Tricks and tips for 3D visualization:

A practical approach to use in your lab

DANGERS OF 3D IMAGING

Karen G. Zimmerman, BS, ACS, RDCS, RVT, FASE

HAWAII
2020

ASE

1

Tricks and tips for 3D visualization:

A practical approach to use in your lab

DANGERS OF 3D IMAGING

Karen G. Zimmerman, BS, ACS, RDCS, RVT, FASE

Disclosures: None

HAWAII
2020

2

Time for echo to JUMP OUT of the 2D plane!

3

DANGERS OF 3D IMAGING

2 Major Dangers with 3D imaging:

- Parallax
- Color Doppler Artifacts

4

DANGERS OF 3D IMAGING

- **Parallax**

5

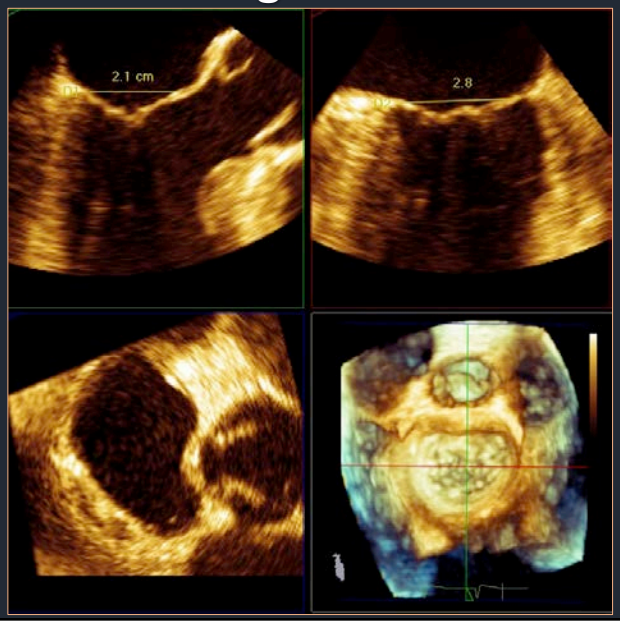
DANGERS OF 3D IMAGING

3D *en face* left atrial view

6

DANGERS OF 3D IMAGING
Alignment

Long axis



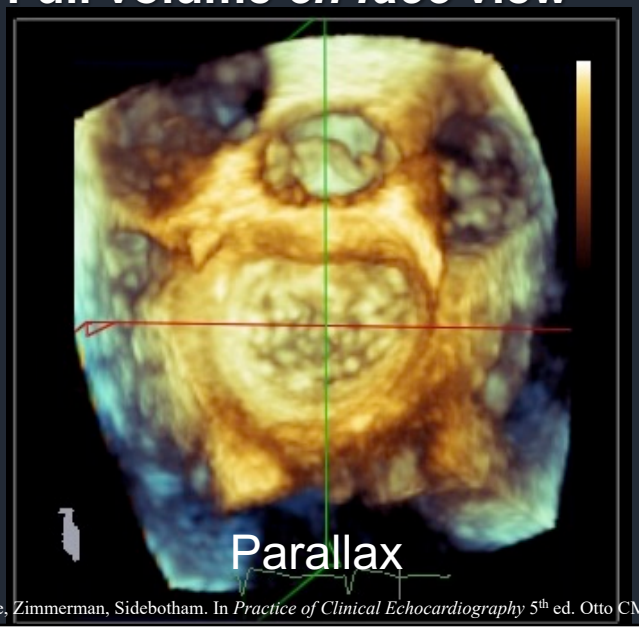
Commissural

Short axis

Full Volume

7

DANGERS OF 3D IMAGING
Full volume *en face* view

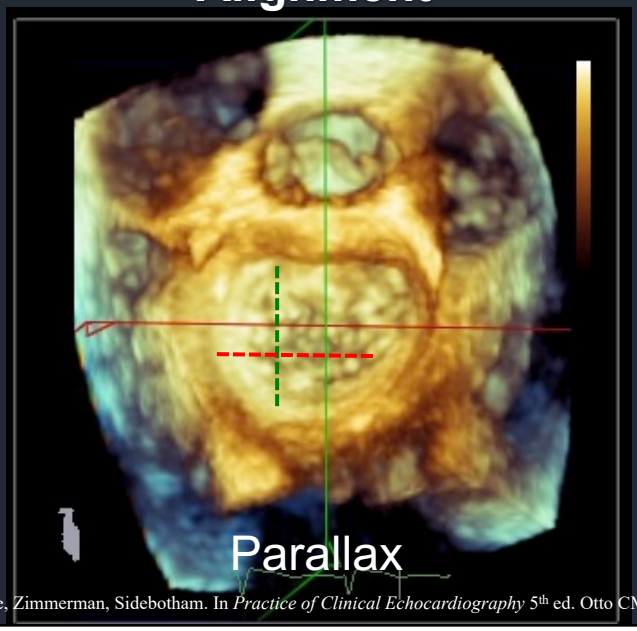


Drake, Zimmerman, Sidebotham. In *Practice of Clinical Echocardiography* 5th ed. Otto CM 2016

8

DANGERS OF 3D IMAGING

Alignment



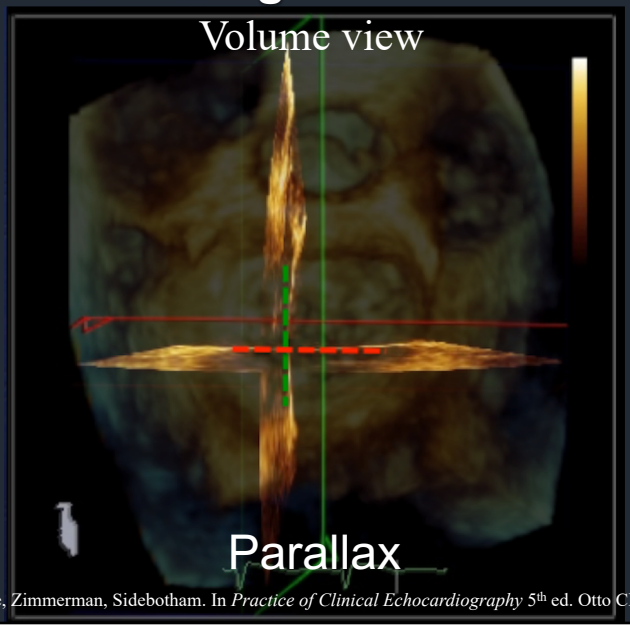
Drake, Zimmerman, Sidebotham. In *Practice of Clinical Echocardiography* 5th ed. Otto CM 2016

