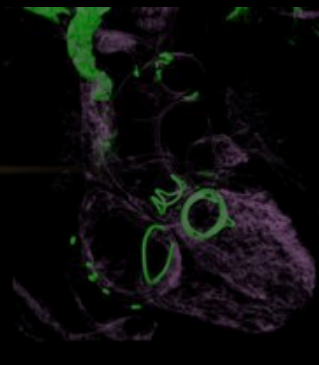
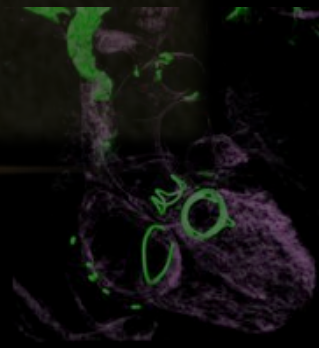


TURF ISSUES

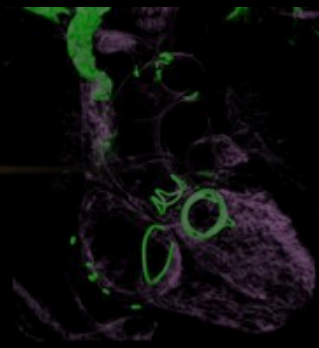
TURF ISSUES

- Is there an “enemy”? If so, who (or what)?
  - Cardiologist?
  - Radiologist?
  - Something Else?



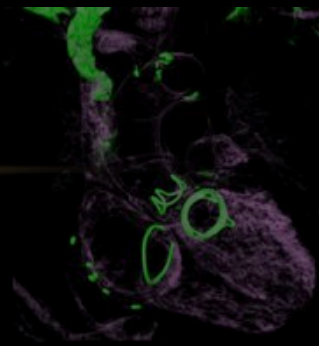
THE COMMON “ENEMY”

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



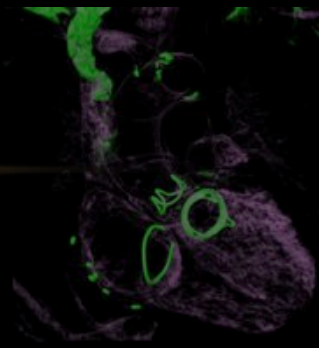
TURF ISSUES

- 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



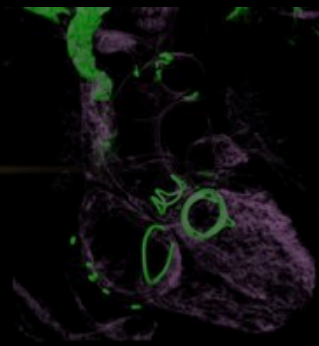
CVI AT ST. VINCENT HEALTH

- 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

THOMSON REUTERS
50 TOP CARDIO HOSPITALS 2012

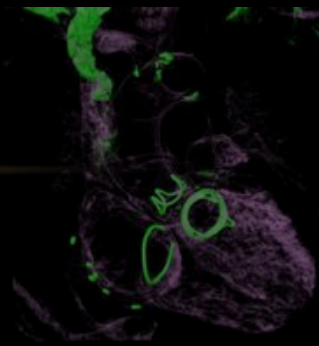
CVI AT ST. VINCENT HEALTH

- 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 ($)



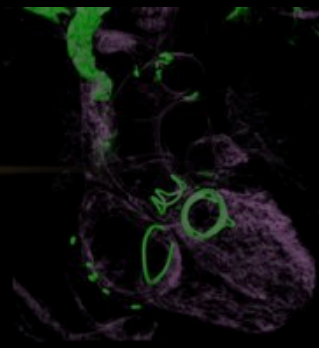
CVI AT ST. VINCENT HEALTH

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



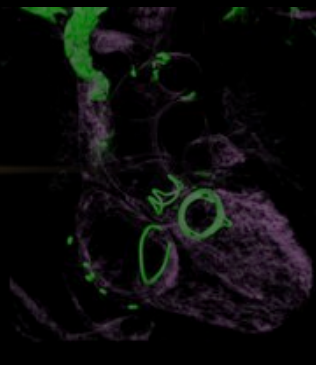
COLLABORATION

- 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



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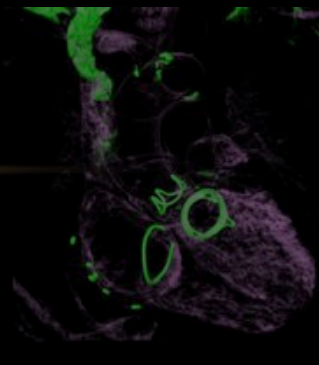
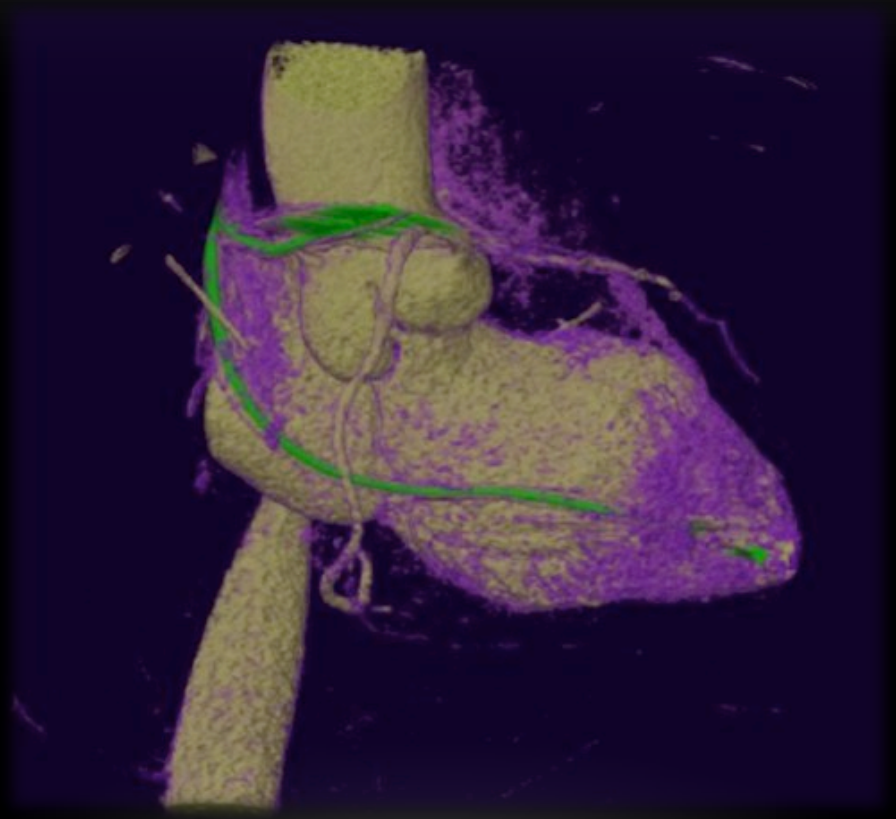
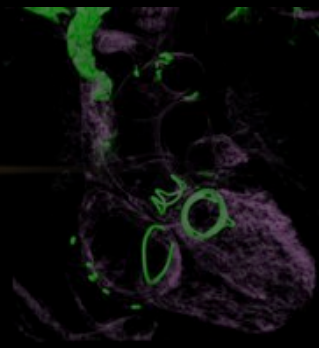


