3D Echo Basics: Acquisition, Cropping and Display

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Uses of 3D Echocardiography

**Recommended**
- LV Volumes
- MV anatomy
- MV Stenosis
- Guidance of Transcatheter Procedures

**Promising Clinical Trials**
- LV Mass
- RV Volumes
- Ao Anatomy
- Ao Stenosis

**Areas of active Research**
- LV Shape
- LV Dyssynchrony
- LA Volumes
- MV Regurgitation
- Prosthetic Valves
**2D Image Quality**

- Before 3DE acquisition, the 2D image should be optimized
  - Poor 2D images, poor 3D images
Select Acquisition Mode

- **Zoom**
- **Narrow volume “live 3D”**
- **Wide angle/full volume**

Indications:
- Valves
- ASD
- VSD
- Small, fast moving structures
- Beware of losing spatial orientation
Narrow Volume

- Useful for procedures

Wide Angle/Full Volume

Narrow Volume vs Full Volume Acquisition

Narrow angle  Full volume
What acquisition mode to choose?

Narrow angle/Zoomed
- Valves
- Inter-atrial septum
- Inter-ventricular septum

Wide angle/Multi-beat
- LV
- RV
- Whole heart

Single or Multi-beat?

Single-beat acquisition
- acquisition of multiple pyramidal data sets per second in a single heartbeat

Single or Multi-beat?

ECG-triggered multiple-beat acquisition
Single or Multi-beat?

FV 1 beat - 4 Hz
FV 4 beats - 15 Hz

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<thead>
<tr>
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<th>Single Beat</th>
<th>Multi-beat</th>
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<tbody>
<tr>
<td>Advantage</td>
<td>Overcomes limitations from rhythm disturbances and respiratory motion</td>
<td>Advantages</td>
</tr>
<tr>
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<td>Images with higher temporal resolution</td>
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<tr>
<td>Disadvantage</td>
<td>Limited by poor temporal resolution</td>
<td>Disadvantages</td>
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<td>Gated images are susceptible to artifacts from respiratory motion or cardiac arrhythmias</td>
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Stitch Artifact

- MUST examine the imaging planes perpendicular to the sweep plane
- Apical 4-chamber acquisition check SAX/side
Check with Biplane Imaging/Multi-View

3DE color Doppler

Can be obtained with single beat or multi-beat
LV Cut Planes

- Transverse
- Sagittal
- Coronal

Short Axis (transverse)


Long Axis (sagittal)

From left: From right

Cropping

- Can be performed before or after data acquisition
- Before acquisition allows better temporal and spatial resolution
- However if cropped image is stored, image may not be amenable to ‘uncropping’
- Wide data set can be acquired and then cropped, retains information but at expense of spatial and temporal resolution

Apply Cut-planes

- Auto Crop
- Box Crop
- Plane Crop
Cut-Planes

- **Box Crop**
  - Auto Crop
  - Box Crop

Cut-Planes

- **Arbitrary Crop**
  (Plane)

Left Ventricle Display

- Volume Rendering
- Surface Rendering
- Wire-Frame
- 2D Tomographic Slices
Gain

↑ "Snow"
↓ Drop-out

Compress

↑ Transparent
↓ Solid

Vision

- Menu of predefined combinations of contrast, transparency, lighting and compositing algorithms
- Affects the spatial filtering and depth of colorization seen
- Ranges from A - H
Colorization
- Predefined Chroma maps which are colorized post-processing setting applied to the image data to highlight the data

Acquisition

Display

Lang, Badano et al. EAE/ASE 3D Guidelines JASE 2012

Lang, Badano et al. EAE/ASE 3D Guidelines JASE 2012.
Rotate to the left atrial on-face view

Rotate 90° to place the aortic valve at the 12 o'clock position

Standard mitral valve view from the left atrial perspective

Standard mitral valve view from the left ventricular perspective

Standard aortic valve view from the ascending aorta perspective. The right coronary cusp should be located at the 6 o'clock position

Standard aortic valve view from the left ventricular perspective. The right coronary cusp should be located at the 6 o'clock position

Use biplane views to check that the aortic valve annulus is centered within the acquisition plane

Use biplane views to check that the mitral valve annulus is centered within the acquisition plane