9

DANGERS OF 3D IMAGING

Alignment

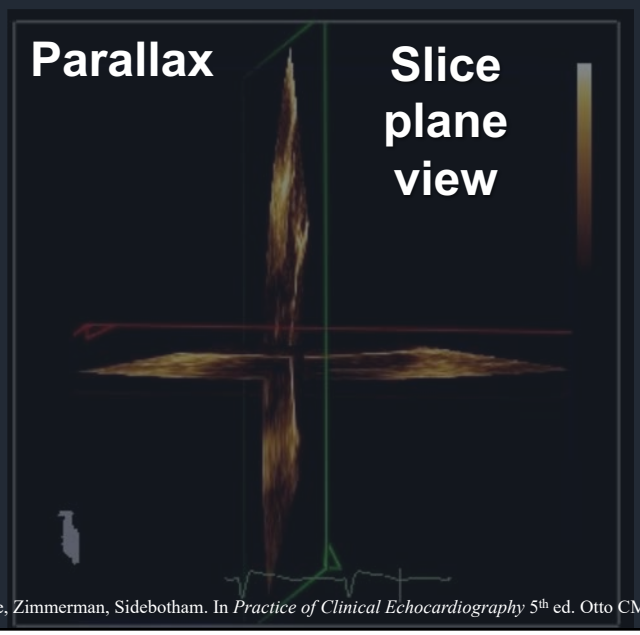
Volume view



Drake, Zimmerman, Sidebotham. In *Practice of Clinical Echocardiography* 5th ed. Otto CM 2016

10

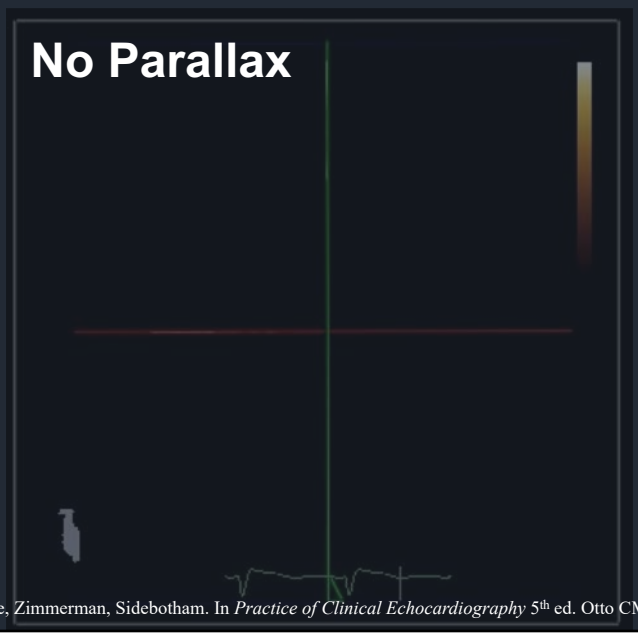
DANGERS OF 3D IMAGING



Drake, Zimmerman, Sidebotham. In *Practice of Clinical Echocardiography* 5th ed. Otto CM 2016

11

DANGERS OF 3D IMAGING

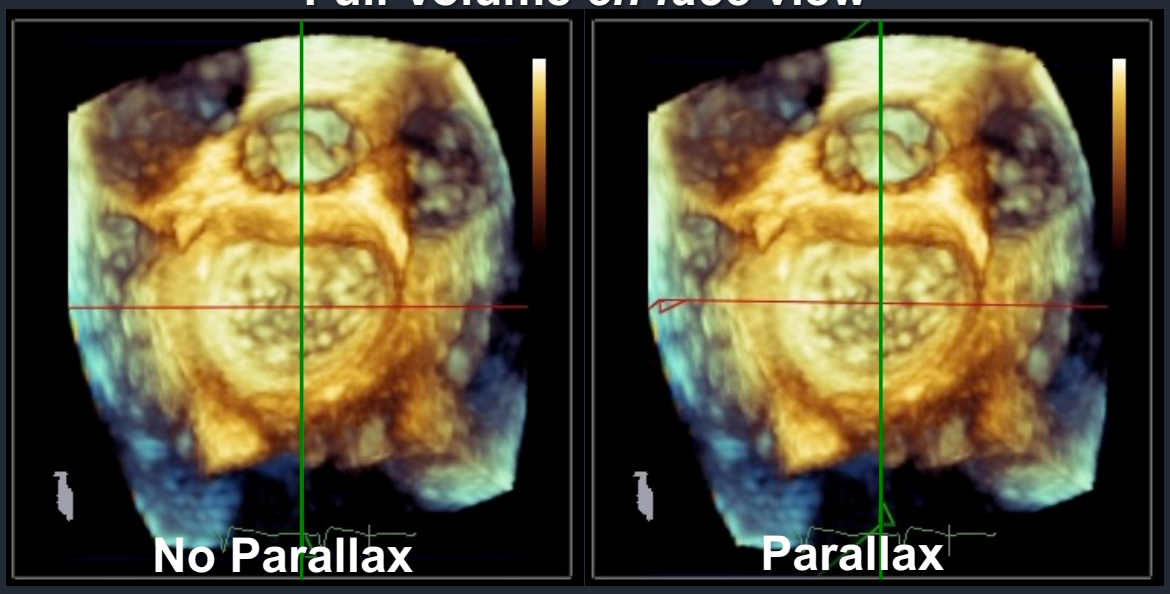


Drake, Zimmerman, Sidebotham. In *Practice of Clinical Echocardiography* 5th ed. Otto CM 2016

12

DANGERS OF 3D IMAGING

Full Volume *en face* view



Drake, Zimmerman, Sidebotham. In *Practice of Clinical Echocardiography* 5th ed. Otto CM 2016