EDUCATING THE “CONSUMER”

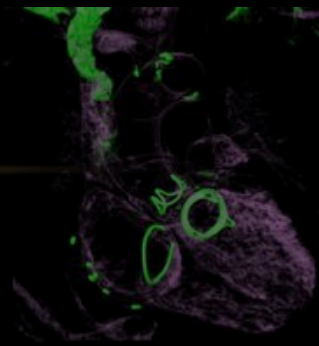




Case Study: Coronary CTA

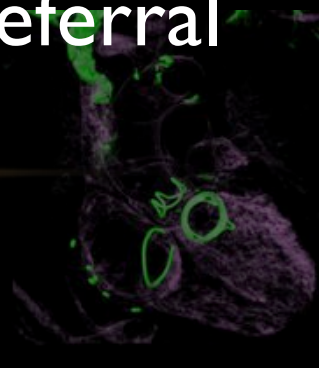
CCTA IS DISRUPTIVE TECHNOLOGY

- 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



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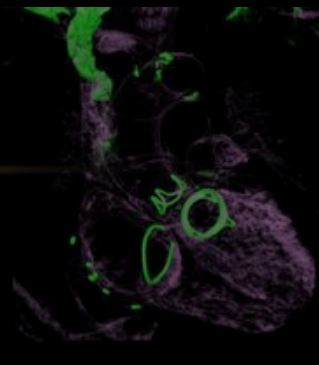
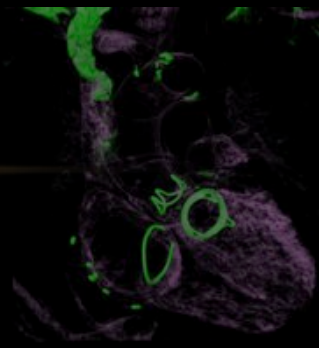
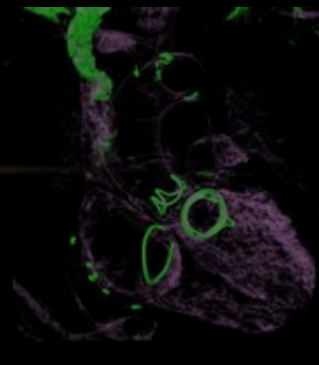


EXAM ORDERING



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

APPROPRIATE INDICATIONS: CORONARY AND CARDIAC CT (2011)

CLINICAL SCENARIO	FOR THESE INDICATIONS:	ORDER THIS:
SYMPTOMATIC, NONACUTE SX (? Ischemic Eq.) NO KNOWN Heart Disease	•LOW Pre-test Probability: ECG uninterpretable OR unable to exercise •INTERMEDIATE Pre-Test Probability (+/- ECG interpretable, can exercise)	CCTA
SYMPTOMATIC, ACUTE SX (Urgent Presentation) NO KNOWN Heart Disease	LOW OR INTERMEDIATE: •Normal ECG and biomarkers OR ECG uninterpretable OR ECG / biomarkers non-diagnostic	CCTA
PRIOR TEST RESULTS	•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	CCTA
SYMPTOMATIC	Evaluate suspected CORONARY ANOMALIES	CCTA
NEW DX OR ONSET HEART FAILURE (NO PRIOR CAD)	LOW OR INTERMEDIATE RISK patients with reduced EF	CCTA
CARDIAC MASS / THROMBUS / VALVULAR DISEASES / PERICARDIAL EVAL. CONGENITAL HEART DISEASE	•If limited info from Echo, TEE, or MRI (problem solving) •STRUCTURE AND FUNCTION	Cardiac CT
RISK ASSESSMENT POST PCI OR CABG	•SYMPTOMATIC (ISCHEMIC EQUIVALENT) : EVALUATE GRAFT PATENCY •Prior to Re-Do CABG (assess positions and patency of bypass grafts- esp. LIMA)	CTA CHEST-BYPASS GRAFT
	ASYMPTOMATIC, PRIOR LEFT MAIN STENT (> 3mm)	CCTA
CORONARY CALCIUM SCORE	•INTERMEDIATE 10-YEAR RISK FOR CHD EVENTS (FRS = 10-20%) •LOW 10-YEAR RISK BUT FAMILY HISTORY OF PREMATURE CHD	CAC SCORE
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	

From: 1. Taylor AJ, et al. Circulation 2010; 122(21) e525-55.
2. Greenland P, et al. JACC 2007 49(3): 378-402

NWR Imaging Assistant: 317-328-5058

APPROPRIATE INDICATIONS: EMERGENCY DEPARTMENT CORONARY CTA (2013)

