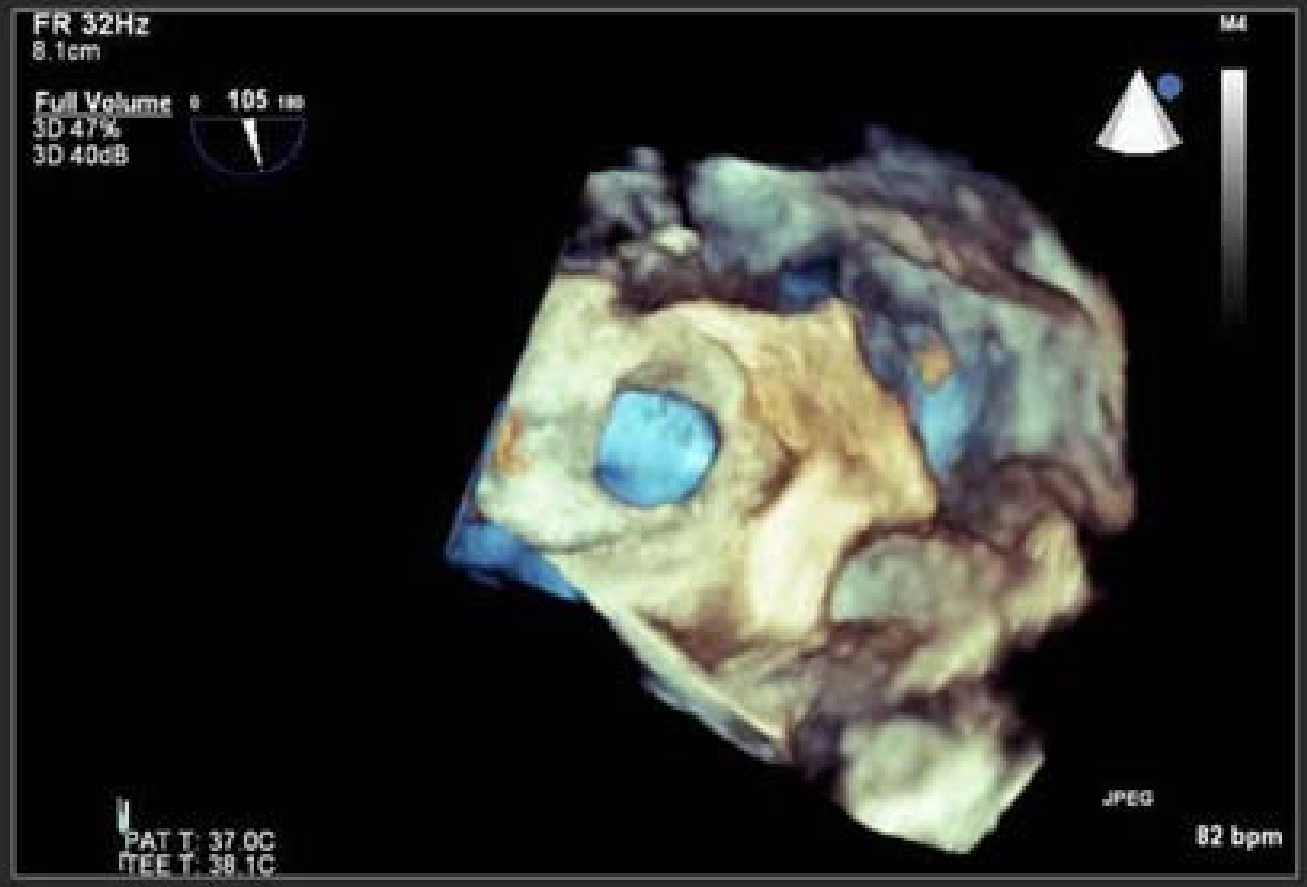
Role of 3D-Echo Guidance in Septal Defect Closure Interventions

Jong-Min Song

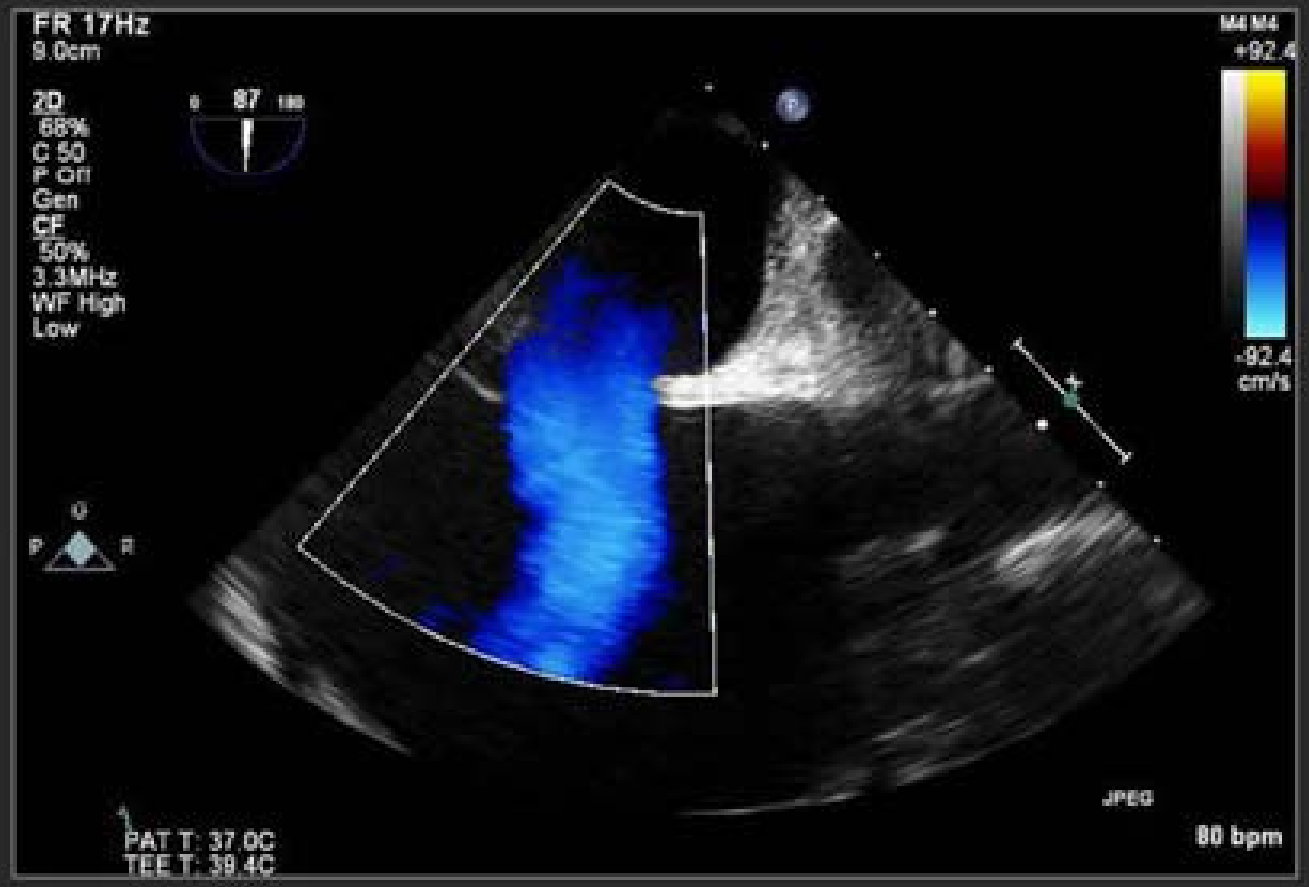
Asan Medical Center
University of Ulsan College of Medicine

3D, More Informative ?

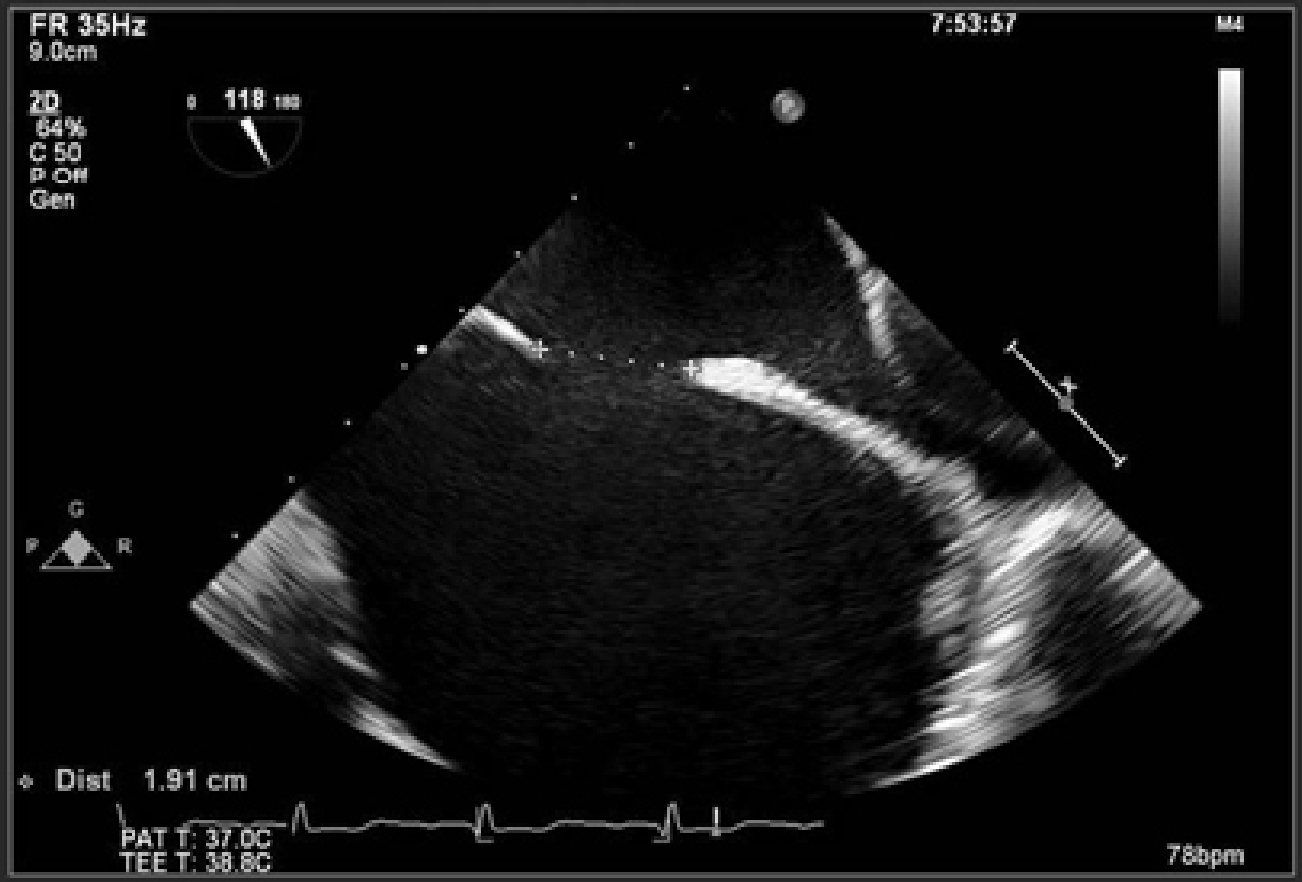
Round ASD


FR 32Hz
8.1cm
Full Volume
3D 47%
3D 40dB
105
JPEG
82 bpm
PAT T: 37.0C
TEE T: 38.1C

