Valvular Imaging
Optimizing Data Acquisition and Interpretation

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Disclosures

• Medical Advisory Board Member
  – Partners Imaging
  – Perceptive Informatics
  – Magellan Healthcare

• Consultant / Editing / Authoring (honoraria):
  – EZEM
  – Siemens Medical Systems
  – Amirsys, Inc.

• Member, Board of Directors
  – Certification Board of Cardiovascular CT (CBCCT)
Role of cardiac CT
Aortic Valve
Stenotic Aortic Valve

LAA

RVOT

LA

RA
mA modulation according to EKG
mA modulation according to EKG
Aortic Valve with Tube Modulation
How to Reconstruct Raw Data?

Abbara et al. AJR 2007; 188(2): 356-60
Phase Definition is Vendor Dependent

HR = 60; R-R = 1000ms 50% reconstruction

Phase start = 500ms

Phase start = 500ms – ½, temporal window [~415ms]
Phase Definition is Vendor Dependent

HR=60; R-R = 1000ms 50% reconstruction

Phase start = 500ms

Rule of Thumb:

Siemens x% equivalent to GE, Philips, Toshiba x+10%

e.g. Siemens 35% ≈ to GE 45%

Relationship is dependent on HR, reconstruction algorithm (single vs. multi segment) and gantry rotation speed.
How to Reconstruct Raw Data?

Hr = 60 bpm

0ms 1000ms

Systole

Diastole

Hr = 100 bpm

0ms 600ms

Systole

Diastole

Abbara et al. AJR 2007; 188(2): 356-60
What Phase to choose for Planimetry?

Aortic Valve Opening Area

Phase Start (ms after R-peak)

Opening Area cm²

Abbara et al. 6th International Conference on Cardiac CT, 2005
Abbara et al. 6th International Conference on Cardiac CT, 2005
Incidence of Artifacts in the Aortic Valve

![Graph showing the incidence of artifacts at different phases with labels and data points.]

- 0ms: 38% double contour, 76% incomplete contour
- 50ms: 13% double contour, 25% incomplete contour
- 100ms: 5% double contour, 20% incomplete contour
- 150ms: 7% double contour, 26% incomplete contour
- 200ms: 43% double contour, 73% incomplete contour

What Phase to choose for Planimetry?

Aortic Regurgitation

Stenosis

A Soni, S Abbara. CT Assessment of Vavular Heart Disease. In: E Braunwald et al. Harrison’s Online. 2008
Aortic Valve Function

Aortic Regurgitation

Stenosis
Aortic stenosis: comparison of 16-MDCT and TEE

CT for quantification of Stenosis & Regurgitation Covered in Following Presentation by Dr. Hatem Alkadhi

Diagnosis of aortic valvular stenosis by multislice cardiac computed tomography

Erik Bouvier\(^1,2\)*, Damien Logeart\(^2\), Jean-Louis Sablayrolles\(^1\), Jacques Feignoux\(^1\), Claude Scheuble\(^3\), Thierry Touche\(^1\), Gabriel Thabut\(^3\), and Alain Cohen-Solal\(^2\)
Congenital Bicuspid Aortic Valve

RR Colen, JD Dodd, JB Roedl, RC Cury, S Abbara.
Bicuspid Aortic Valve with Stenosis
Sinus of Valsalva Aneurysm

Echocardiogram Normal
Sinus of Valsalva Aneurysm

Echocardiogram Normal
NC Sinus of Valsalva Aneurysm
R Sinus of Valsalva Aneurysm
Undersized Aortic Root replacement resulting in Aortic Cusp Prolapse
LV apical conduit
LV Apical Conduit
Infected Apical Aortic Conduit
Infected Apical Aortic Conduit
Artificial Valves
Mechanical Heart Valves

St. Judes Valve in 60yom pre PVI

Starr-Edwards silastic ball valve
St. Jude Mitral Valve Replacement
Tilting Disc Valve

Abbara S. Prosthetic Cardiac Valves. DI Cardiac. Amirsys Inc. 2007
Soni, Abbara. Assessment of valvular heart disease by CT.
In: E Braunwald et al. *Harrison’s Online*. 2008
Stuck Valve

Courtesy Dr. Stephan Achenbach
Stuck Valve

Courtesy Dr. Stephan Achenbach
Paravalvular Leak & Pulsating Pseudoaneurysms

Abbara S. Prosthetic Cardiac Valves. DI Cardiac. Amirsys Inc 2007
Mitral Valve
MR - Regurgitant Orifice Planimetry

Soni, Abbara. Assessment of valvular heart disease by CT. In: E Braunwald et al. Harrison’s
HCM S/P Myectomy to treat SAM
MV Prolapse

ER Ryan, S Abbara, RR Colen, S Arnous, M Quinn, RC Cury, JD Dodd. AJR 2008 in press.
Tricuspid Valve
Ebsteins anomaly
Carcinoid
Carcinoid

ER Ryan, S Abbara, ... JD Dodd. AJR 2008; 190:W294–W303
Pulmonic Valve
Thank you!
Sabbara@Partners.org
Thank you!

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MV prolaps (flail leaflet by ECHO)
Parachute Mitral Valve

- Chordae tendinae from both mitral leaflets converge to anterolateral papillary muscle

How to Reconstruct Raw Data?

Hr = 60 bpm

Hr = 100 bpm

Abbara et al. AJR 2007; 188(2): 356-60
AR due to Infective Endocarditis

Table 2  ACC/AHA grading of aortic stenosis according to cardiac CT and echocardiography

<table>
<thead>
<tr>
<th>Echocardiographic grading</th>
<th>Critical</th>
<th>Severe</th>
<th>Moderate</th>
<th>Mild</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT grading</td>
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<tr>
<td>Critical</td>
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<td>1</td>
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<tr>
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<td>1</td>
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<tr>
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<td>0</td>
</tr>
<tr>
<td>Mild</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 3  Bland and Altman analysis of aortic stenoses (≤200 mm$^2$).

AORTIC VALVULAR FIBROELASTOMA

• IMAGING:
  – <1.5mm, Short Thin Stalk, Flutters Or Prolapses
  – Atrial Surface Of AV Valves
  – Arterial Surface Of Semilunar Valves
  – Echo: Stippled Or "Shimmering Edge"

• TREATMENT:
  – Surgical Excision +/- Leaflet Repair
  – Valve Replacement

• PROGNOSIS:
  – No Recurrence Reported
Mitral Valve Regurgitation

Mitral Valve Regurgitation

$r = 0.922$
$P < 0.001$
$n = 19$

Ventriculography grading

MR due to Ischemic Dilated Cardiomyopathy

Thank you!

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