An Introduction to the Clinical Use of 3D Echo: Problems and Dilemmas

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THESSALONIKI, GREECE
3- Dimensional Echocardiography 2019

One step further for the assessment of:

- **Anatomy**
- **Volumes**
- **Myocardial Mass**
- **Myocardial Mechanics**
Imaging in 3 Dimensions

M-Mode 1973
2D Imaging 1977
Volumetric Imaging 1997
Different Modes of 3D Imaging
Rule # 1: A Good Acoustic Window is Essential for Optimal 3-D Visualization. Best Resolution at Axial Level
3D Acquisition Modes:
Narrow Angle versus Full-volume Imaging / Different Levels of Resolution Possible
Imaging Modes with a Matrix Phased Array Transducer
Real-Time vs ECG Gated Full Volume Imaging:
The inverse relationship between volume size, resolution and volume rate
Main Problem with Gating: Stiching Artifacts

Problem Solution:
- Breath Holding
- Stable Transducer Position
- Regular Heart Rhythm
Full Volume Mode Usually Requires Cropping
3D Full Volume Mode versus Live 3D Zoom

**TTE full volume 31 Hz**
- high frame rate
- large region
- limited resolution
- stitch artifacts
- needs cropping

**TTE live 3D zoom 9 Hz**
- direct live 3D view
- one-beat acquisition
- no stitch artifacts
- independence of rhythm and breathing
- limited resolution
- low frame rate
- small region

**TEE full volume 30 Hz**
- excellent resolution
- high frame rate
- large region
- stitch artifacts mainly from breathing

**TEE live 3D zoom 12 Hz**
- very good resolution
- direct live 3D view
- one-beat acquisition
- no stitch artifacts
- independent of rhythm and breathing

Low Frame Rate Small Region
Preferred Method for MV
3D Volume Rendering (to Visualize Anatomic Structures)

3D Object

Gain
Compress
Vision
Smoothing
Brightness

2D Image
Caution to Gain Settings! Does this Patient Have an ASD or is this a Dropout at Fossa Ovalis?

*The Effect of Gain Settings on 3-D Echo*
Caution to Gain Settings!
Can we accurately measure ASD size?

*The Effect of Gain Settings on 3-D Echo*
The Importance of Spatial Orientation
Normal Mitral Valve 3D Anatomy

Anatomic View

LA surgeon’s View

LV VIEW

Anterior
Mitral Valvuloplasty Ring

LA view

LV view
Prosthetic Valves - Colour Flow Doppler
Surface Rendering for LV volumes in Full Volume Data
Surface Rendering for LV volumes and Function in Full Volume Data
Full Volume- Multislice Rendering: En face images for MV area measurement
Full Volume- Multislice Rendering: Stress Contrast Echo
3 – D Echo Limitations

- 3-D can only visualize what is also seen on the 2-D image
- Operator experience with rendering and interpretation is also necessary
- 3-D image quality greatly depends on the quality of the 2-D image and the ability to obtain a motion and artifact free 3-D data set
- 3-D imaging only creates a “virtual sense of depth” on a 2-D screen
- Stiching artifacts with gated full volume acquisition
- Manual or automated endocardial tracing to obtain volumes can be subjected to errors