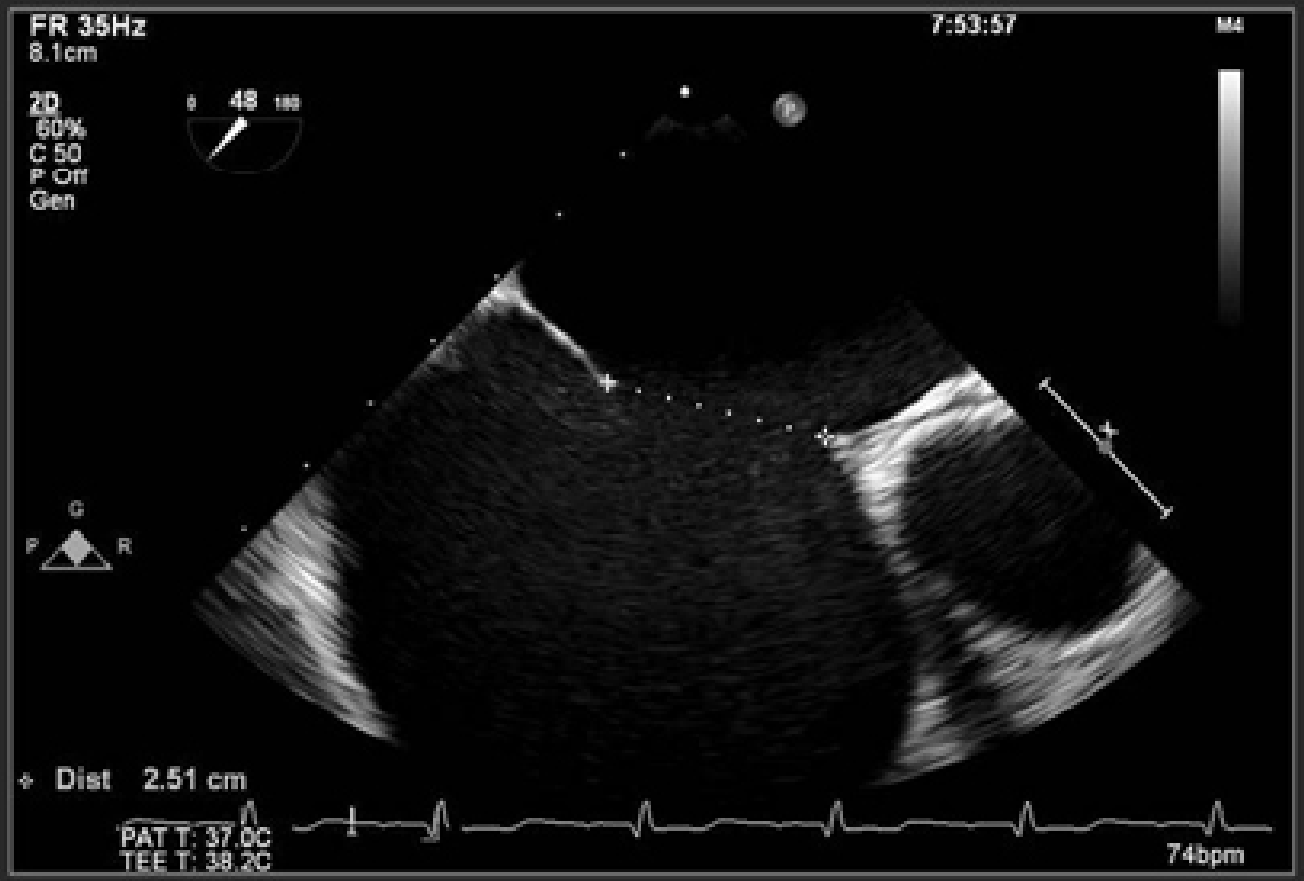
Ellipsoidal ASD



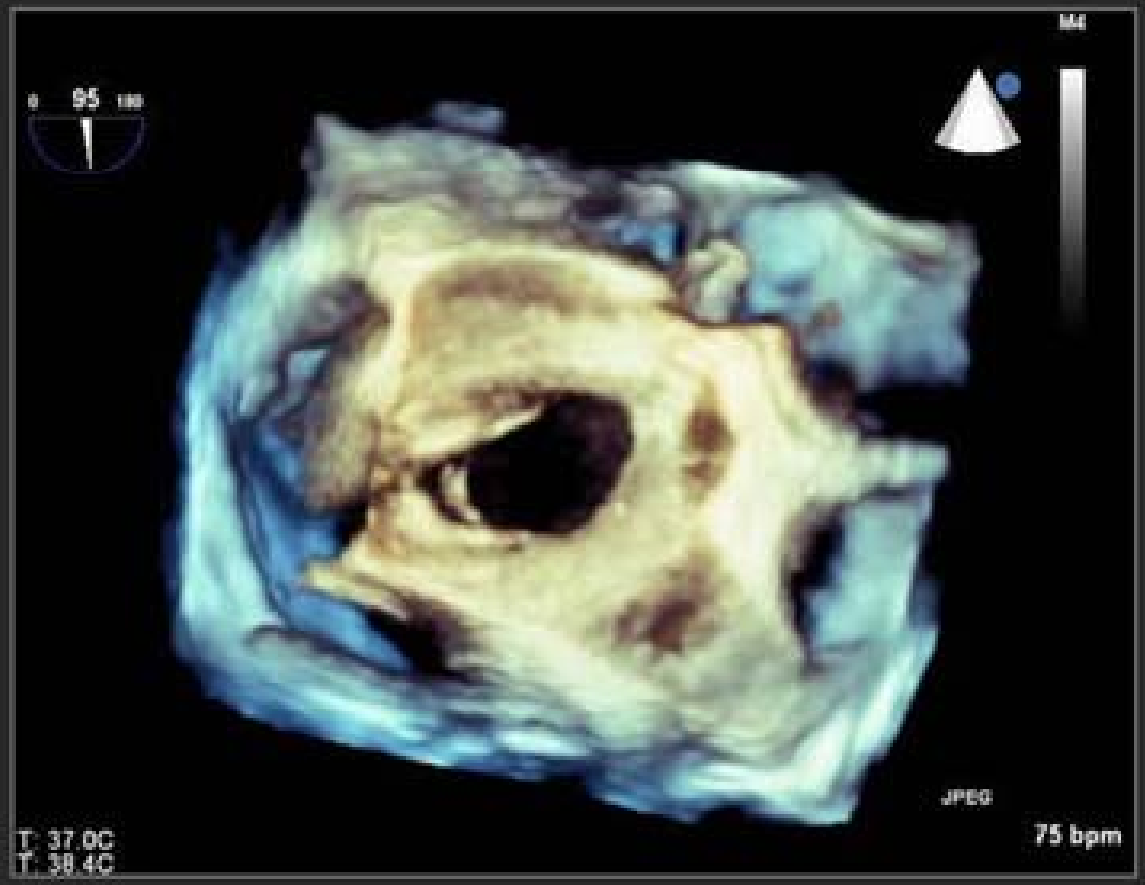
Ellipsoidal ASD



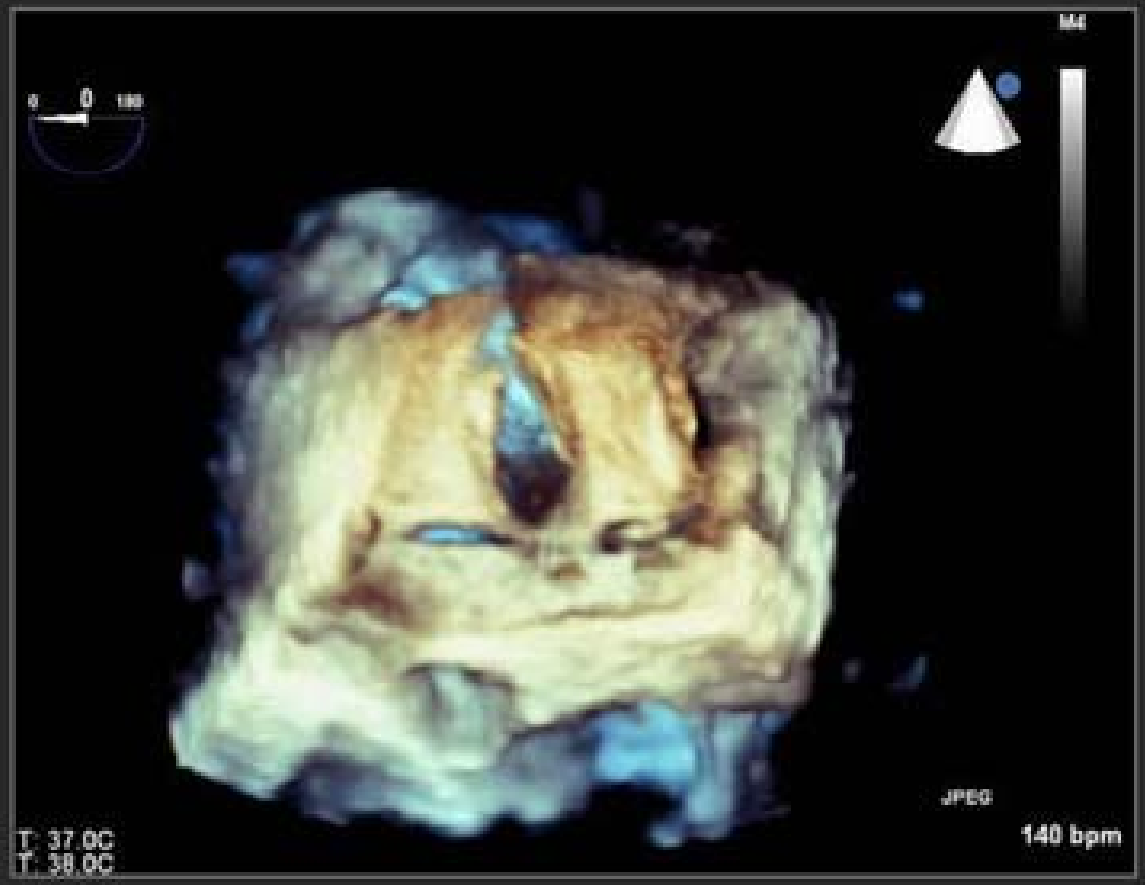
Ellipsoidal ASD



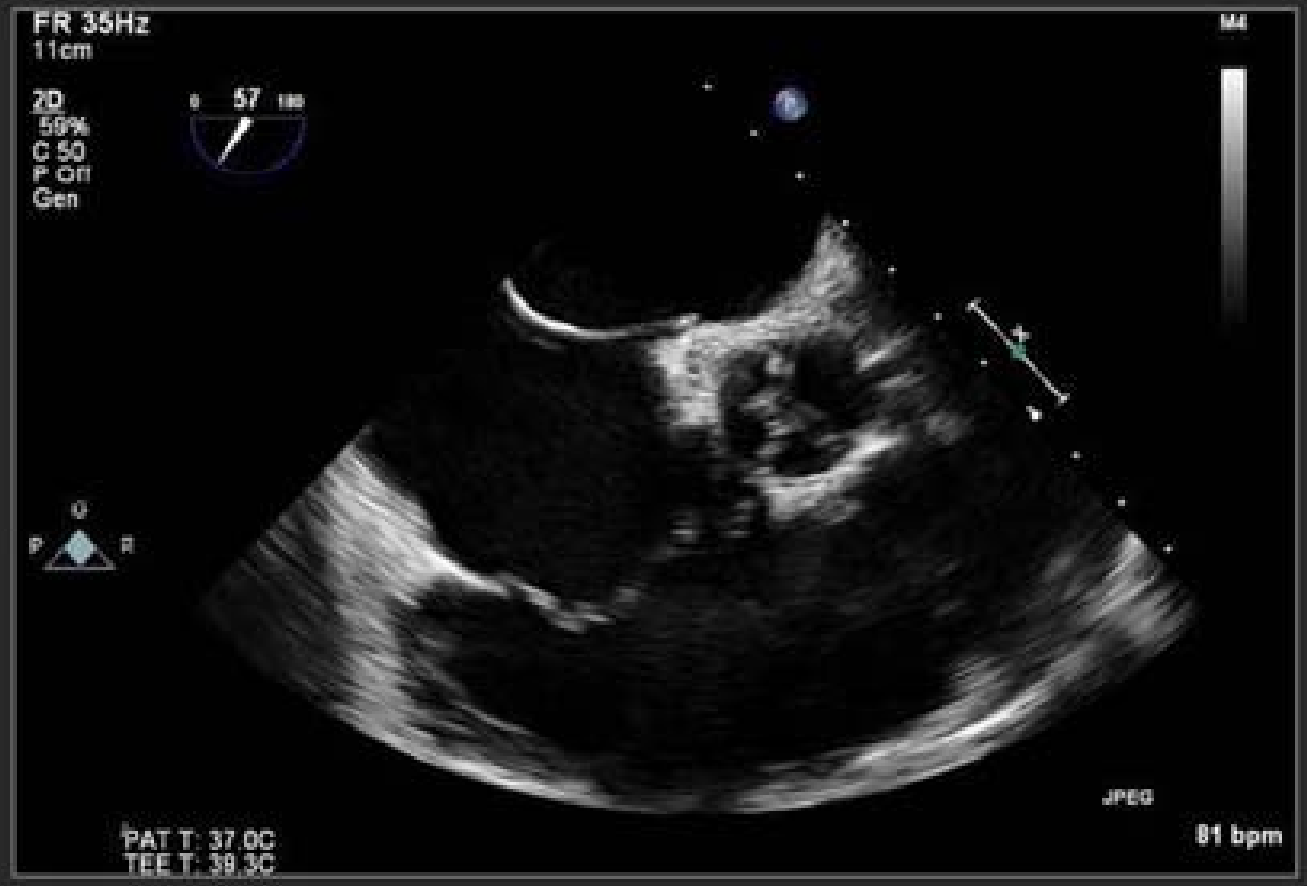