CLINICAL SCENARIO	FOR THESE INDICATIONS:	ORDER THIS:
SYMPTOMATIC - NONACUTE SX (? Ischemic Equivalent) NO KNOWN Heart Disease	•LOW Pre-test Probability: ECG uninterpretable OR unable to exercise •INTERMEDIATE Pre-Test Probability (+/- ECG interpretable, can exercise)	CCTA
SYMPTOMATIC - ACUTE SX (Urgent Presentation) NO KNOWN Heart Disease	LOW OR INTERMEDIATE: •Normal ECG and biomarkers OR ECG uninterpretable OR ECG / biomarkers non-diagnostic	CCTA
PRIOR TEST RESULTS	•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	CCTA
SYMPTOMATIC PATIENTS	Evaluate suspected CORONARY ANOMALIES	CCTA
NEW DX OR ONSET HEART FAILURE (NO PRIOR CAD)	LOW OR INTERMEDIATE RISK patients with reduced EF	CCTA
CONTRAINDICATIONS to CORONARY CTA: (MOST ARE RELATIVE)	•Weight >300 lbs or BMI >35 •Calcium Score >500 •Iodinated Contrast allergy (and not pre-medicated) •Contraindication to B-blocker, NTG •Severe Asthma or COPD •AFIB	

FRAMINGHAM RISK CALCULATOR:
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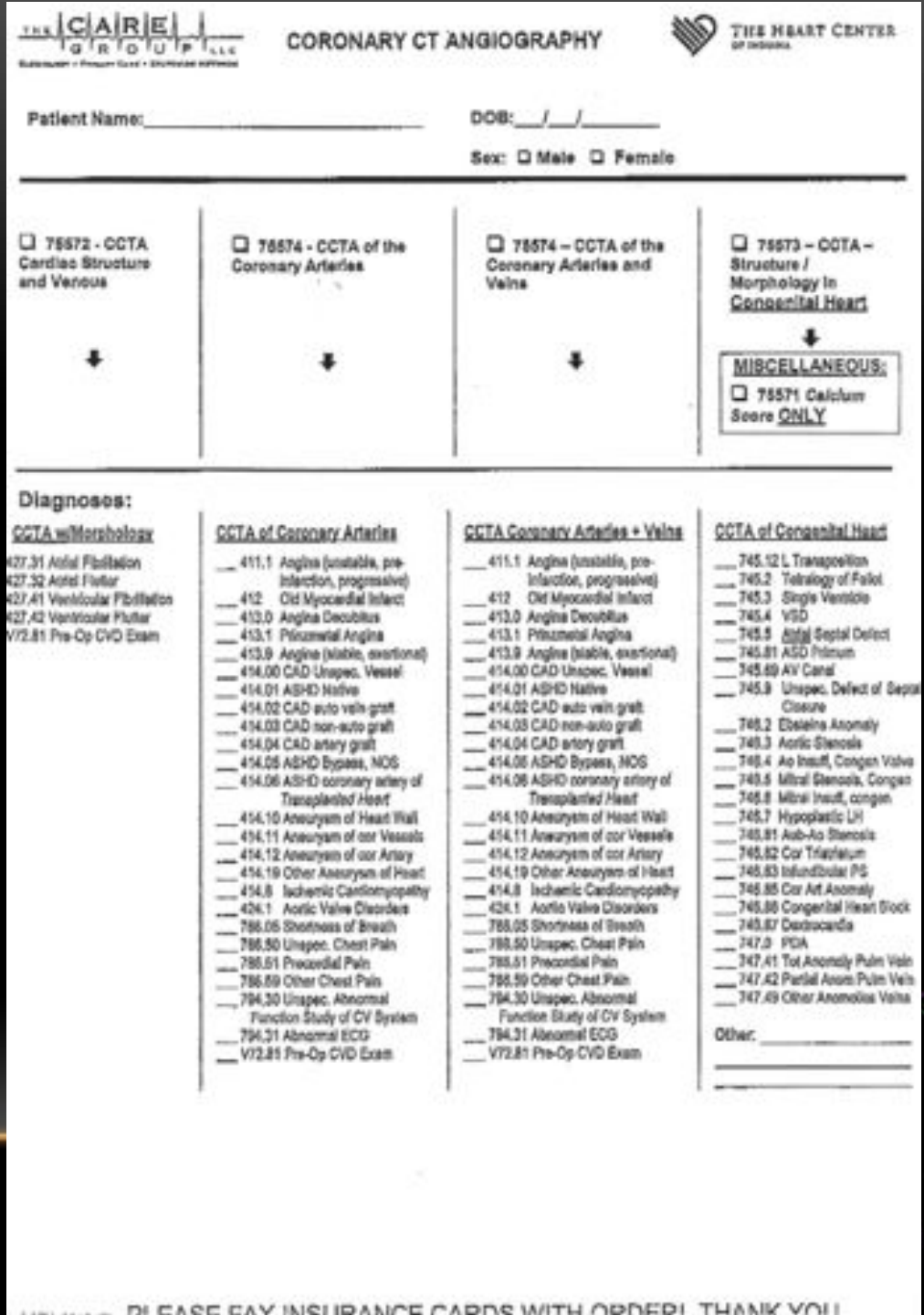
Cardiac CT Order Form (Outpatient)



THE CARE GROUP LLC

CORONARY CT ANGIOGRAPHY

THE HEART CENTER OF INDIANA

Patient Name:_____ DOB:__/__/_____

Sex: ☐ Male ☐ Female

☐ 75572 - CCTA Cardiac Structure and Venous

☐ 75574 - CCTA of the Coronary Arteries

☐ 75574 – CCTA of the Coronary Arteries and Veins

☐ 75573 – CCTA – Structure / Morphology in Congenital Heart

MISCELLANEOUS:
☐ 75571 Calcium Score ONLY

Diagnoses:

CCTA w/Morphology

427.31 Atrial Fibillation
427.32 Atrial Flutter
427.41 Ventricular Fibillation
427.42 Ventricular Flutter
V72.81 Pre-Op CVD Exam