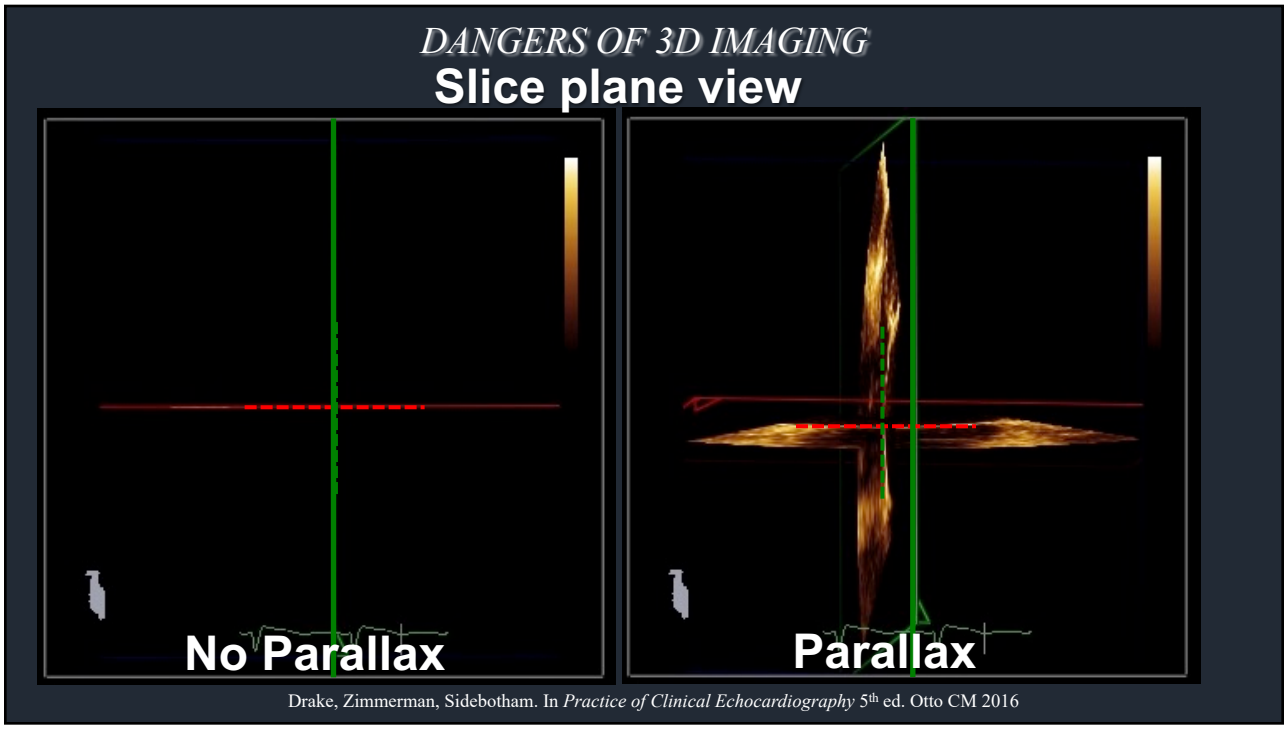
13

DANGERS OF 3D IMAGING

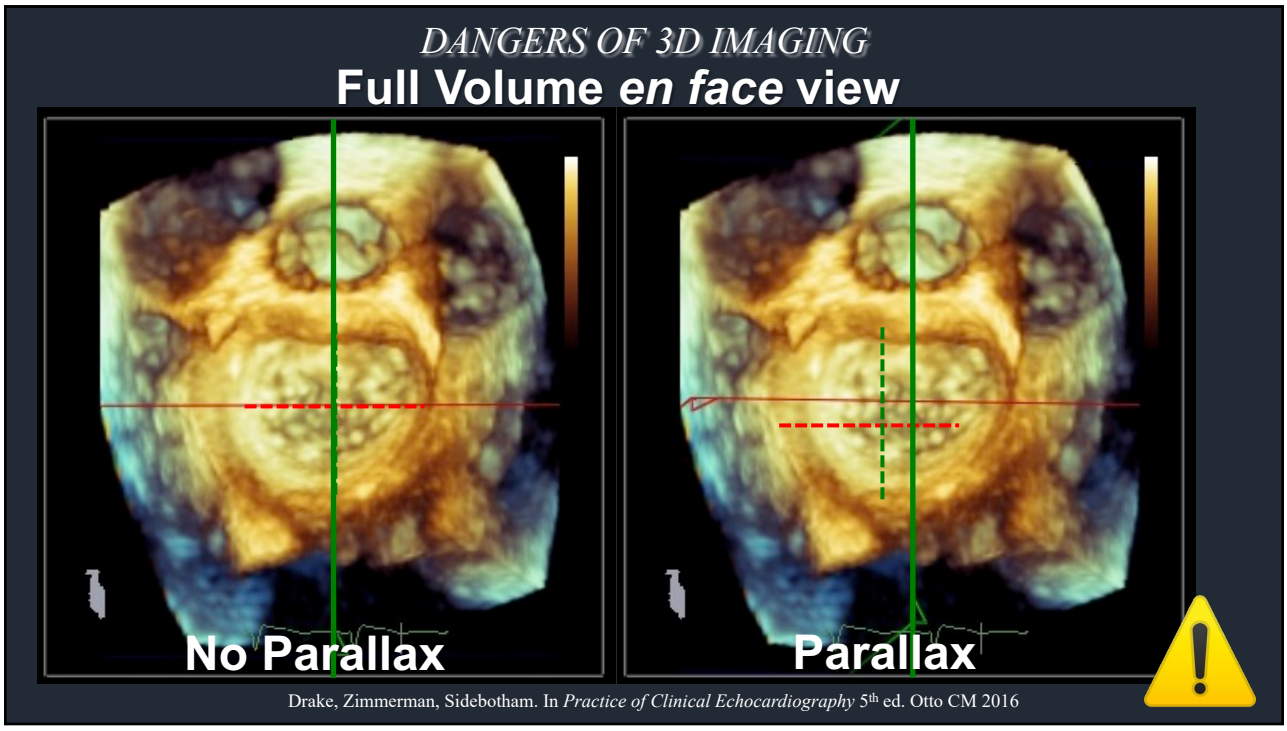
Slice plane view

Drake, Zimmerman, Sidebotham. In *Practice of Clinical Echocardiography* 5th ed. Otto CM 2016

14


DANGERS OF 3D IMAGING
Slice plane view
No Parallax
Parallax
Drake, Zimmerman, Sidebotham. In Practice of Clinical Echocardiography 5th ed. Otto CM 2016

15


DANGERS OF 3D IMAGING
Full Volume en face view
No Parallax
Parallax
Drake, Zimmerman, Sidebotham. In Practice of Clinical Echocardiography 5th ed. Otto CM 2016

16

DANGERS OF 3D IMAGING

Slice plane view

Drake, Zimmerman, Sidebotham. In *Practice of Clinical Echocardiography* 5th ed. Otto CM 2016

17

DANGERS OF 3D IMAGING

- Color Doppler Artifacts

18

DANGERS OF 3D IMAGING

Understand the imaging perspective

Are images truly axial or are they distorted?