Ellipsoidal ASD



Ellipsoidal ASD



Multiple ASD



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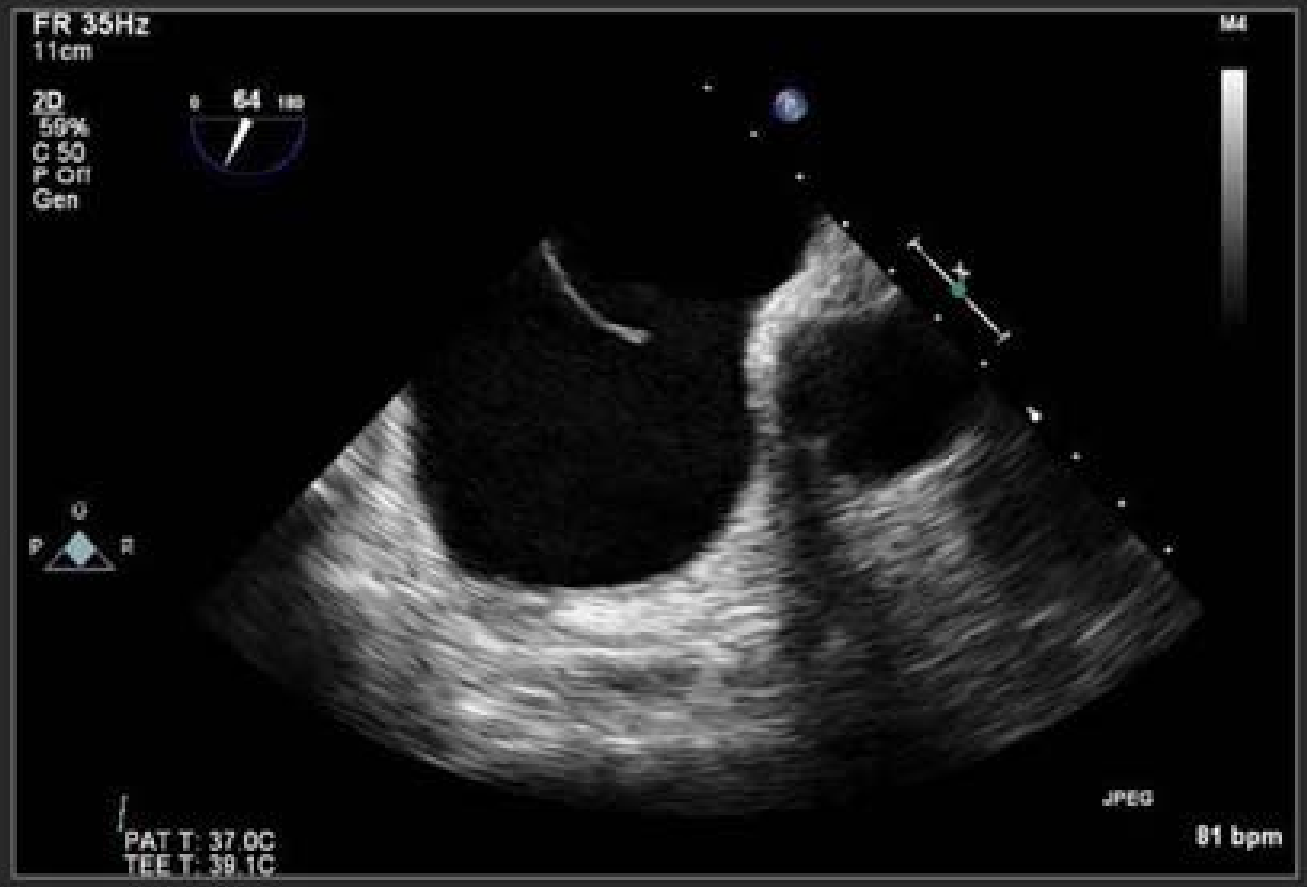
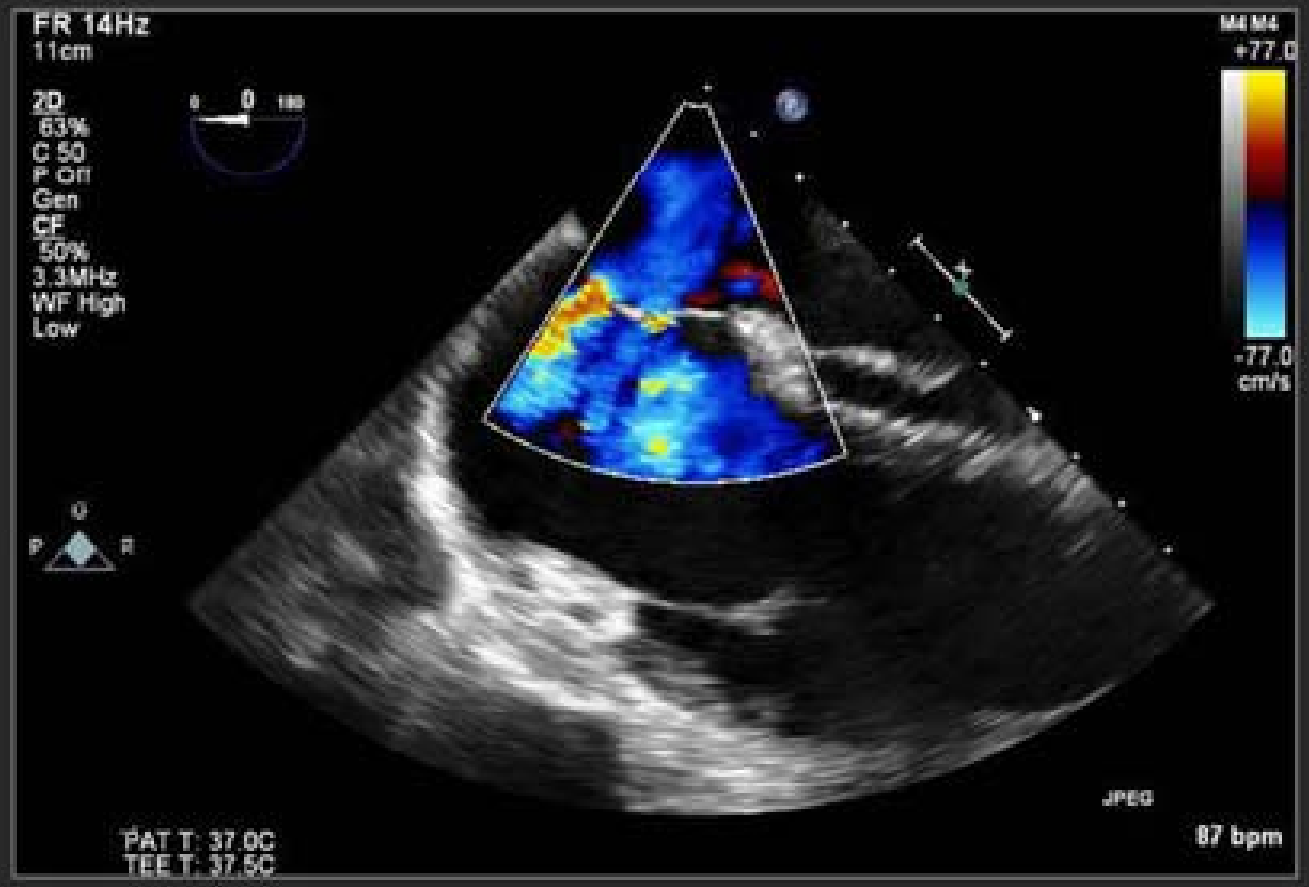
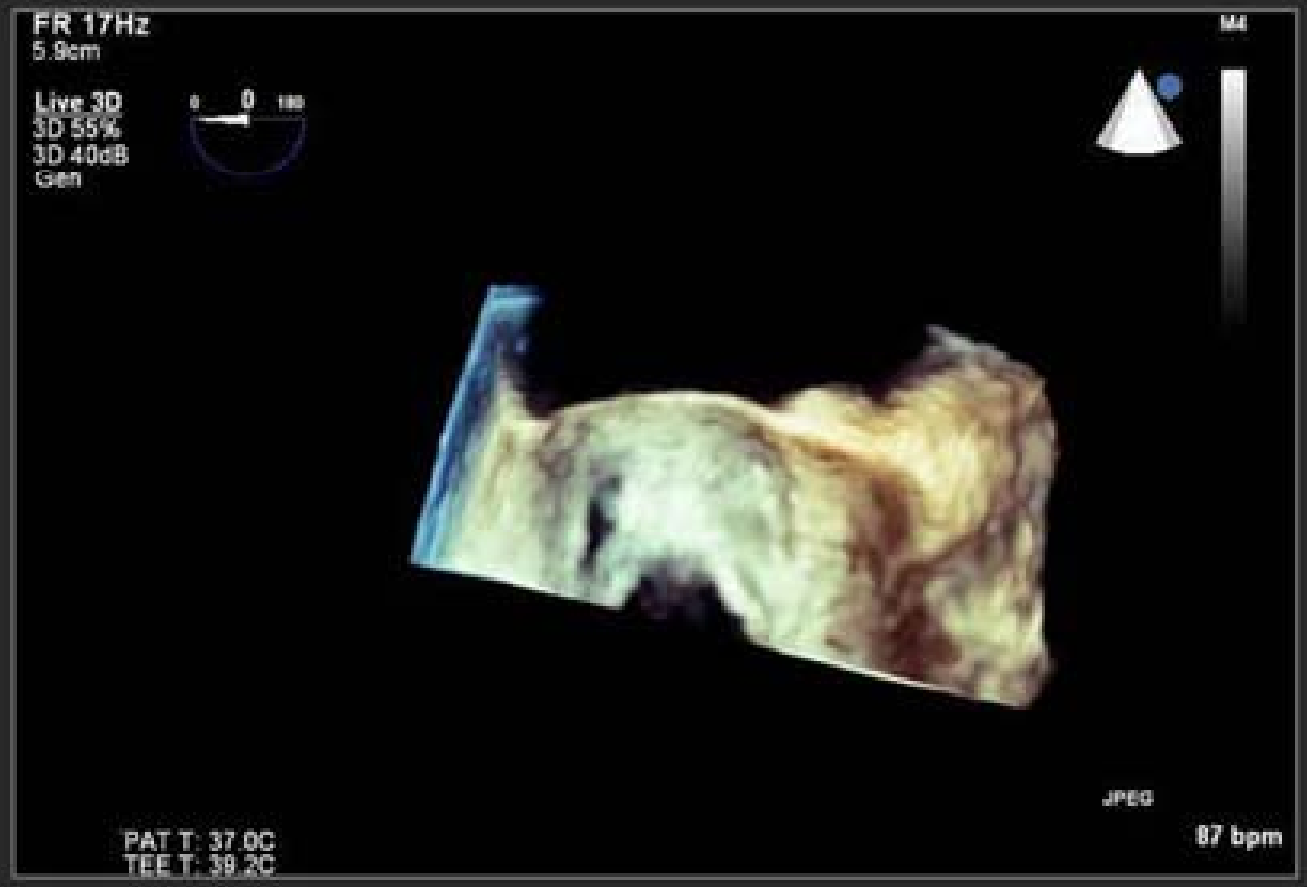