CCTA of Coronary Arteries

___ 411.1 Angina (unstable, pre-Infarction, progressive)
___ 412 Old Myocardial Infarct
___ 413.0 Angina Decubitus
___ 413.1 Prinzmetal Angina
___ 413.9 Angina (stable, exertional)
___ 414.00 CAD Unspec. Vessel
___ 414.01 ASHD Native
___ 414.02 CAD auto vein graft
___ 414.03 CAD non-auto graft
___ 414.04 CAD artery graft
___ 414.05 ASHD Bypass, NOS
___ 414.06 ASHD coronary artery of *Transplanted Heart*
___ 414.10 Aneurysm of Heart Wall
___ 414.11 Aneurysm of cor Vessels
___ 414.12 Aneurysm of cor Artery
___ 414.19 Other Aneurysm of Heart
___ 414.8 Ischemic Cardiomyopathy
___ 424.1 Aortic Valve Disorders
___ 786.05 Shortness of Breath
___ 786.50 Unspec. Chest Pain
___ 786.51 Precordial Pain
___ 786.59 Other Chest Pain
___ 794.30 Unspec. Abnormal Function Study of CV System
___ 794.31 Abnormal ECG
___ V72.81 Pre-Op CVD Exam

CCTA Coronary Arteries + Veins

___ 411.1 Angina (unstable, pre-Infarction, progressive)
___ 412 Old Myocardial Infarct
___ 413.0 Angina Decubitus
___ 413.1 Prinzmetal Angina
___ 413.9 Angina (stable, exertional)
___ 414.00 CAD Unspec. Vessel
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CCTA of Congenital Heart

___ 745.12 L Transposition
___ 745.2 Tetralogy of Fallot
___ 745.3 Single Ventricle
___ 745.4 VSD
___ 745.5 Atrial Septal Defect
___ 745.61 ASD Primum
___ 745.69 AV Canal
___ 745.9 Unspec. Defect of Septal Closure
___ 746.2 Ebsteins Anomaly
___ 746.3 Aortic Stenosis
___ 746.4 Ao Insuff, Congen Valve
___ 746.5 Mitral Stenosis, Congen
___ 746.6 Mitral Insuff, congen
___ 746.7 Hypoplastic LH
___ 746.81 Asb-Ao Stenosis
___ 746.82 Cor Triatriatum
___ 746.83 Infundibular PS
___ 746.85 Cor Art Anomaly
___ 746.86 Congenital Heart Block
___ 746.87 Dextrocardia
___ 747.0 PDA
___ 747.41 Tot Anomaly Pulm Vein
___ 747.42 Partial Anom Pulm Veins
___ 747.49 Other Anomalies Veins

Other: _____

PLEASE FAX INSURANCE CARDS WITH ORDER! THANK YOU

Outpatient Cardiac CT Patient Prep Form

Patient Preparation / Info

ORDERING PHYSICIAN SIGNATURE: _____

Please fax the following information to (317) 583-5425 before the date of the exam:

_____ dosage of Beta Blockers

_____ Heart Rate _____ Blood Pressure

_____ BUN _____ CR
(less than one month old)

Test Date:

Time:

The Heart Center of Indiana
10580 N. Meridian
Indpls., IN 46290
(317) 583-5151
(317) 583-5425 FAX

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 w/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-medicate 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. Arial 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

Referring Physician: _____

Fax number for results: _____

CCTA 10-2008 PLEASE FAX INSURANCE CARDS WITH ORDER! THANK YOU.

CCTA Reporting Form

Name: _____

MRN: _____

Northwest Radiology Network

Coronary CTA Preliminary Interpretation

Study Date __ __/__ __/__ __ __ __
mo day year

FACILITY: _____

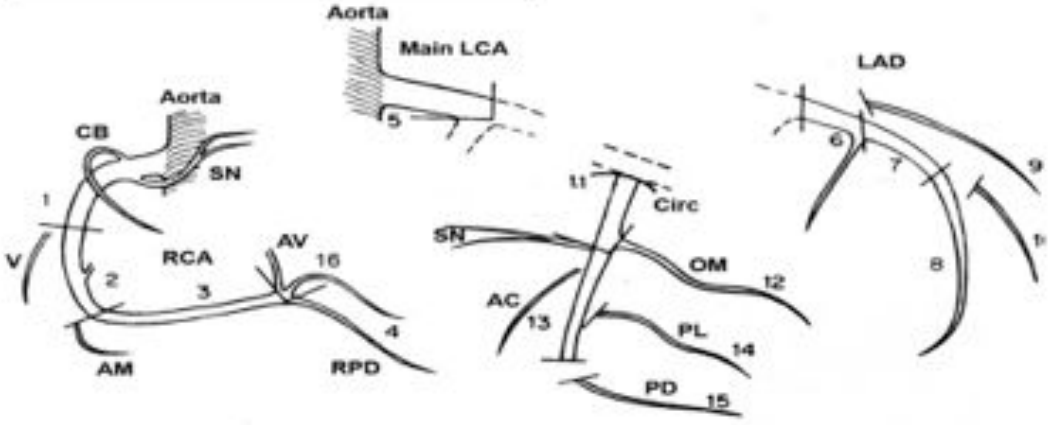
RADIOLOGIST: _____

TIME OF WET READ: _____

CALCIUM SCORE: _____

OTHER FINDINGS:

FINDINGS	
Vessel segment	Stenosis or Occlusion
RCA	
PROX (1)	
MID (2)	
DISTAL (3)	
PDA (4)	
LEFT MAIN (5)	
LAD	
PROX (6)	
MID (7)	
DISTAL (8)	
DIAG1 (9)	
DIAG2 (10)	
LCX	
PROX (11)	
OM1 (12)	
DISTAL (13)	
OM2 (14)	
PDA (15)	
RAMUS (17)	
Other____	