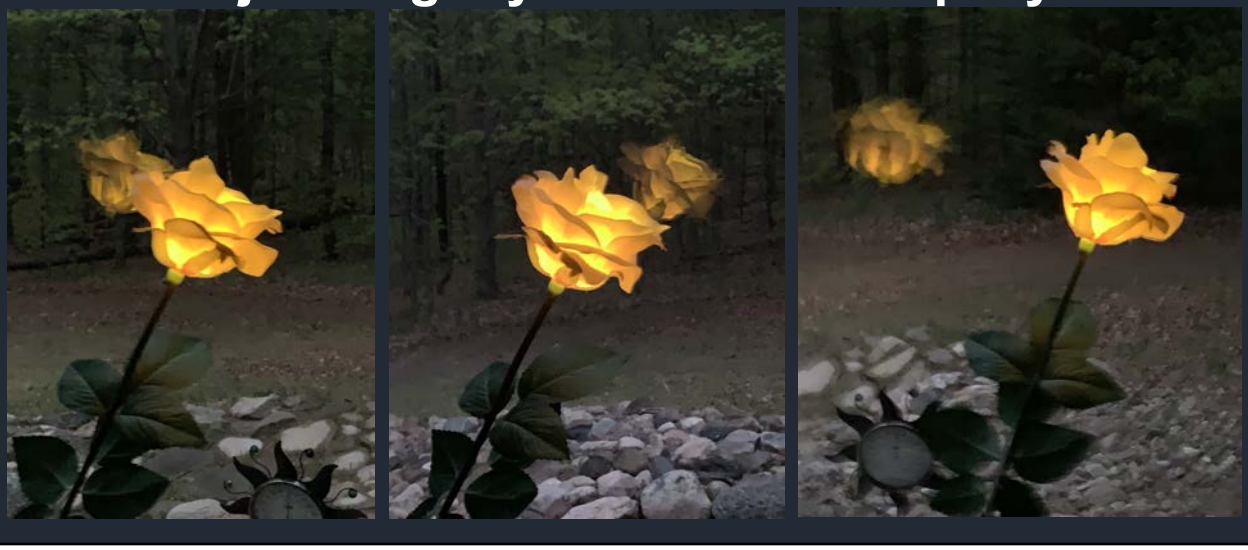
Check out the perpendicular view of this lovely yellow rose….

Isn't this just lovely?

19

DANGERS OF 3D IMAGING

Now look what happens to the color if we stand just slightly off axis or obliquely…



20

DANGERS OF 3D IMAGING

Color may also appear larger than it really is..

21

DANGERS OF 3D IMAGING

…or create artifacts… like ghosts!

22

DANGERS OF 3D IMAGING

..which might create all kinds of roses!

23

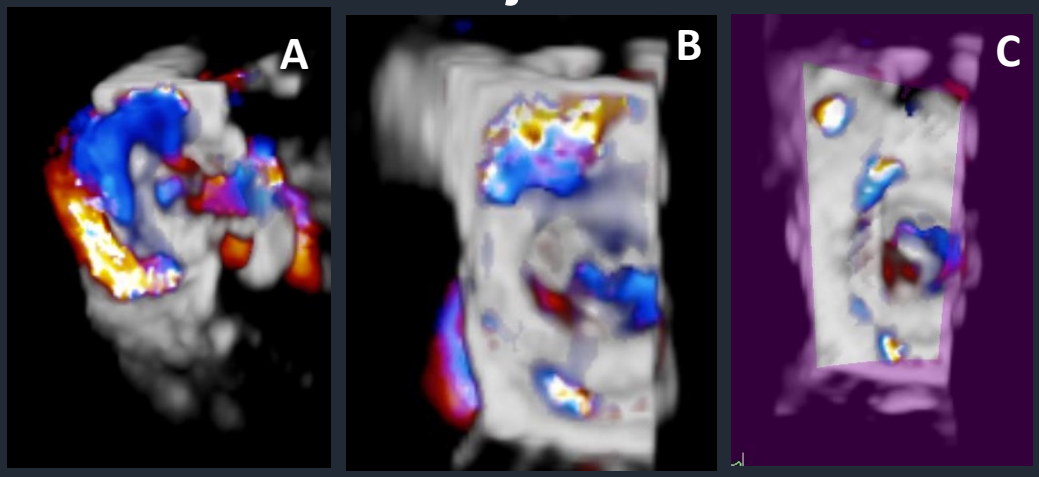
DANGERS OF 3D IMAGING

Beware of Color Doppler artifact!!!!