Multiple ASD



Multiple ASD

Multiple ASD



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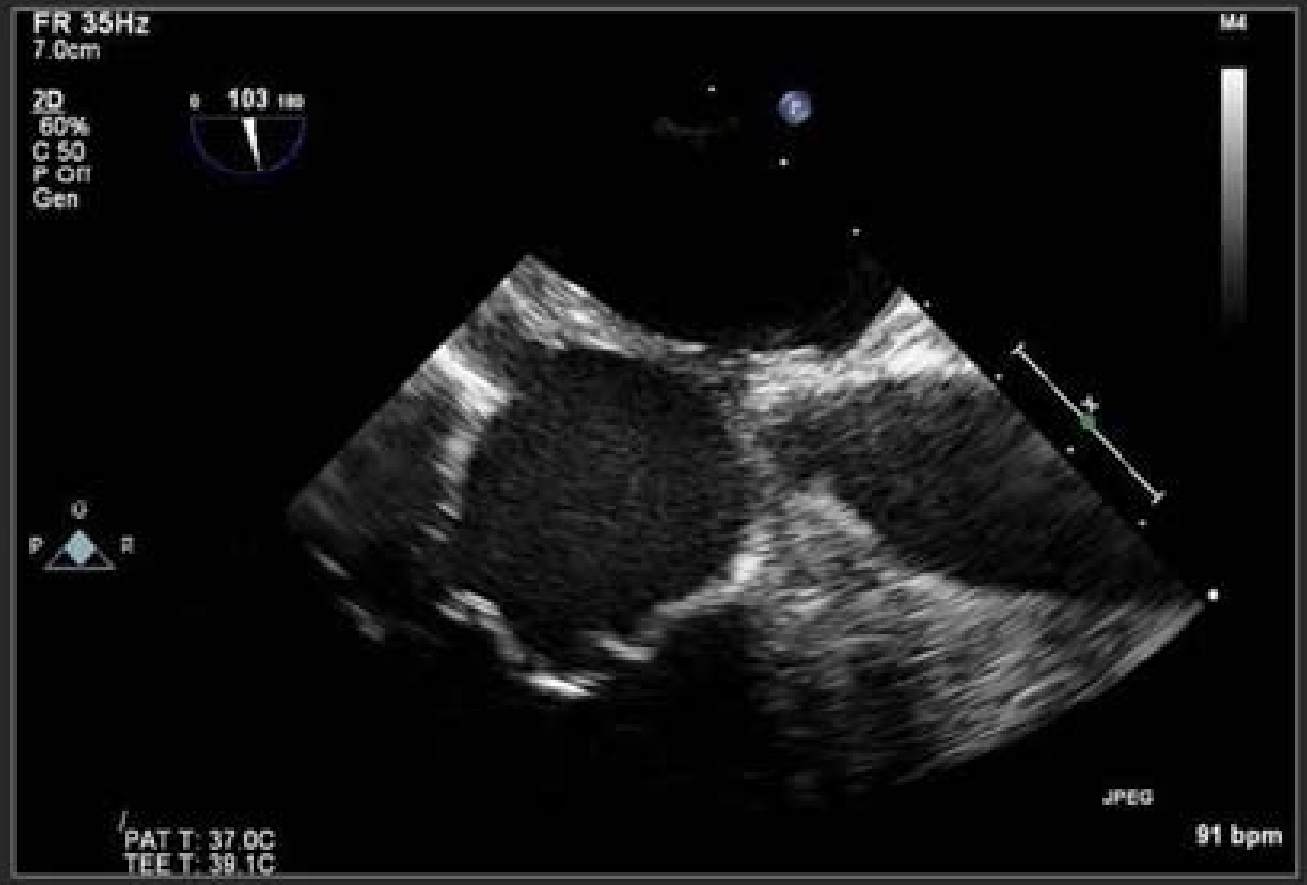

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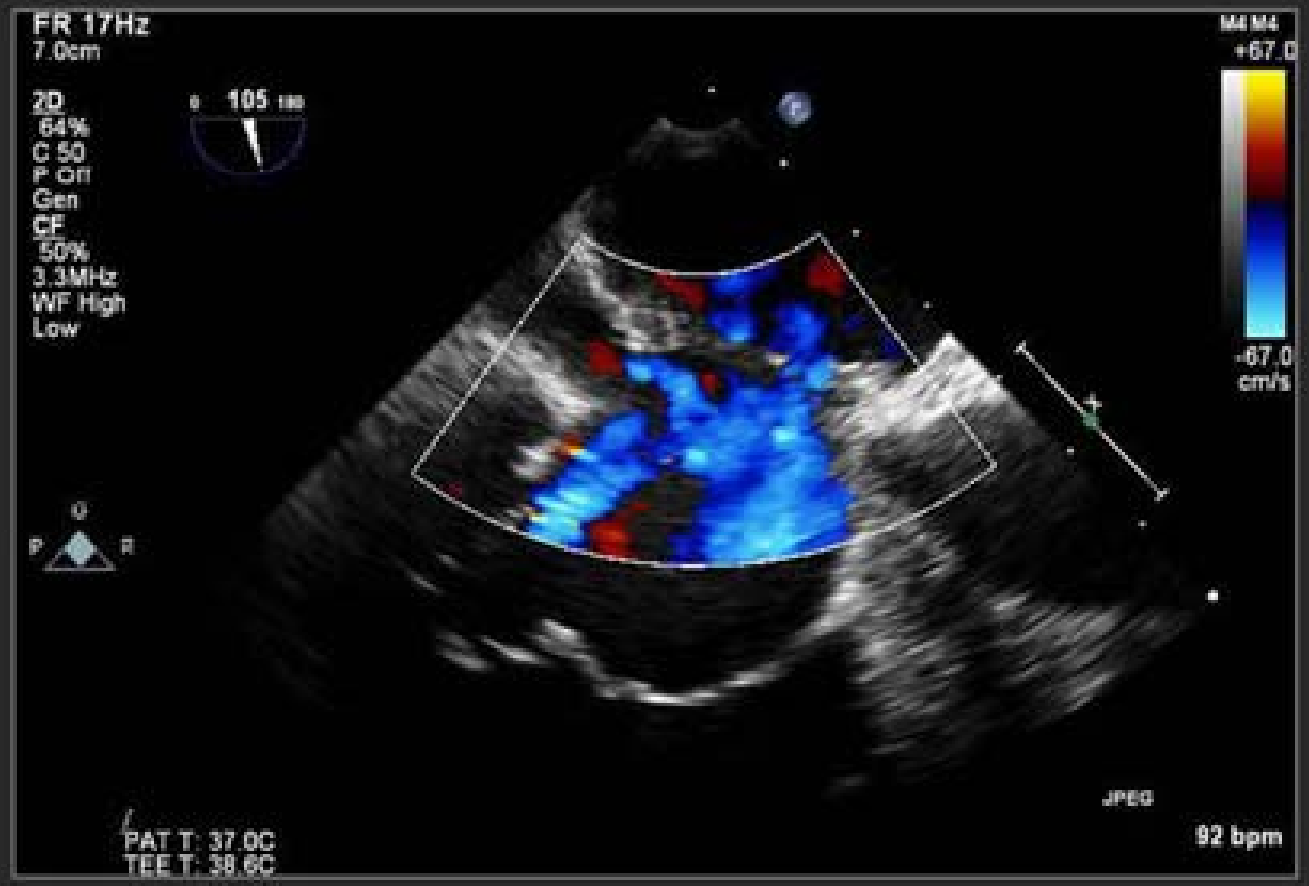
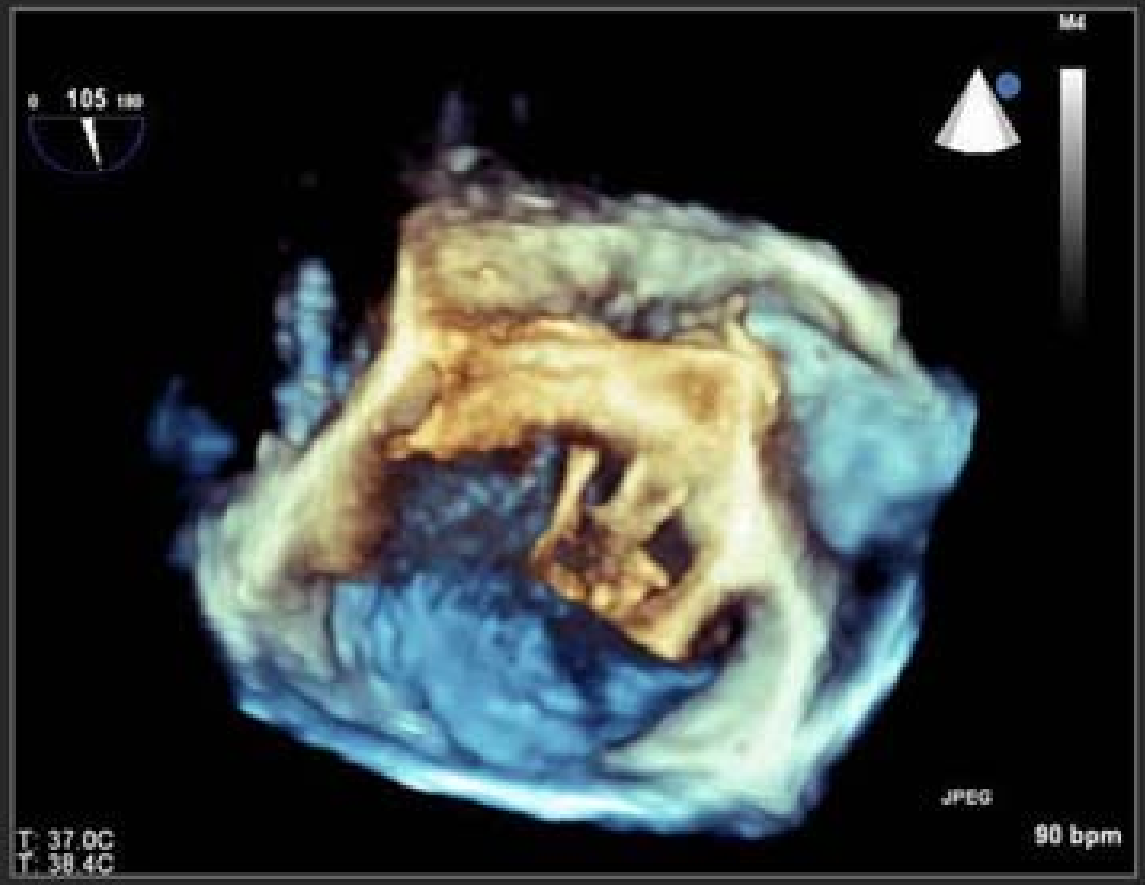
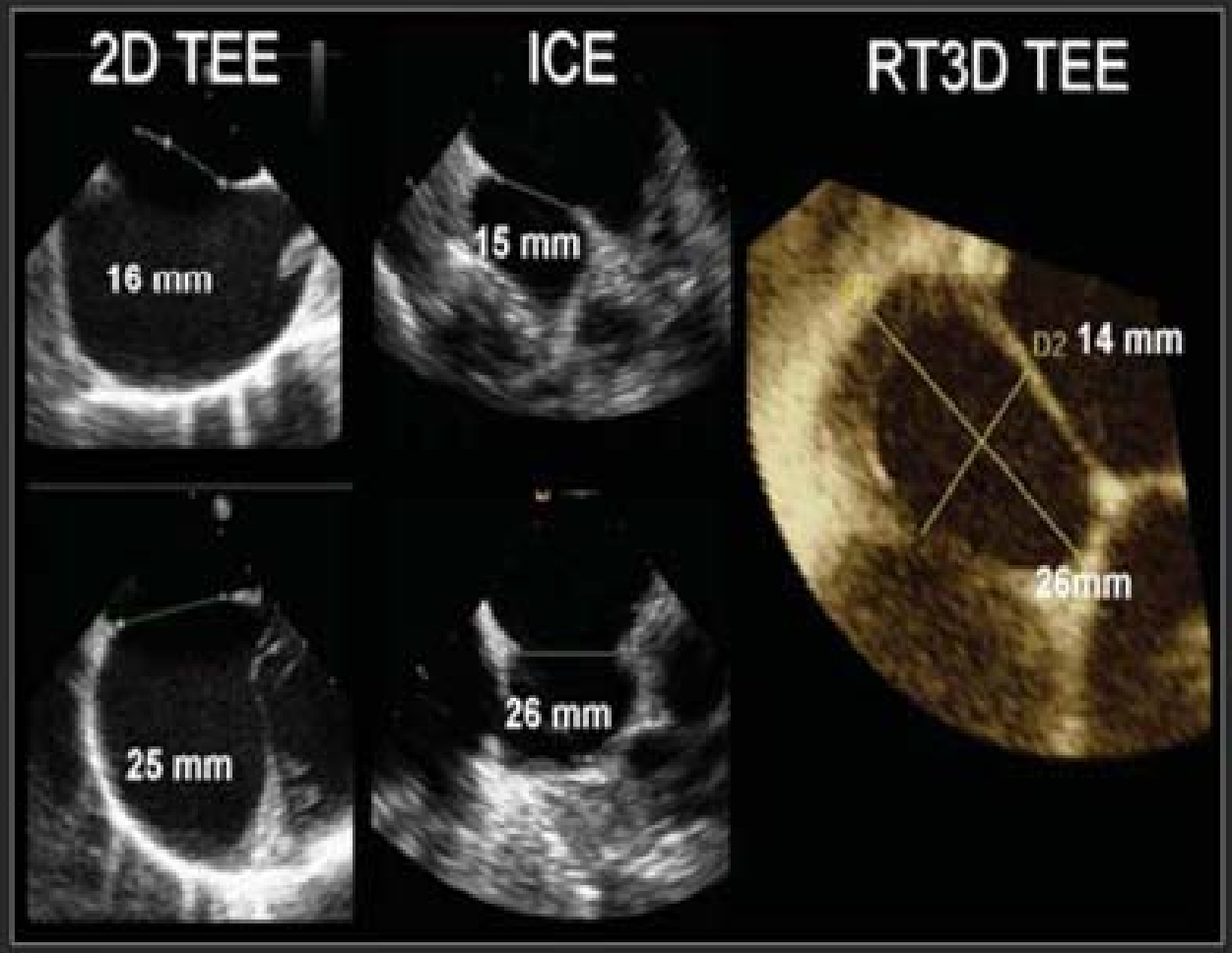