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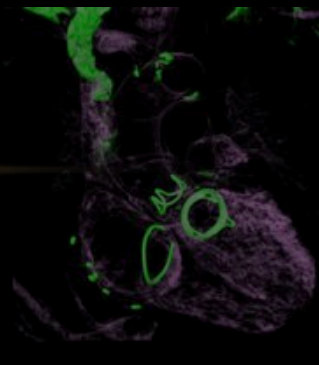
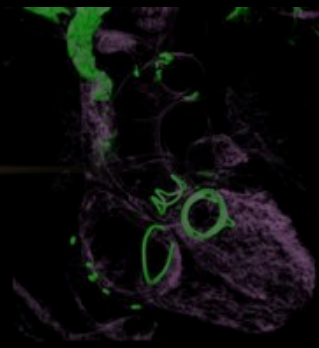
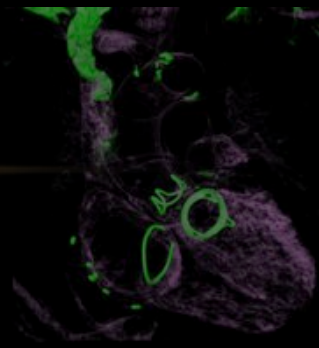


PROVIDE A QUALITY PRODUCT



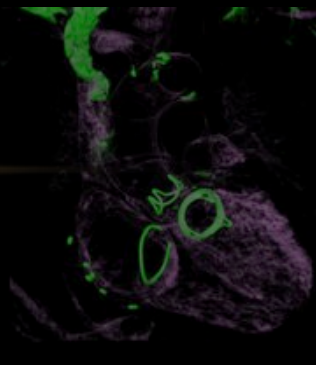
PROVIDE A QUALITY PRODUCT

- 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



NASCI EDUCATION

NASCI North American Society for Cardiovascular Imaging

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Table of Contents

NASCI Curriculum

- Physiological aspects of cardiac imaging
- Anatomy of the heart and great vessels
- Techniques for imaging the heart and great vessels
- Congenital heart disease: basic
- Unusual congenital heart disease: advanced
- Ischemic heart disease
- Valvular disease
- Cardiac and pericardial masses
- Acquired disease of the thoracic aorta
- Cardiomyopathy
- Diseases of the pericardium
- Miscellaneous
- Physics
- 3-D Imaging and post-processing
- Radiation
- Evidence-based Cardiovascular Imaging

NASCI Curriculum - Table of Contents

Objectives:

- To provide fellowship directors and fellows with a list of topics that should be covered in a 1-year curriculum in cardiac imaging.
- To provide practicing radiologists with a list of the fundamental knowledge and skills necessary to be valuable consultants to cardiologists, cardiothoracic surgeons, and other referring physicians.

Topics:

1. Physiological aspects of cardiac imaging
   - A. Normal cardiac cycle
   - B. Electrocardiography
   - C. Physiological anatomy of cardiac muscle
   - D. Mechanics of cardiac contraction
   - E. Physical basis for blood flow, pressure, and resistance
2. Anatomy of the heart and great vessels
   - A. Normal morphology and structure
   - B. Segmental anatomy of the heart
   - C. Normal adult heart measurements
3. Techniques for imaging the heart and great vessels
   - A. Radiography
   - B. Computed tomography
   - C. Magnetic resonance imaging
   - D. Cardiac scintigraphy (including PET)
   - E. Other (working understanding)
4. Congenital heart disease: basic
   - A. Cyanotic versus acyanotic presentations
   - B. Most common lesions

- Online CV Imaging Curriculum:

  http://www.nasci.org/Education/CardiovascularImagingCurriculum/TableofContents.aspx

North American Society for Cardiovascular Imaging
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Reston, VA 20191
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info@nasci.org

Cardiomyopathy

General Articles/Presentations

- **ACCF/ACR/AHA/NASCI/SCMR 2010 Expert Consensus Document on Cardiovascular Magnetic Resonance**
  Hundley, W. Gregory, Bluemke, David A., Finn, J. Paul, Flamm, Scott D., Fogel, Mark A., Friedrich, Matthias G., Ho, Vincent B., Jerosch-Herold, Michael, Kramer, Christopher M., Manning, Warren J., Patel, Manesh, Pohost, Gerald M., Stillman, Arthur E., White, Richard D., Woodard, Pamela K.
  J Am Coll Cardiol 2010 0: j.jacc.2009.11.011

A. Hypertrophic

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

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

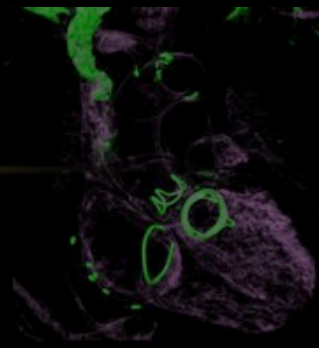
- **MRI in nonischemic acquired heart disease**
  Ordovás KG, Reddy GP, Higgins CB.
  J Magn Reson Imaging. 2008 Jun;27(6):1195-213

- **Magnetic Resonance Imaging of Hypertrophic Cardiomyopathy** (Abstract)
  Cannavale, Alessandro; Ordovás, Karen G.; Rame, Eduardo J.; Higgins, Charles B.
  Journal of Thoracic Imaging. 25(4):W121-W123, November 2010 doi: 10.1097/RTI.0b013e3181ced17a

