CTA OF THE EXTRACORONARY HEART

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NO DISCLOSURES

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CARDIAC CASE DISTRIBUTION

- Coronary CTA – 30%
- ED chest pain – 10%
- Post-CABG -10%
- Other – 50%
  - Congenital HD
  - Valves
  - Pulmonary Veins – RF ablation
  - Tumor
  - Perfusion, dysplasia
CARDIAC CT

Outline

- Technical Aspects
- Extra-coronary cardiac CT
  - Chambers
  - Valves
  - Masses
  - Congenital
- Function and perfusion
- Interactive Workstation
TECHNICAL ASPECTS
CORONARY vs EXTRACORONARY CTA

CONSIDERATIONS
• TYPE OF ECG-GATING
• CONTRAST INJECTION
• LENGTH OF SCAN
CLASSIC ECG-GATING IN MDCT

Prospective
- part of cardiac cycle
- Lower radiation
- HR sensitive (<65bpm)
- Ca Scoring

Retrospective
- entire cardiac cycle
- Higher radiation
- less sensitive to HR
- Coronary CTA
RETROSPECTIVE GATING
DOSE MODULATION

Retrospective ECG Tagging

Tube output (x-ray) ON

Spiral Acquisition

Retrospective ECG Tagging With Dose Modulation

Maximum tube output (100%)

Reduced tube output (20%)

Spiral Acquisition
<table>
<thead>
<tr>
<th>Coronary CTA</th>
<th>Extracoronary CTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Prospective is preferred</td>
<td>● Indications often require function</td>
</tr>
<tr>
<td>● Retrospective if:</td>
<td>● Retrospective more often used</td>
</tr>
<tr>
<td>» High or irregular heart rate</td>
<td>● If prospective used, looser HR/BMI limitations 2º less strict IQ needs</td>
</tr>
<tr>
<td>» Large BMI</td>
<td></td>
</tr>
<tr>
<td>» Need functional info</td>
<td></td>
</tr>
</tbody>
</table>
TECHNICAL ASPECTS

CONTRAST ADMINISTRATION

CARDIAC CTA (Majority)
Test injection
  » 20 ml @ 6 cc/sec
• Injection protocol
  » 80 ml (100%) @ 6 cc/sec
  » 40 ml (50/50) @ 5 cc/sec
  » 50 ml (saline) @ 5 cc/sec
• Bolus tracking
• 100 CC

CARDIAC CT (R sided)
• Test injection
  » 20 ml @ 6 cc/sec
• Injection protocol
  » 80 ml (100%) @ 6 cc/sec
  » 50 ml (saline) @ 2 cc/sec
  » 50 ml (saline) @ 5 cc/sec
• Bolus tracking
• 130 CC

Courtesy: MedRad
CONTRAST ADMINISTRATION

CARDIAC CTA (Majority)  CARDIAC CT (R sided)
LENGTH OF SCAN
ITERATIVE RECONSTRUCTION (225 LB.)

FBP

Iterative Recon
SPECIFIC DISEASE OUTLINE

- Chambers
- Valves
- Masses
- Congenital
- LV analysis (function, perfusion)
CHAMBERS – CARDIAC VIEWS

Axial

4CH

2CH VLA

2CH SA
LEFT ATRIAL EVALUATION

- Treatment for Atrial Fibrillation
- Radiofrequency ablation
- Probing tool destroys abnormal conduction pathways in LA
- Risk of post-procedure pulmonary vein stenosis
LEFT ATRIAL EVALUATION
LEFT ATRIAL EVALUATION
LEFT ATRIAL EVALUATION

“NORMAL”

VARIANT
LEFT ATRIAL EVALUATION-COMPLICATION
LEFT ATRIAL EVALUATION - STENOSIS

18 (5%) of 335 pts developed pulmonary vein stenosis post RF ablation for AF

Table 2. Summary of Clinical and Radiologic Findings and Pulmonary Vein Interventions in 18 Patients*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ablated pulmonary veins, n</td>
<td></td>
</tr>
<tr>
<td>LSPV</td>
<td>17</td>
</tr>
<tr>
<td>LIPV</td>
<td>17</td>
</tr>
<tr>
<td>RSPV</td>
<td>13</td>
</tr>
<tr>
<td>RIPV</td>
<td>11</td>
</tr>
<tr>
<td>Patients with symptoms at clinical presentation, n (%)</td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>7 (39)</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>8 (44)</td>
</tr>
<tr>
<td>Pleuritic pain</td>
<td>4 (22)</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>5 (28)</td>
</tr>
<tr>
<td>None</td>
<td>8 (44)</td>
</tr>
<tr>
<td>Patients with abnormal results on chest radiography, n (%)</td>
<td></td>
</tr>
<tr>
<td>Parenchymal consolidation</td>
<td>7 (78)</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>5 (56)</td>
</tr>
<tr>
<td>Veins with &gt;70% stenosis on CT scan/veins, n/n</td>
<td></td>
</tr>
<tr>
<td>LSPV</td>
<td>12/3</td>
</tr>
<tr>
<td>LIPV</td>
<td>13/4</td>
</tr>
<tr>
<td>RSPV</td>
<td>3/1</td>
</tr>
<tr>
<td>RIPV</td>
<td>3/1</td>
</tr>
<tr>
<td>Veins with &gt;70% stenosis on angiography, n</td>
<td></td>
</tr>
<tr>
<td>LSPV</td>
<td>9</td>
</tr>
<tr>
<td>LIPV</td>
<td>10</td>
</tr>
<tr>
<td>RSPV</td>
<td>3</td>
</tr>
<tr>
<td>RIPV</td>
<td>1</td>
</tr>
<tr>
<td>Not performed</td>
<td>6</td>
</tr>
<tr>
<td>Patients with pulmonary vein intervention, n (%)</td>
<td></td>
</tr>
<tr>
<td>Balloon angioplasty</td>
<td>12 (67)</td>
</tr>
<tr>
<td>Balloon angioplasty plus stent</td>
<td>8 (44)</td>
</tr>
</tbody>
</table>