Multiple ASD



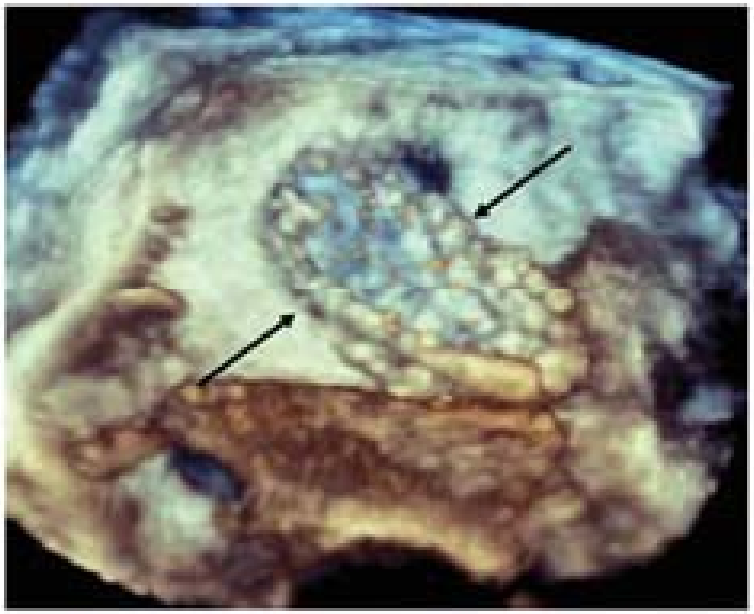
Multiple ASD

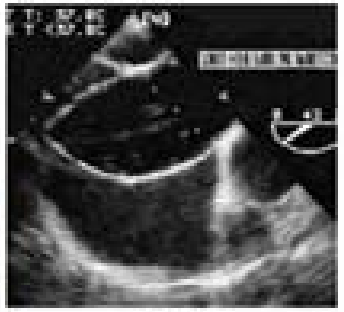
ASD Size Measurement Using RT3DE



Lodato JA, Eur J Echocardiogr. 2009;10:543–8

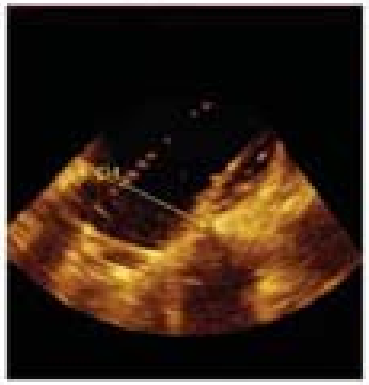
Balloon Sizing of ASD





2DTEE

ICE



RT3D TEE

Lodato JA, Eur J Echocardiogr. 2009;10:543–8

ASD Size Measurement Using RT3DE

Table 1 Long-axis, short-axis, and balloon dimensions ($n = 7$) in mm (mean ± SD), for the echocardiographic techniques

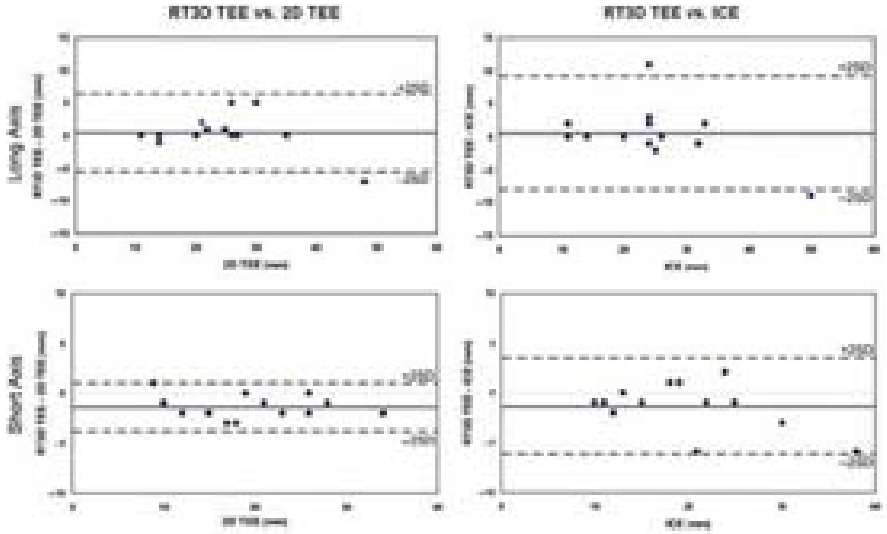
	3D TEE	ICE	2D TEE	3D-ICE	3D-2D	2D-ICE
LAX (mm) range	25 ± 9	24 ± 10	25 ± 10	0.5 (−9 to 11)	0.5 (−7 to 5)	0.07 (−6 to 6)
SAX (mm) range	18 ± 7	20 ± 8	20 ± 7	−1.4† (−6 to 2)	−1.4* (−3 to 0)	0.0 (−4 to 2)
BD (mm) range	27 ± 7	26 ± 7		0.9‡ (−1 to 2)		

The three right-sided columns represent the mean difference in dimensions and the range of differences comparing RT3D TEE with ICE and 2D TEE, and 2D TEE with ICE. Only the difference of short-axis dimension as measured by RT3D TEE and 2D TEE was statistically significant; however, there was a trend towards a statistically significant difference comparing short-axis dimension by RT3D TEE and ICE. There is considerable range of measurement differences comparing 3D and 2D imaging techniques. (LAX, long axis; SAX, short axis; BD, balloon dimension).

*$P < 0.05$.

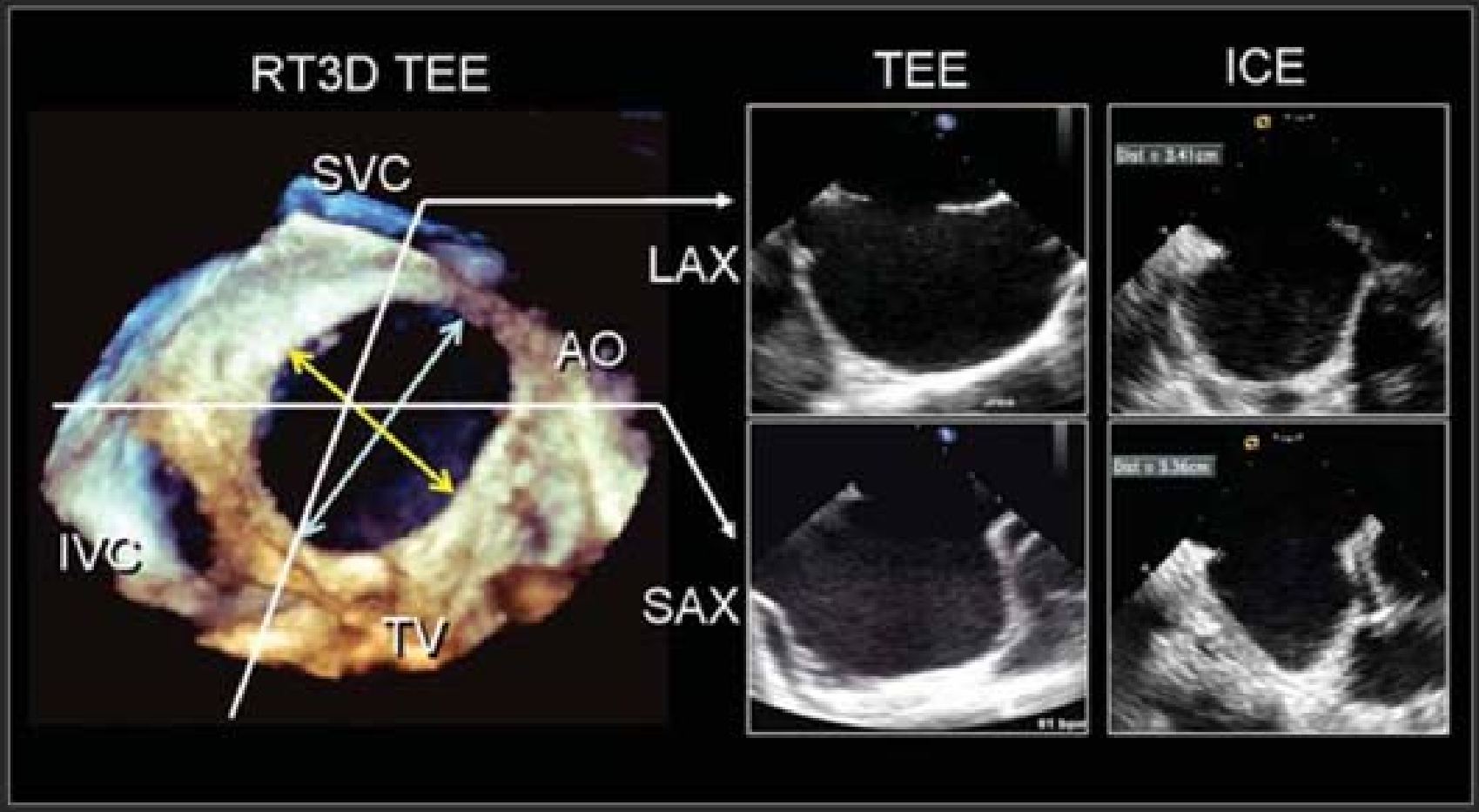
†$P = 0.06$.