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

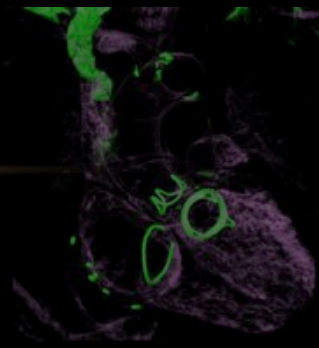
INTERPRETATION OF DATA

- 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



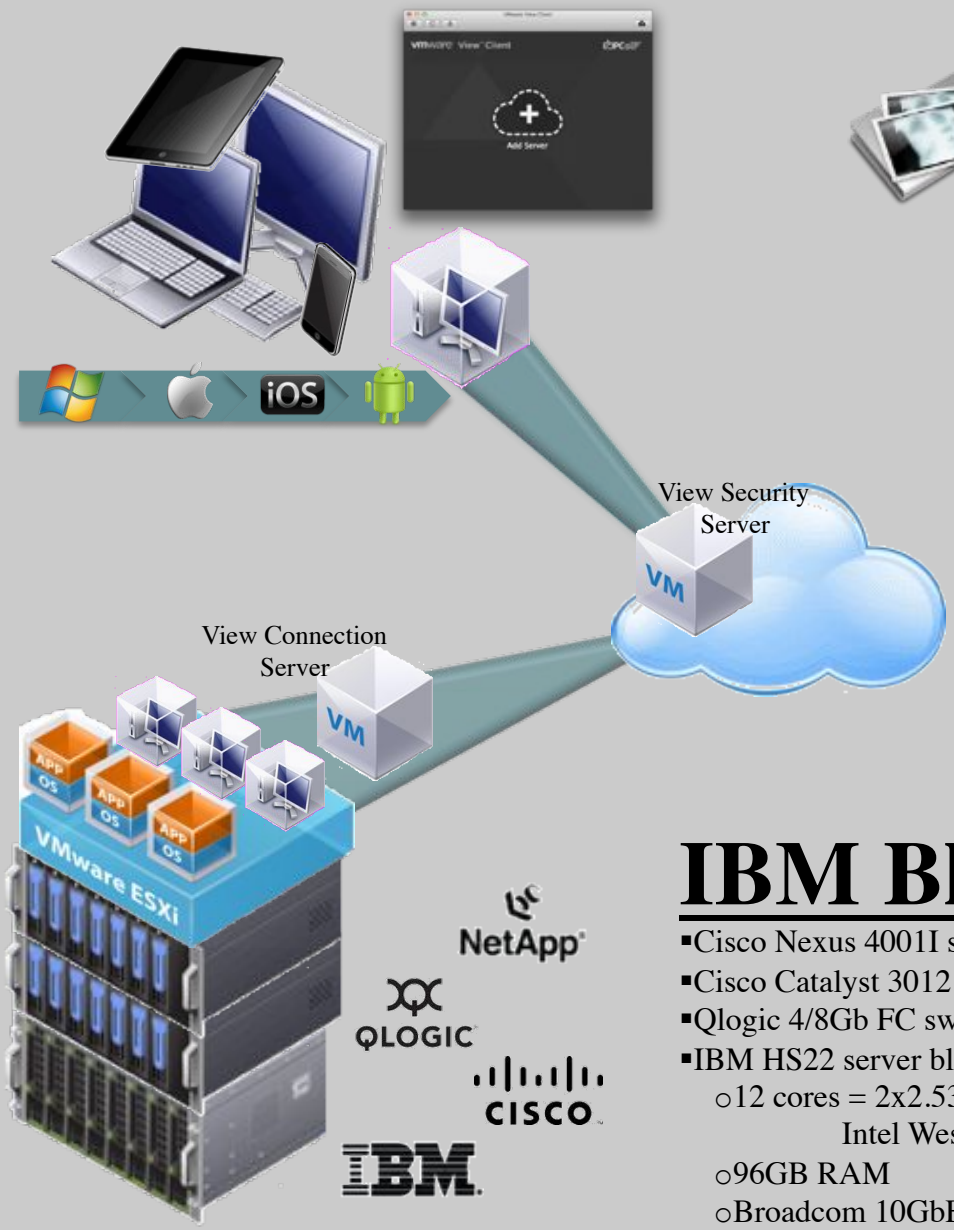
LEVERAGE TECHNOLOGY

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



NorthwestRadiologyNetwork
"Trusted Imaging Since 1967"