* CT = computed tomography; LIPV = left inferior pulmonary vein; LSPV = left superior pulmonary vein; RIPV = right inferior pulmonary vein; RSPV = right superior pulmonary vein.

From: Saad Ann Int Med, 2003
LA RF ABLATION COMPLICATION

ATRIOESOPHAGEAL FISTULA

Courtesy: S. Aquino MD
LA THROMBUS
LV ANEURYSM
PSEUDOANEURYSM
CARDIAC VALVES
BICUSPID AORTIC VALVE

- 1-2% of population
- M:F = 2:1
- Predisposition to AS, usually in middle age
- Assoc with coarctation, William’s Sx
AORTIC STENOSIS

- Planimetric measurements of AVA with retrospectively electrocardiographically gated 16-detector row CT allow classification of AS that is similar to that achieved with measurements by using echocardiographic methods.

AORTIC REGURGITATION
AORTIC REGURGITATION
AORTIC REGURGITATION

- Results of assessment of AR with 64-section CT are similar to those with TTE.

Alkadhi H. Radiology. 2007;245:111
SUBAORTIC STENOSIS
REFORMATS
AORTIC VALVE – PRE/POST-OP
TRANSCATHETER AORTIC VALVE IMPLANTATION (TAVI OR TAVR)
TAVI - POST-OPERATIVE
AORTIC VALVE COMPLICATION
AORTIC VALVE COMPLICATION
POST-OP ASSESSMENT
MITRAL VALVE ASSESSMENT
Mitral valve leaflet calcification on MDCT indicates mitral valve sclerosis or stenosis.

MITRAL VALVE PROSTHESES
PULMONIC VALVE ASSESSMENT
PULMONIC VALVE ASSESSMENT
TRICUSPID
MASSES
CARDIAC THROMBUS
CARDIAC THROMBUS
CARDIAC MASSES

Lipomatous Hypertrophy
WHERE’S THE MASS
CARDIAC TUMOR

Hepatoma
CARDIAC TUMOR

Angiosarcoma
CARDIAC TUMOR

Right atrial osteosarcoma
CONGENITAL HEART DISEASE

- **Valvular**
  - Bicuspid aortic valve
  - Pulmonic stenosis
  - Tricuspid (Ebstein’s anomaly)

- **Left to right shunts**
  - Atrial septal defect (most common)
  - Ventricular septal defect
  - Patent ductus arteriosus

- **Complex**
  - Tetralogy of Fallot
  - Transposition of great vessels
  - Miscellaneous

- **Post-operative**
CT FOR CHD - PRINCIPLES

- Ideally, adults (radiation concern)
- Children for optimal 3D recons
- In younger children
  - Sedation
  - Hand injection
  - Non-gated often
  - 240-300 mg/mL concentration
ATRIAL SEPTAL DEFECT

- Most common adult CHD
- F>M – 3:1
- Secundum (75%), primum, and sinus venosus types
- Fatigue, SOB, atrial arrhythmias
- Consider transcatheter closure
VENTRICULAR SEPTAL DEFECT

- 2nd most common adult CHD
- Usually small
- Membranous, muscular, supracristal
- Dyspnea, pulmonary HTN
PATENT DUCTUS ARTERIOSUS

- Abnormal persistence after 10 days of life
- Fourth most common adult CHD abnormality
- Complications
  - Pulmonary hypertension
  - CHF
  - Aneurysm
PULMONIC STENOSIS

- 10% of CHD
- M=F
- Dysplastic leaflets
- Large Left PA, NL R PA due to post-stenotic jet
- Balloon dilatation
TETRALOGY OF FALLOT

VSD/RVH

Pulmonary Stenosis

Aortic override

Right aortic arch
LV ANALYSIS
Strong correlation between CT and MRI
LV function (r> 0.95)

Yamamuro Radiology 2005
LV FUNCTION/PERFUSION

ED Volume: 97.1 ml
ES Volume: 36.5 ml
Stroke Volume: 60.6 ml
Ejection Fraction: 62%
LV FUNCTION/PERFUSION
LV FUNCTION/PERFUSION
CARDIAC PERFUSION

Perfusion defect
CARDIAC PERFUSION DEFECT
THANK YOU