24

DANGERS OF 3D IMAGING

Note size of the jets at 11:00 and 6:30

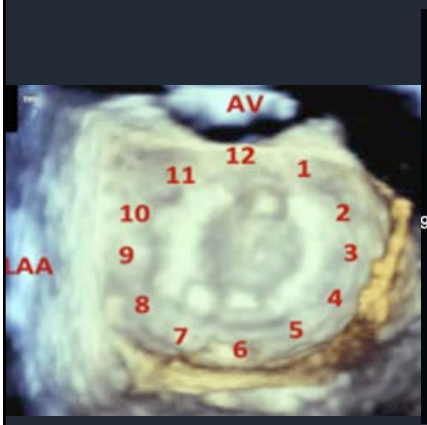


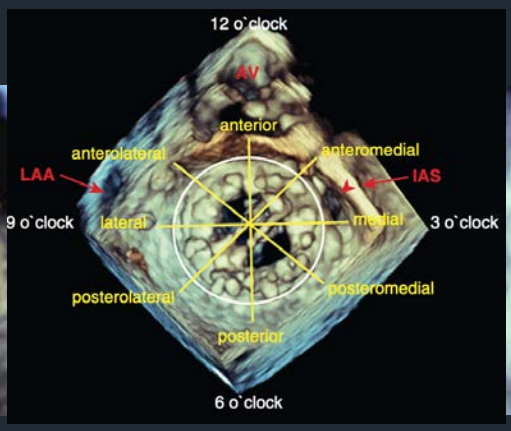
Splay | Jet en face | Correct

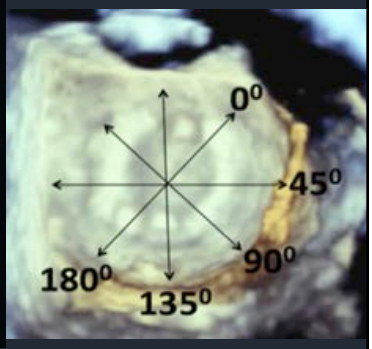
25

DANGERS OF 3D IMAGING

Accurately communicate findings





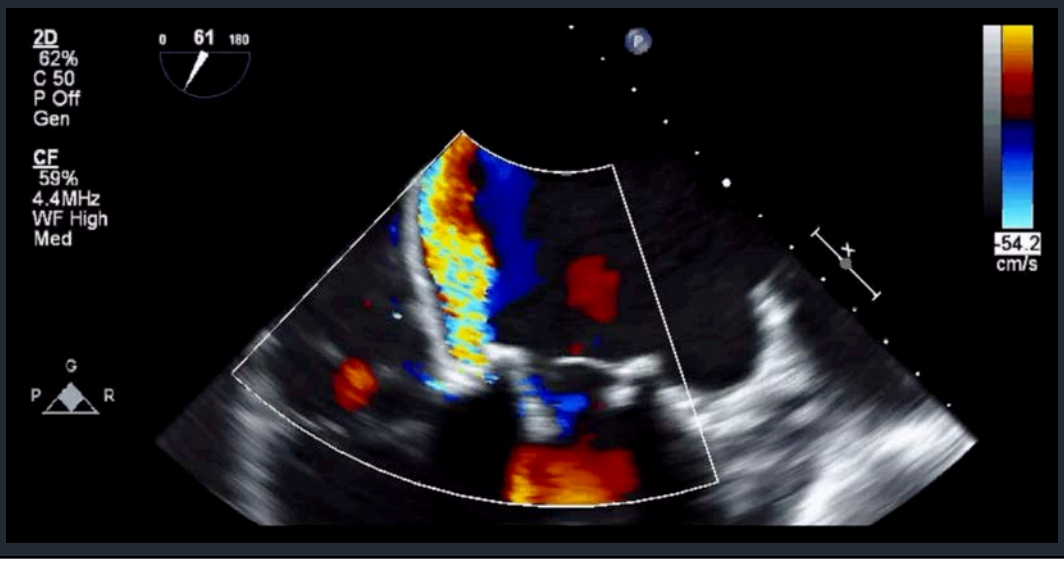


Quader, N. et al JASE 28,5:497-508 | *Wunderlich et al. JACC:CVI 11,6:872-901* | *Quader, N. et al* JASE 28,5:497-508

26

DANGERS OF 3D IMAGING

4-chamber view displays PVL on left side



27

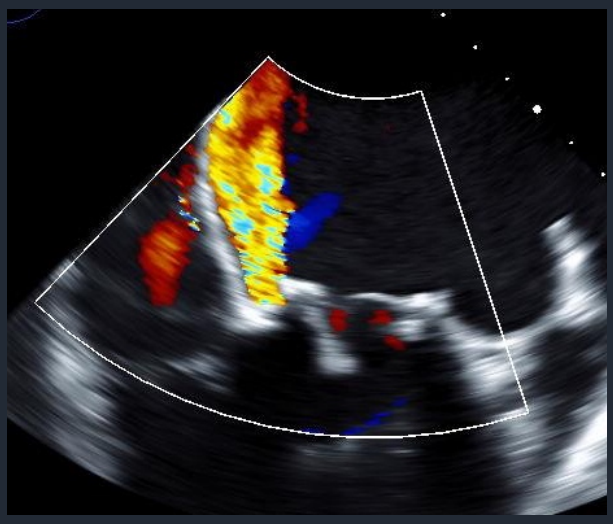
DANGERS OF 3D IMAGING

3D Zoom *en face* view displays PVL on right side!

28

DANGERS OF 3D IMAGING

2D vs 3D TEE perspectives by modality



29

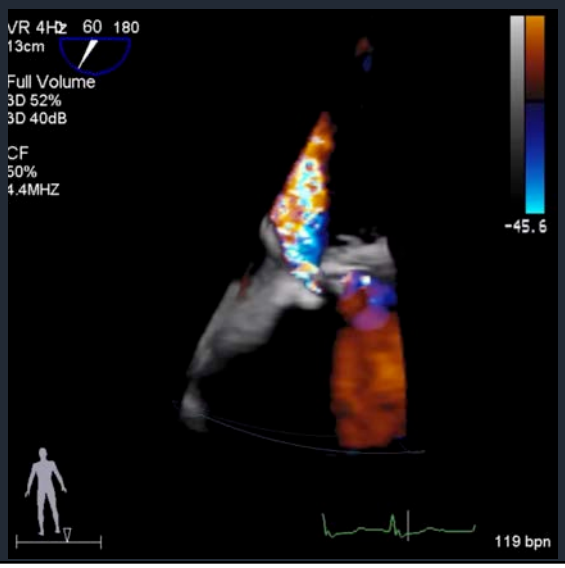
DANGERS OF 3D IMAGING

Full volume 3D color automatically crops

30

DANGERS OF 3D IMAGING

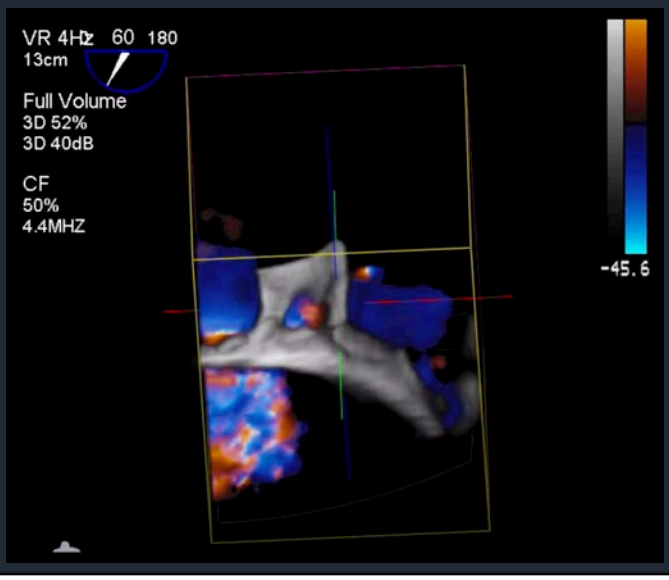
Simply freeze… and uncrop full volume…



31

DANGERS OF 3D IMAGING

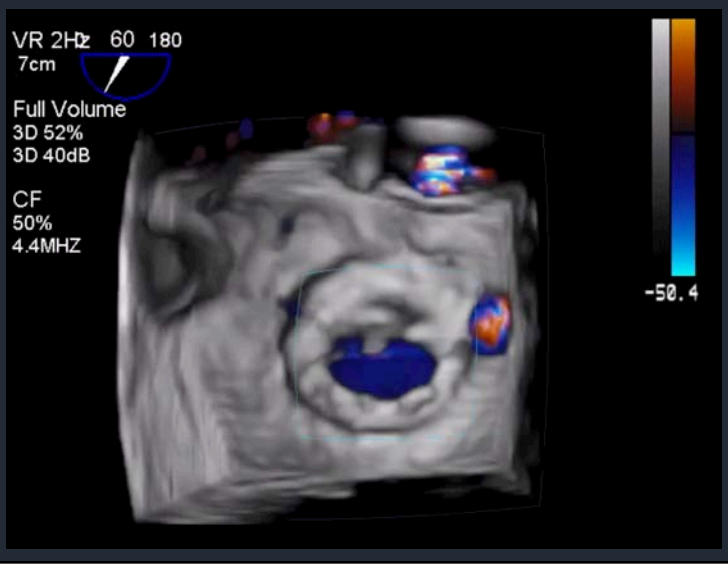
…rotate Z to position aortic valve above mitral