‡$P = 0.08$.



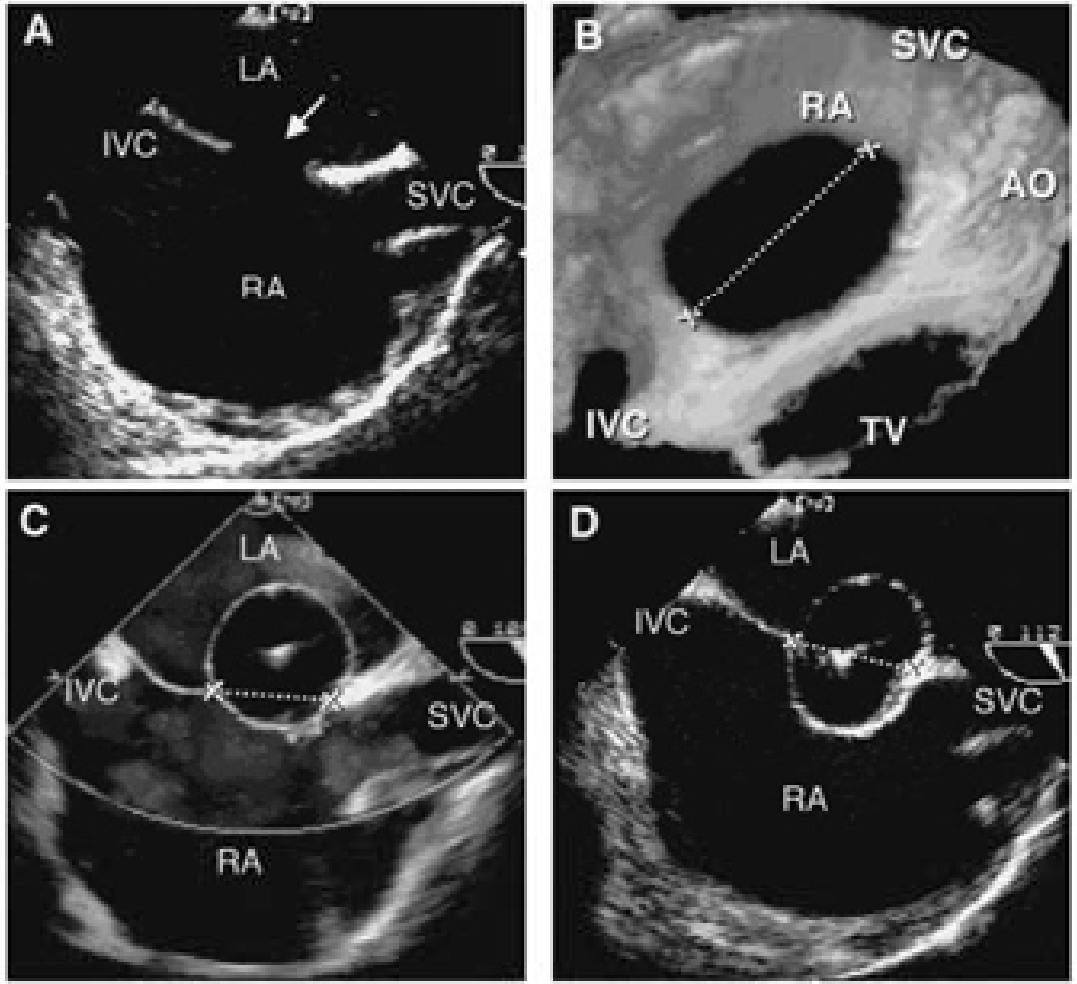
Lodato JA, Eur J Echocardiogr. 2009;10:543–8

ASD Size Measurement Using RT3DE



Lodato JA, Eur J Echocardiogr. 2009;10:543–8

ASD Size by RT3DE vs. Balloon



Zhu W, Pediatr Cardiol. 2000;21:465-9

ASD Size by 3D TEE vs. Balloon

Table 1. Correlation between SBD and other ASD size measurements

Measurement	Mean Diff. (mm)	r	SEE	Equation	P
2-D TEE vs SBD	−4.44	0.86	1.46	$y = 0.80x - 0.67$	<0.0001
3-D TEE vs SBD	−2.38	0.87	1.33	$y = 0.77x + 1.95$	<0.0001
BOD vs SBD	−1.98	0.92	1.04	$y = 0.81x + 1.60$	<0.0001

ASD, atrial septal defect; BOD, balloon occlusive diameter; Mean Diff., mean difference; SBD, stretched balloon diameter; SEE, standard error of estimation; TEE, transesophageal echocardiography.

Table 2. Correlation between BOD and other ASD size measurements

Measurement	Mean Diff. (mm)	r	SEE	Equation	P
2-D TEE vs BOD	−2.41	0.95	0.89	$y = 1.01x - 2.50$	<0.0001
3-D TEE vs BOD	−0.40	0.98	0.59	$y = 0.98x - 0.15$	<0.0001

ASD, atrial septal defect; BOD, balloon occlusive diameter; Mean Diff., mean difference; SEE, standard error of estimation; TEE, transesophageal echocardiography.

Zhu W, Pediatr Cardiol. 2000;21:465-9

ASD Size by 3D TEE vs. Balloon

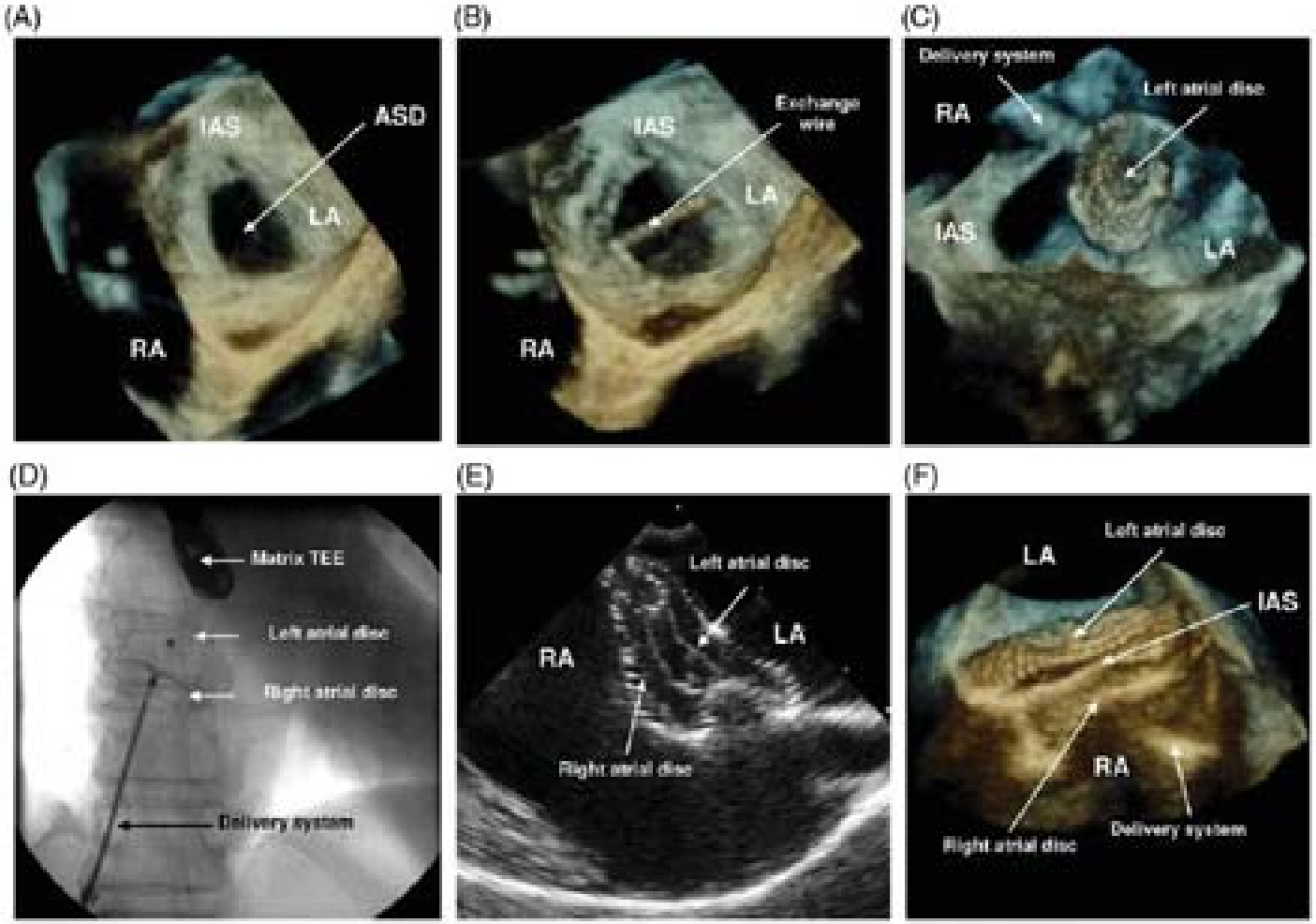
Table 3 Atrial septal defect maximal diameter vs balloon-stretched diameter

	Cath (mm) (mean ± SD)	3DE (mm) (mean ± SD)	Mean diff	Line of identity	
Total population (n=12)	17·9 ± 3 (12–20)	17·7 ± 4 (13–27)	0·2 ± 4	y=0·3 × +13	r=0·41
Round shape (n=6)	18 ± 2 (12–20)	17·1 ± 3 (15–27)	0·8 ± 2	y=0·5 × +9·5	r=0·68
Complex shape (n=6)	17·8 ± 4 (15–20)	18·2 ± 2·5 (12–27)	0·3 ± 5	y=0·24 × +13	r=0·35

ASD=atrial septal defect; Cath=balloon-stretched diameter obtained by transatrial ballon catheter; 3DE=maximal diameter obtained by three-dimensional echocardiography; Mean diff=mean difference between the two methods.