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

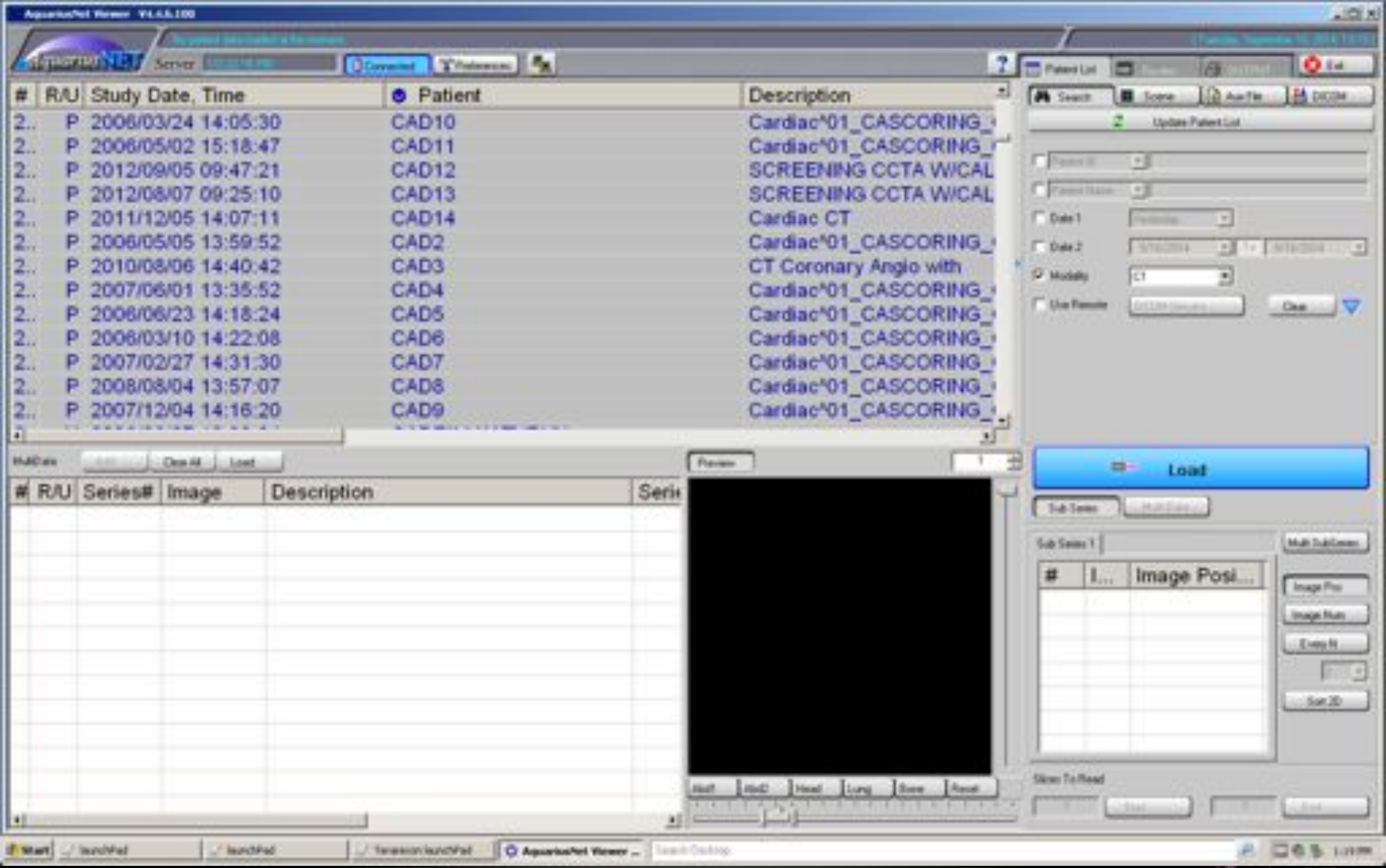
IBM BladeCenter H

- 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

Powered By NWR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2.. P 2006/05/02 15:18:47 CAD11 Cardiac^01_CASCORING_
2.. P 2012/09/05 09:47:21 CAD12 SCREENING CCTA W/CAL
2.. P 2012/08/07 09:25:10 CAD13 SCREENING CCTA W/CAL
2.. P 2011/12/05 14:07:11 CAD14 Cardiac CT
2.. P 2006/05/05 13:59:52 CAD2 Cardiac^01_CASCORING_
2.. P 2010/08/06 14:40:42 CAD3 CT Coronary Angio with
2.. P 2007/06/01 13:35:52 CAD4 Cardiac^01_CASCORING_
2.. P 2006/06/23 14:18:24 CAD5 Cardiac^01_CASCORING_
2.. P 2006/03/10 14:22:08 CAD6 Cardiac^01_CASCORING_
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2.. P 2007/12/04 14:16:20 CAD9 Cardiac^01_CASCORING_
Update Patient List
Load
R/U Series# Image Description
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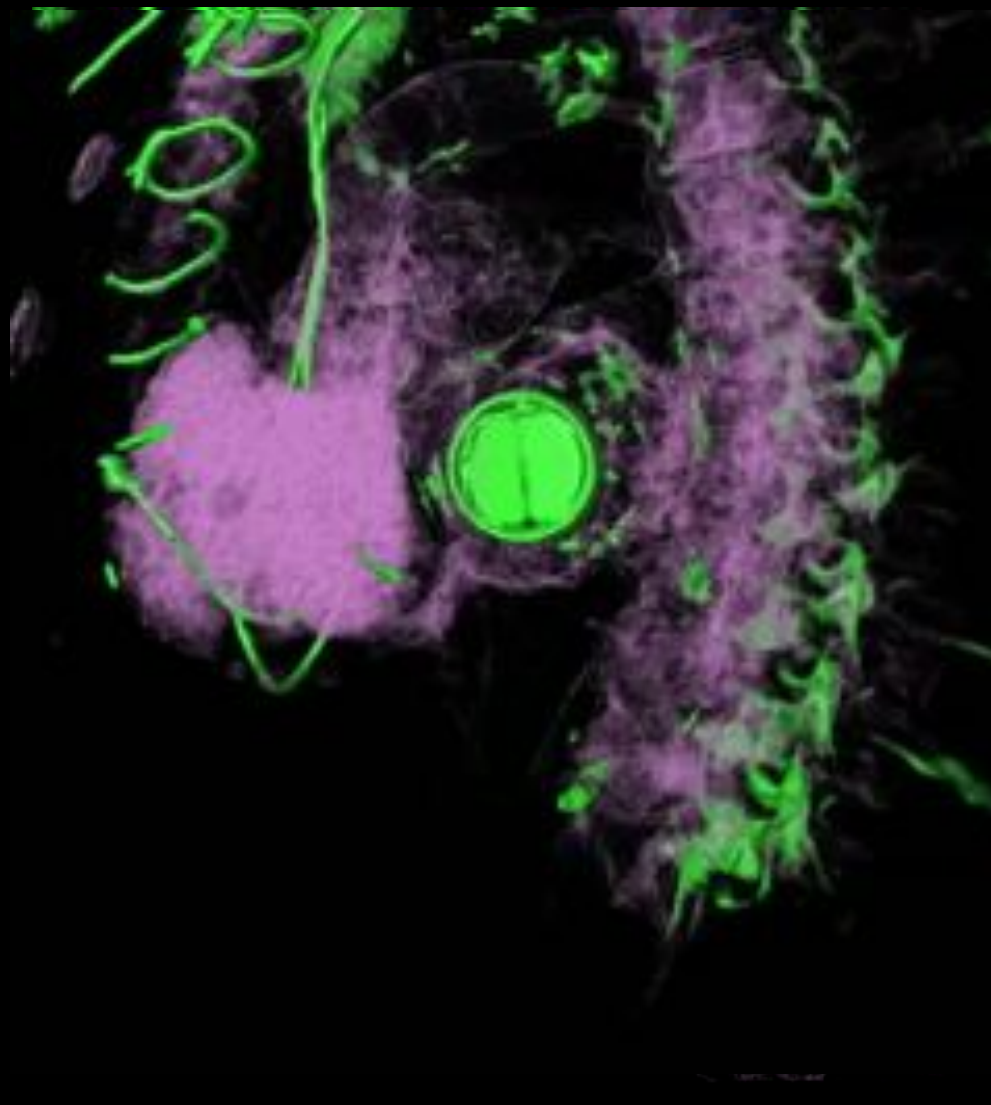
COMMUNICATE RESULTS EFFICIENTLY