32

DANGERS OF 3D IMAGING

…tilt image down for *en face* view

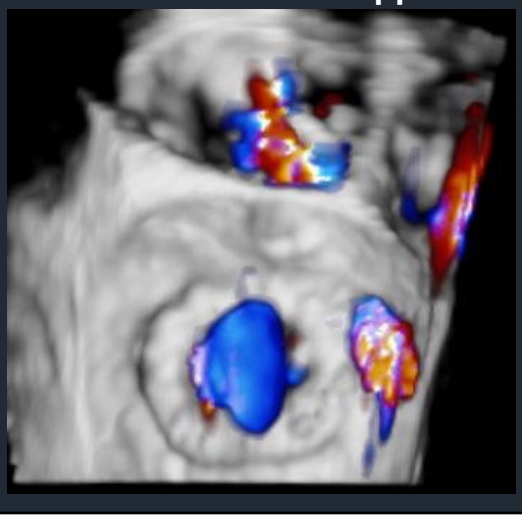


33

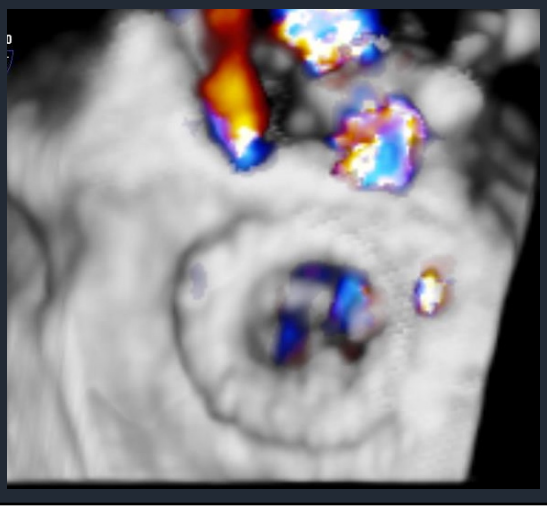
DANGERS OF 3D IMAGING

Timing also matters!

Diastole and uncropped



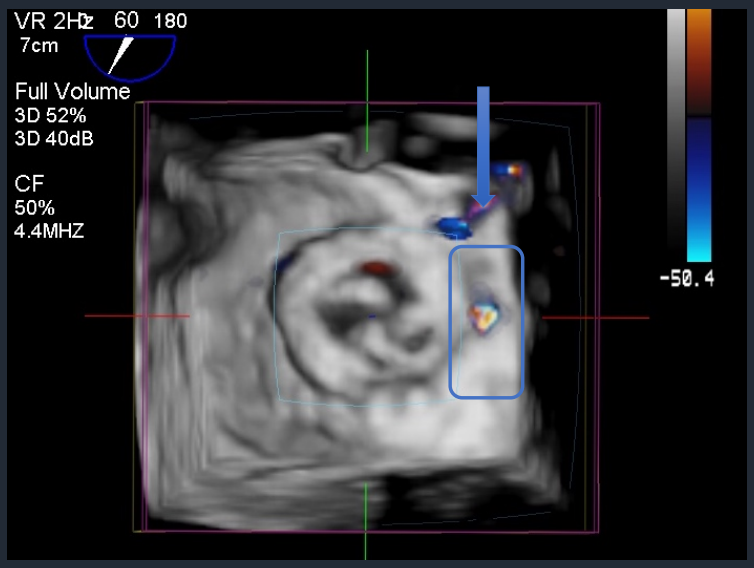
Systole and cropped



34

DANGERS OF 3D IMAGING

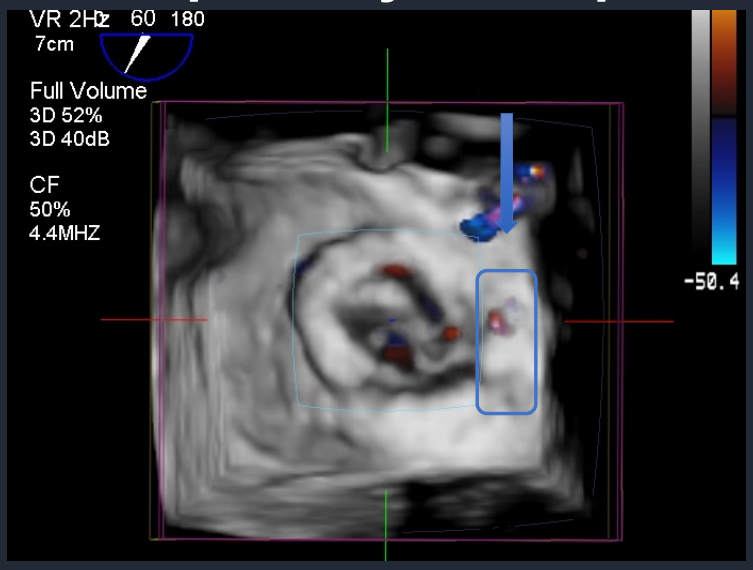
Crop to the surface of tissue



35

DANGERS OF 3D IMAGING

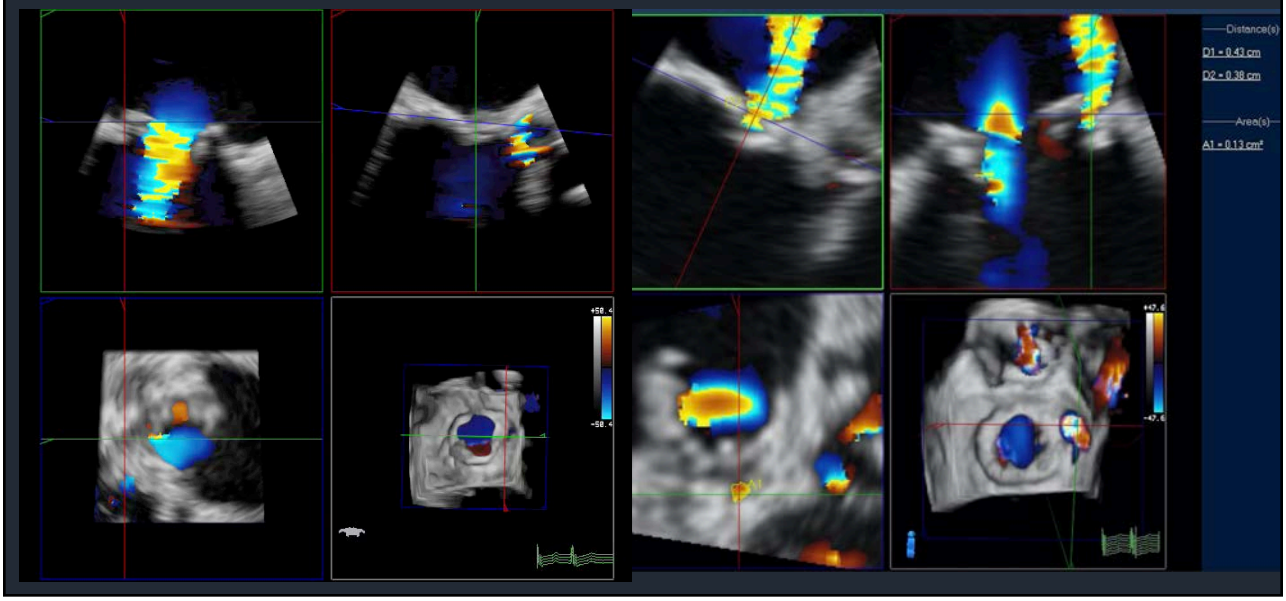
Crop until you drop!