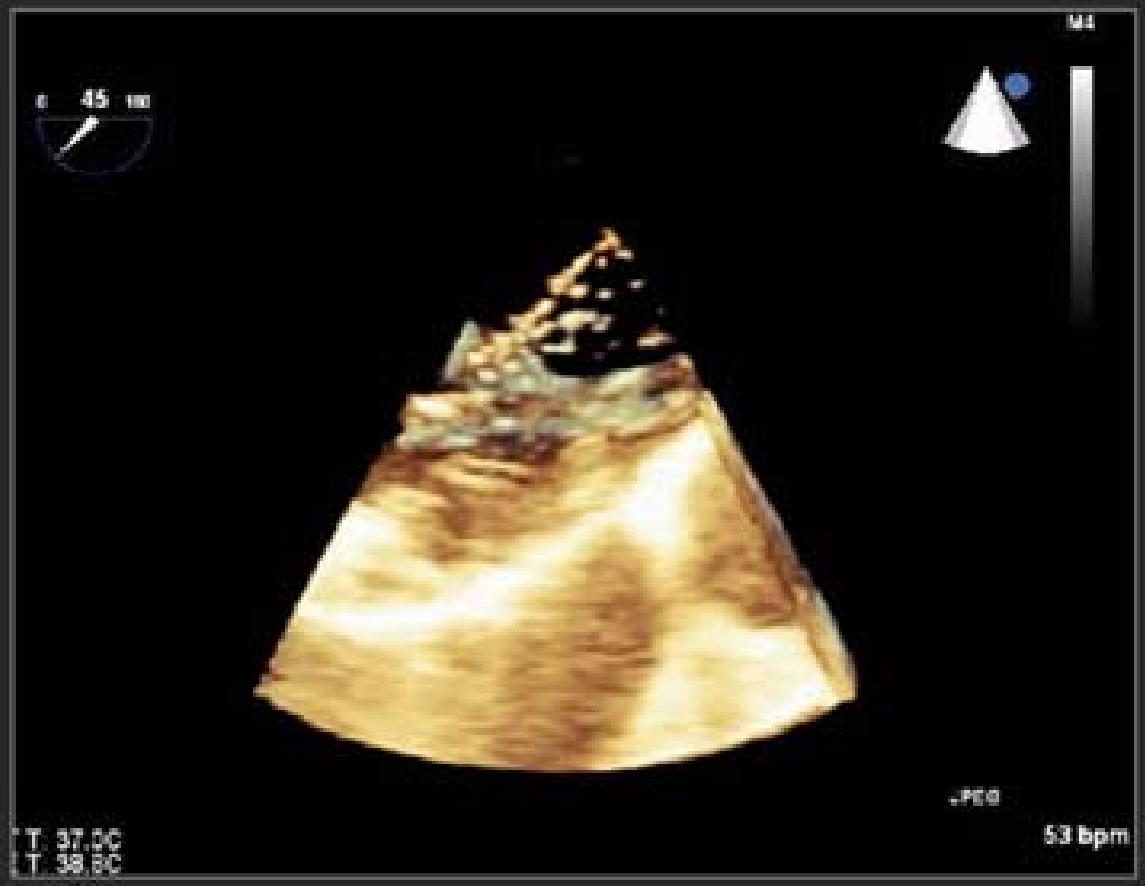
Acar P, Eur Heart J. 2000; 21:573–581

Deployment of Amplatzer Septal Occluder

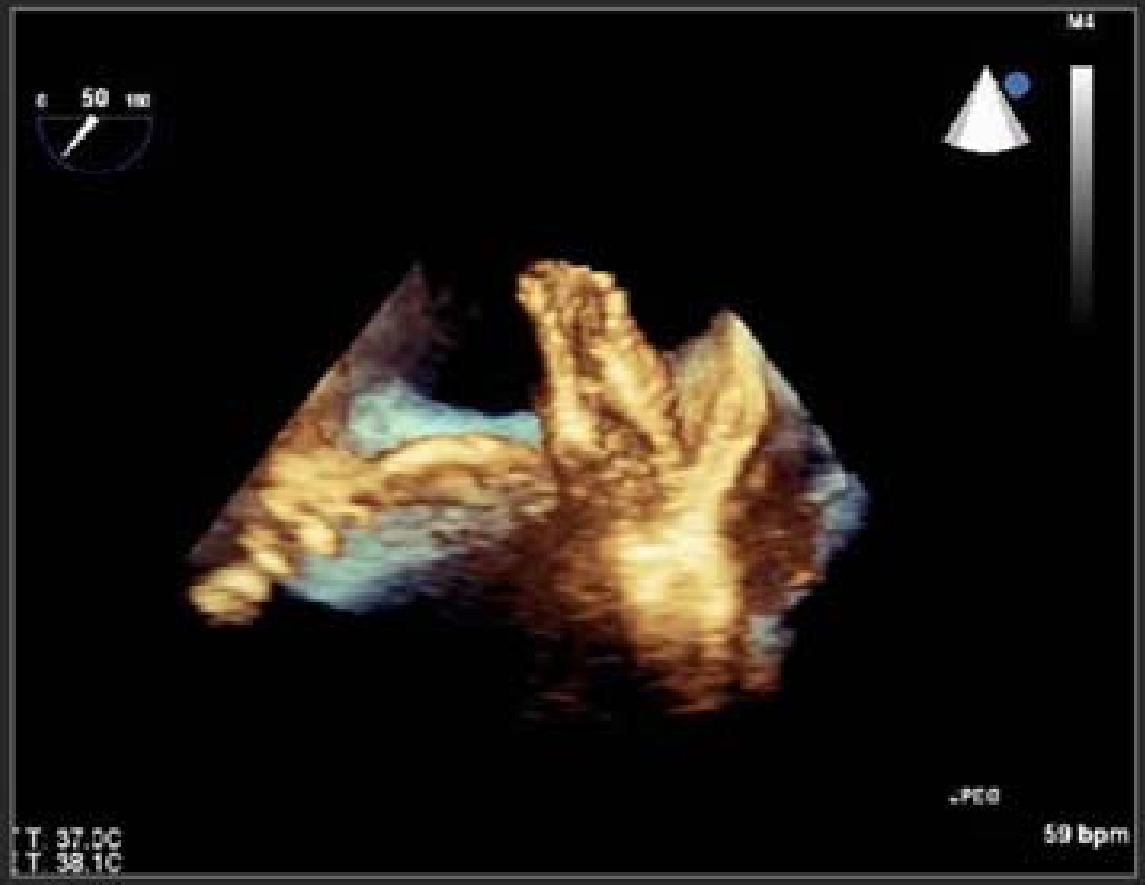


Balzer J. Eur Heart J. 2008;29:2226

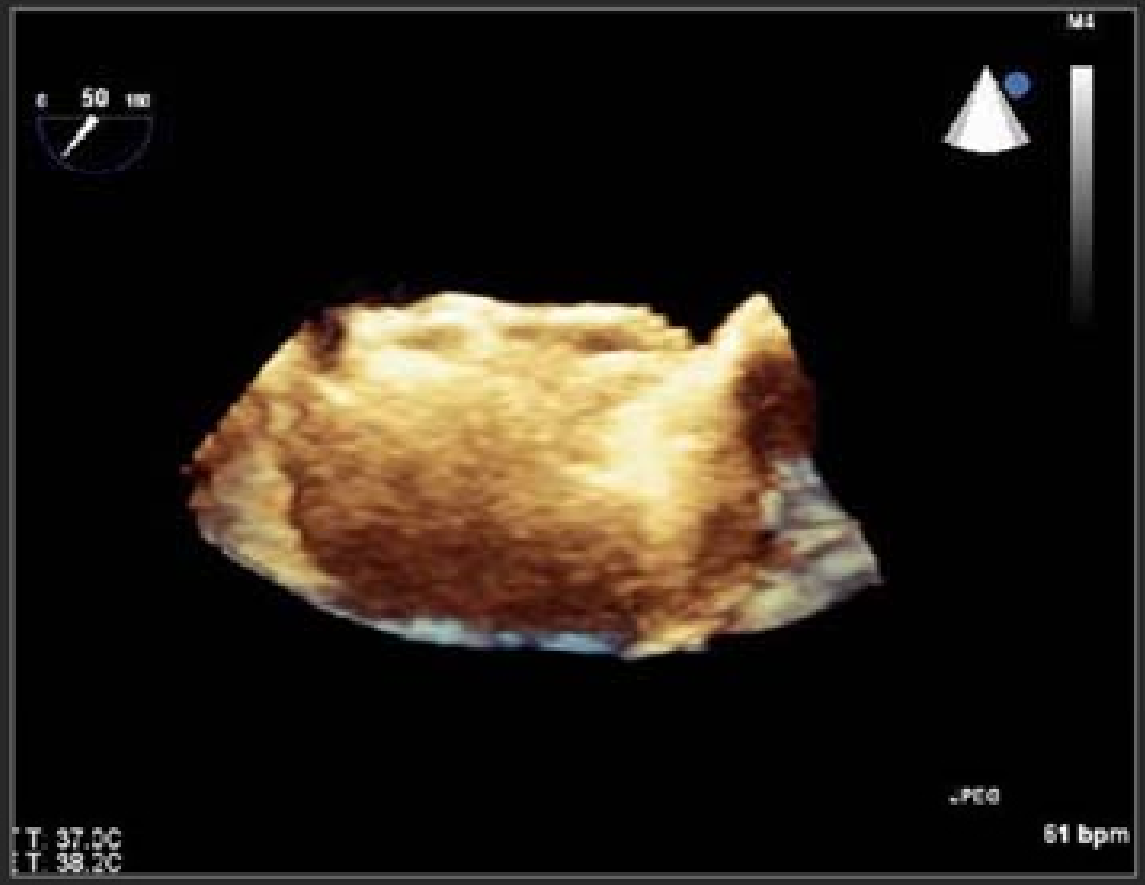
Deployment of Amplatzer Septal Occluder



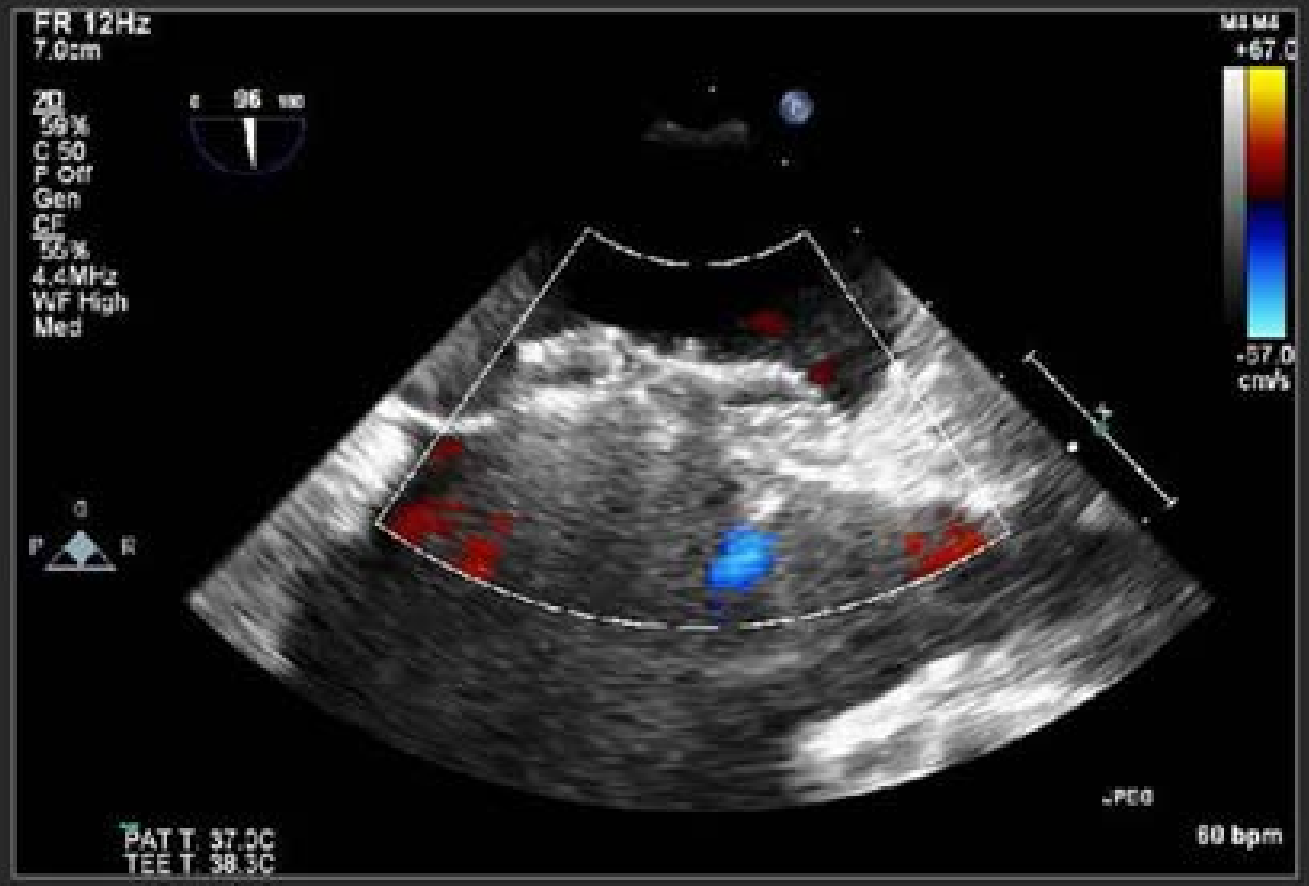
Deployment of Amplatzer Septal Occluder