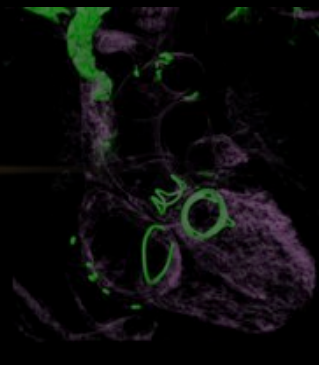
- Phone calls!!
- Reports
  - Structured reporting (consistent)
  - VR shortcuts
- Images
  - To referring Docs
  - To PACS



KEYS TO BUILDING A PRACTICE

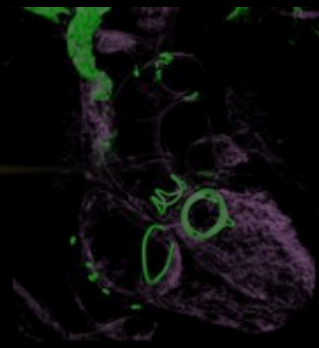
- Resolve Turf Issues
- Educate the “consumer”
- Make ordering the appropriate exam easy

  (Make reimbursement more likely)
- Provide quality product, Communicate Results Efficiently
- Value-Added services



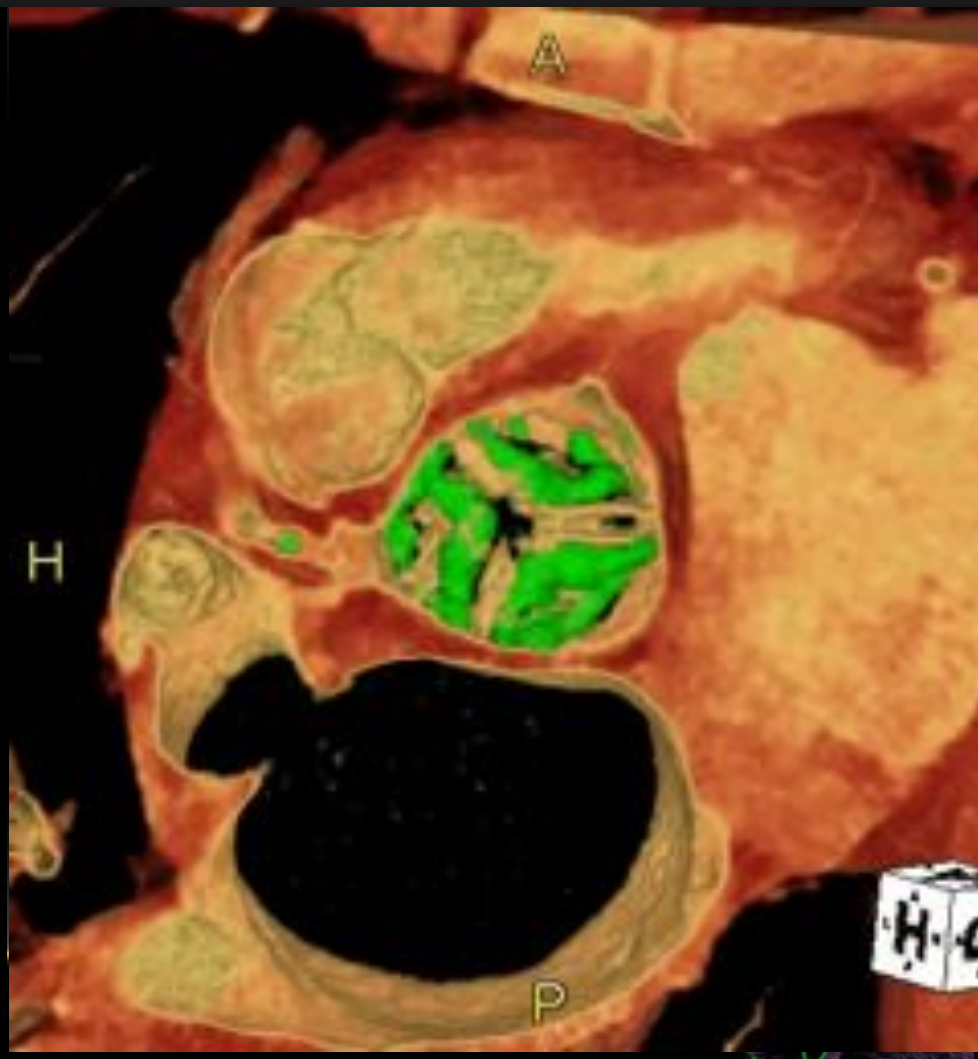
VALUE ADDED SERVICES

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



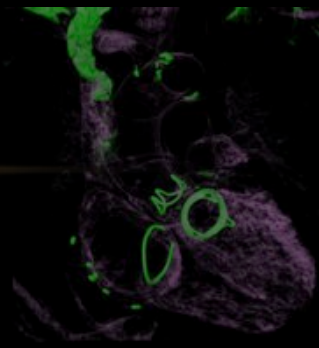
[1] http://webcast.jhu.edu/mediasite/Catalog/pages/catalog.aspx?catalogId=7e18b7d5-9c63-487e-aaf1-77a86f83b011

VALUE ADDED: TAVI STUDIES



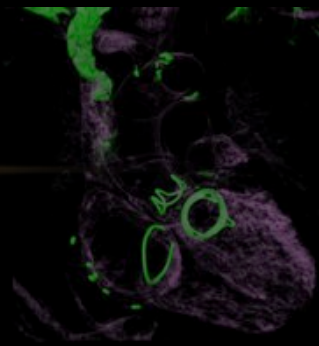
SUMMARY: WHAT TO DO

- 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!

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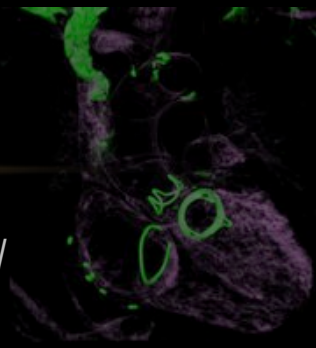
- *Mike Elliott, MD*



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