36

DANGERS OF 3D IMAGING

MPR analysis sizing: 0.43 cm x 0.38 cm

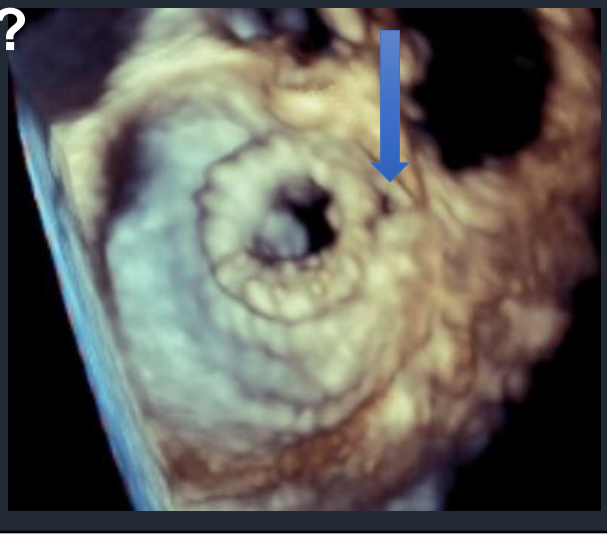


37

DANGERS OF 3D IMAGING

Caution: Make NO assumptions!

Does 3D Zoom with no color demonstrate the defect?



38

DANGERS OF 3D IMAGING

Maybe NOT!

- Uneven tissue or ridges may create an area of dropout, NOT REAL!
- Combine evaluation with color and Doppler to unmask this artifact

39

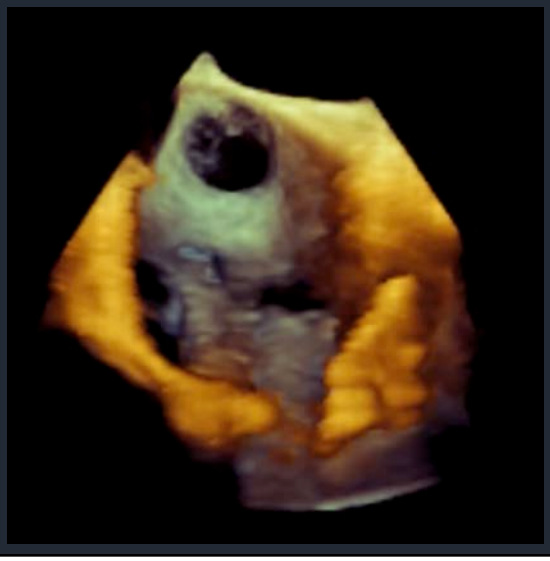
DANGERS OF 3D IMAGING

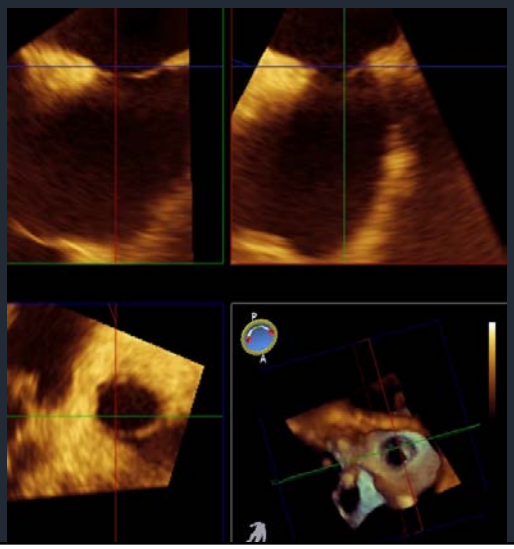
Pre-procedural imaging 3D color through a secundum ASD

40

DANGERS OF 3D IMAGING

Imaging will size and guide intervention





41

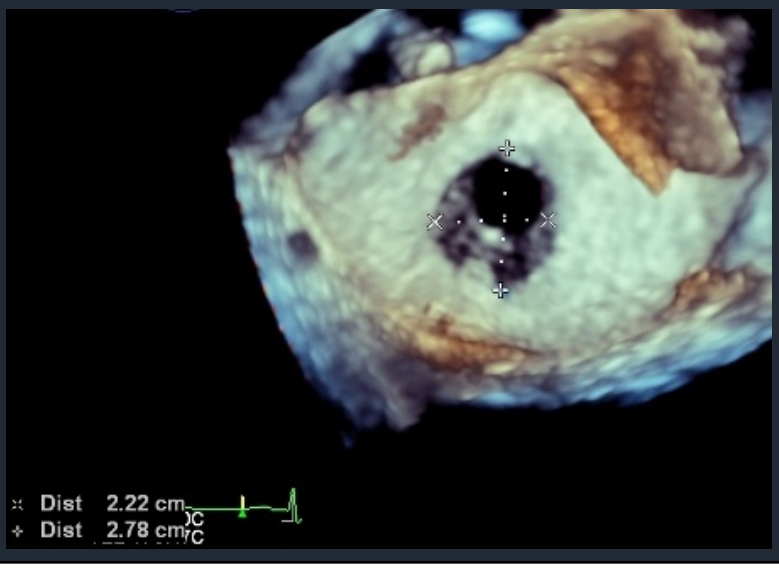
DANGERS OF 3D IMAGING

Sizing defect by 2D TEE is 1.11 cm and 2.11 cm

42

DANGERS OF 3D IMAGING

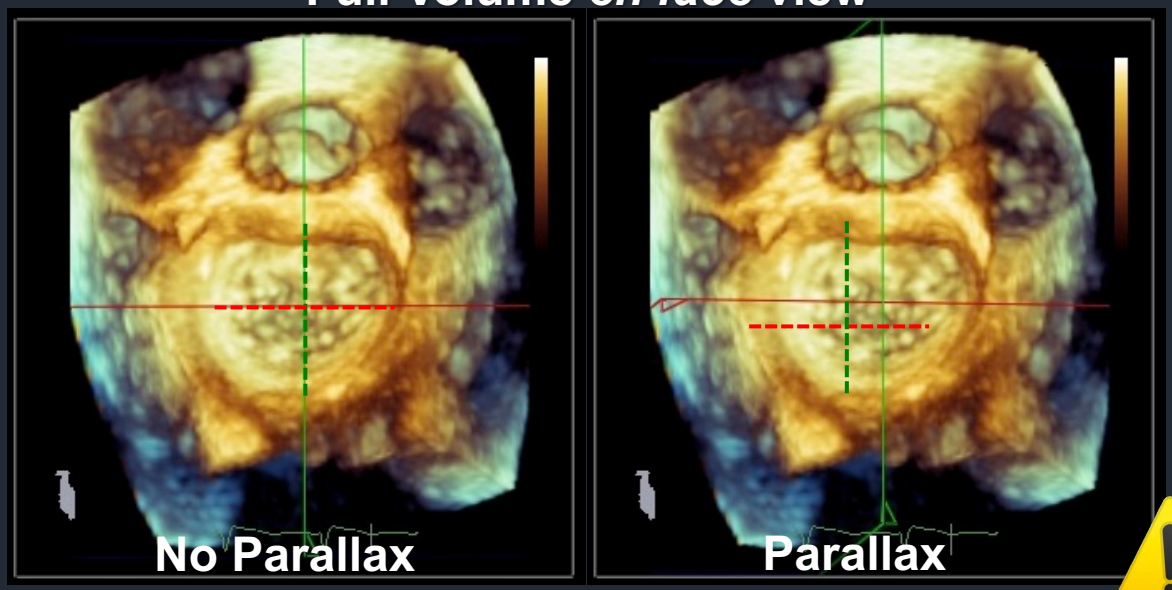
3D Live *en face* measures 2.22 cm x 2.78 cm



43

DANGERS OF 3D IMAGING

Full Volume *en face* view



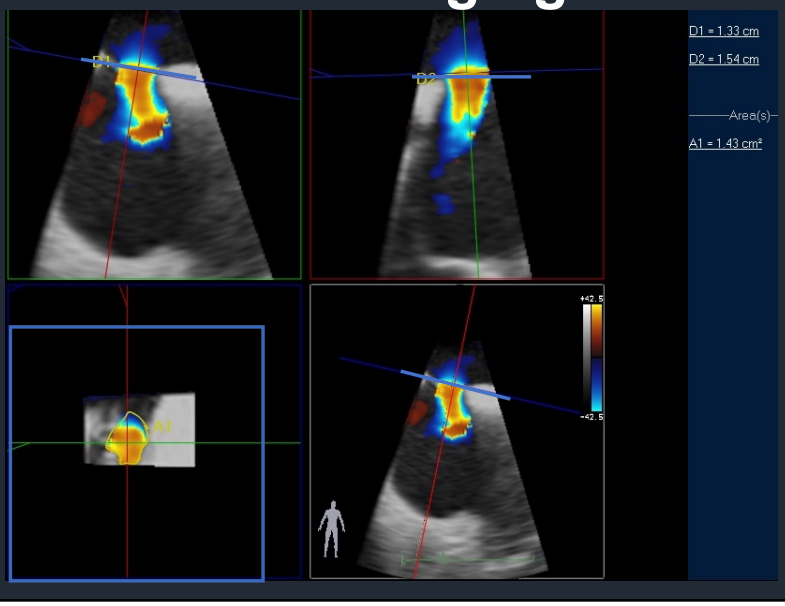
Drake, Zimmerman, Sidebotham. In *Practice of Clinical Echocardiography* 5th ed. Otto CM 2016

44

DANGERS OF 3D IMAGING

MPR utilizes axial imaging

- Axial diameters and area can then be performed
- 1.33 cm
- 1.54 cm
- Area 1.43 cm^2

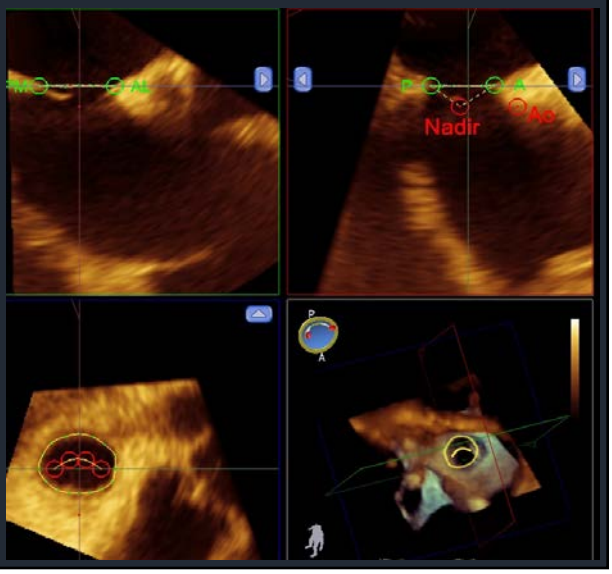


45

DANGERS OF 3D IMAGING

3D MVQ sizing tool traces around the defect

- MVQ places 16 points along plane line providing more detailed accurate analysis
- Diameters: 2.1 cm x 1.83 cm, area of 3.18 cm^2 and perimeter of 64 mm



46

DANGERS OF 3D IMAGING

What difference does it make?

- **2D images display defect of 1.1 cm and 2.11 cm**
- **3D 'en face' displays 2.22 cm x 2.78 cm!**
- **MPR line up 1.33 cm and 1.54 cm, area 1.43cm^2**
- **MVQ analysis reveals 2.1cm x 1.83 cm, area of 3.18 cm^2, and perimeter of 64 mm**

47

DANGERS OF 3D IMAGING

HUGE Difference!

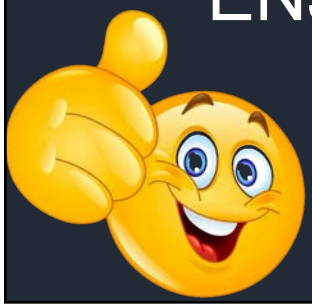
- 2D dimension is a single slice measurement (of a 3D object)
- 3D Live en face **can be completely inaccurate**, since there is no way to know the image perspective
- 3D MPR, after elimination of parallax, allows for accurate **axial alignment of 2D imaging planes** by cross-sectional analysis
- **3D MVQ axially and accurately measures 16 points around the circumference of the circle**

48

DANGERS OF 3D IMAGING

3D structures require 3D analysis

Proceed with caution!!
ENJOY the new adventure!



49

Tricks and tips for 3D visualization:

A practical approach to use in your lab

DANGERS OF 3D IMAGING

Karen G. Zimmerman, BS, ACS, RDCS, RVT, FASE

HAWAII
2020

ASE

50