Deployment of Amplatzer Septal Occluder



Deployment of Amplatzer Septal Occluder



Deployment of Amplatzer Septal Occluder

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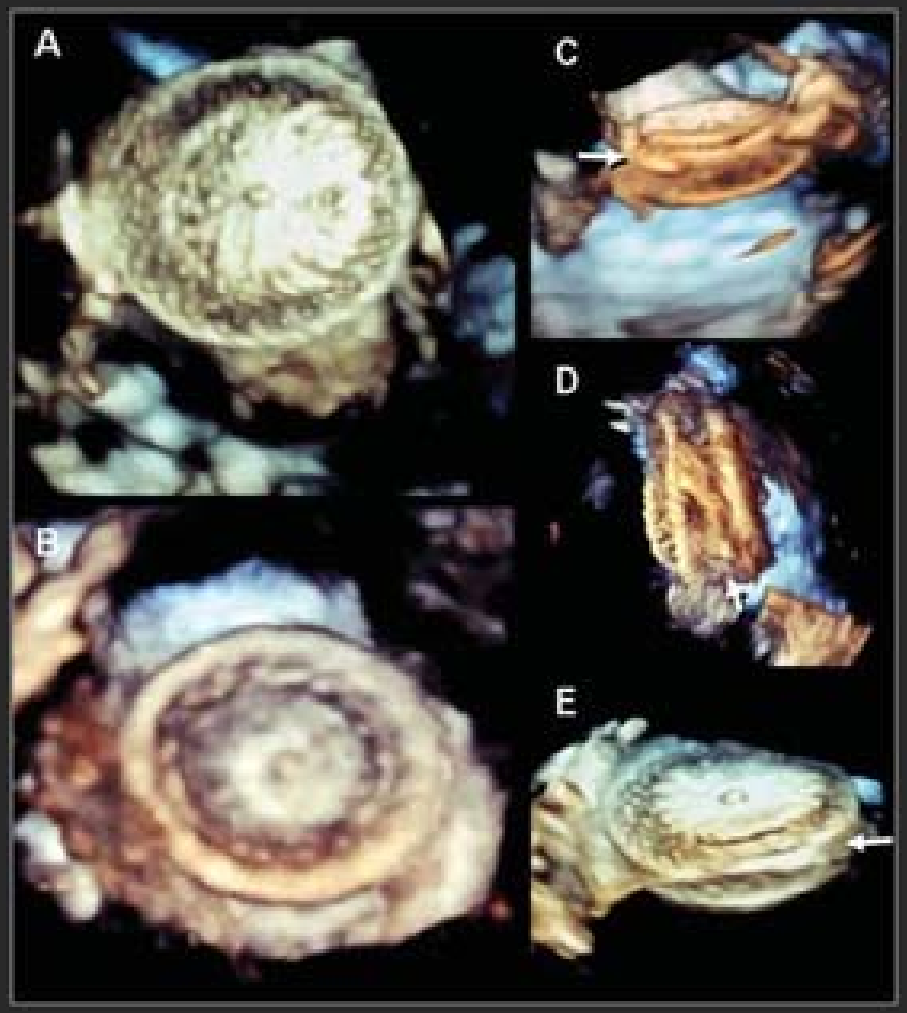
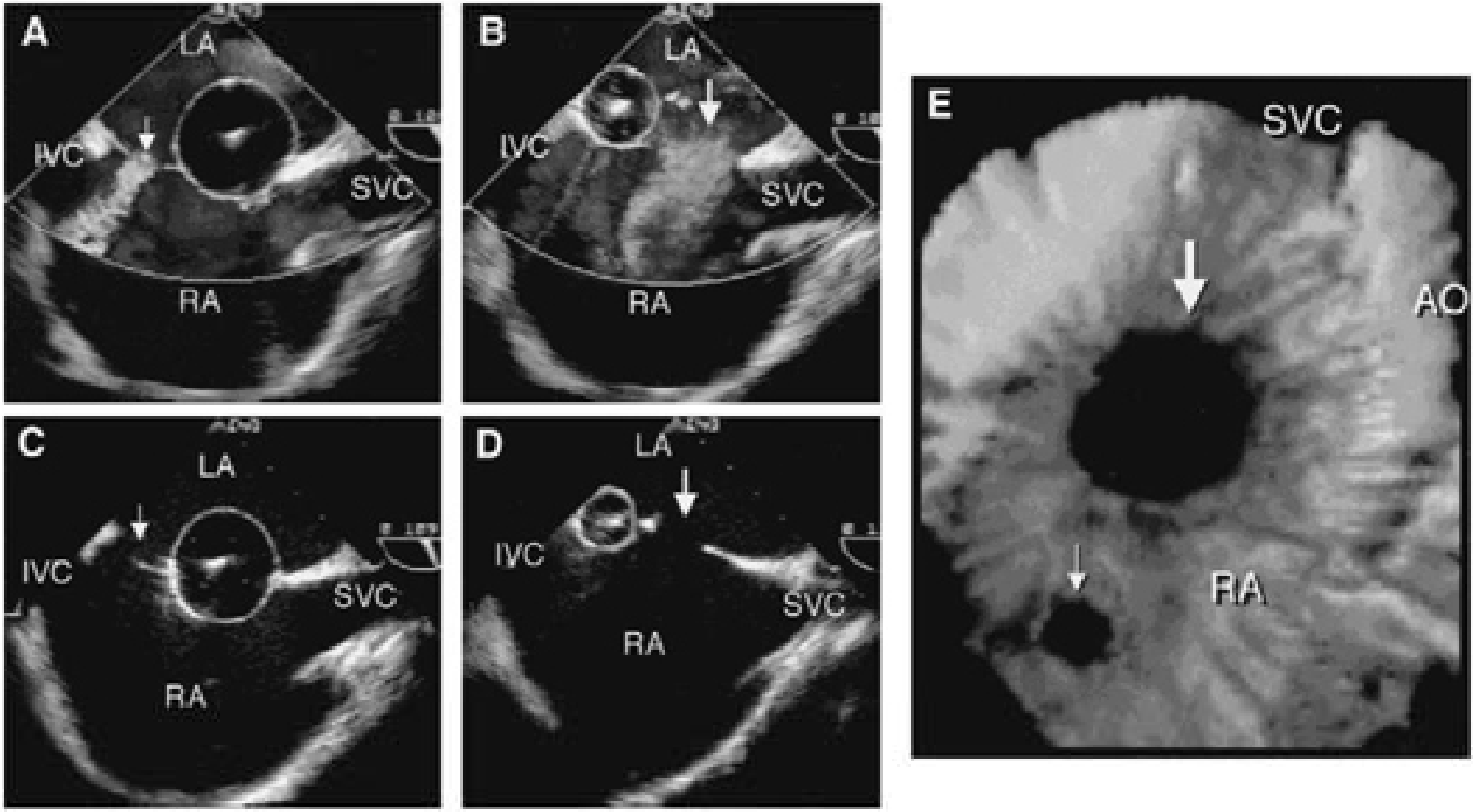


Lodato JA, Eur J Echocardiogr. 2009;10:543–8

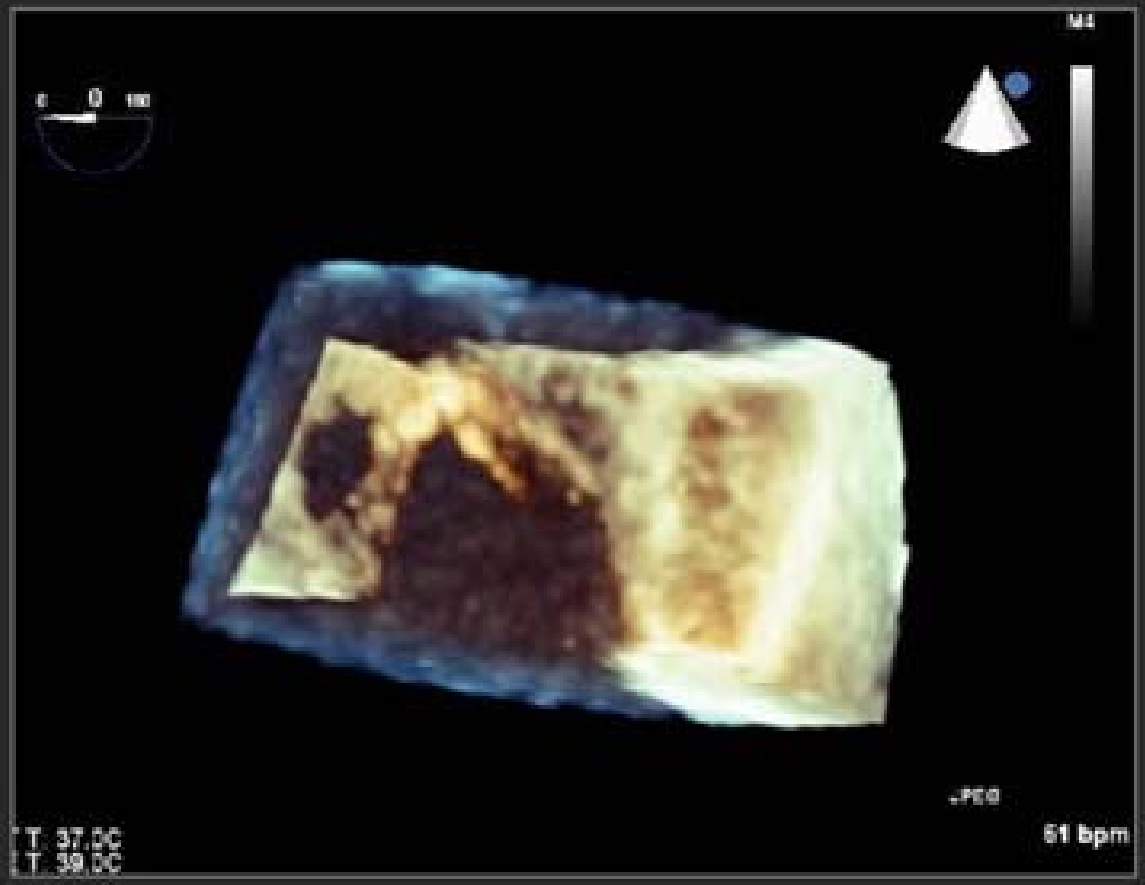
Multiple ASD



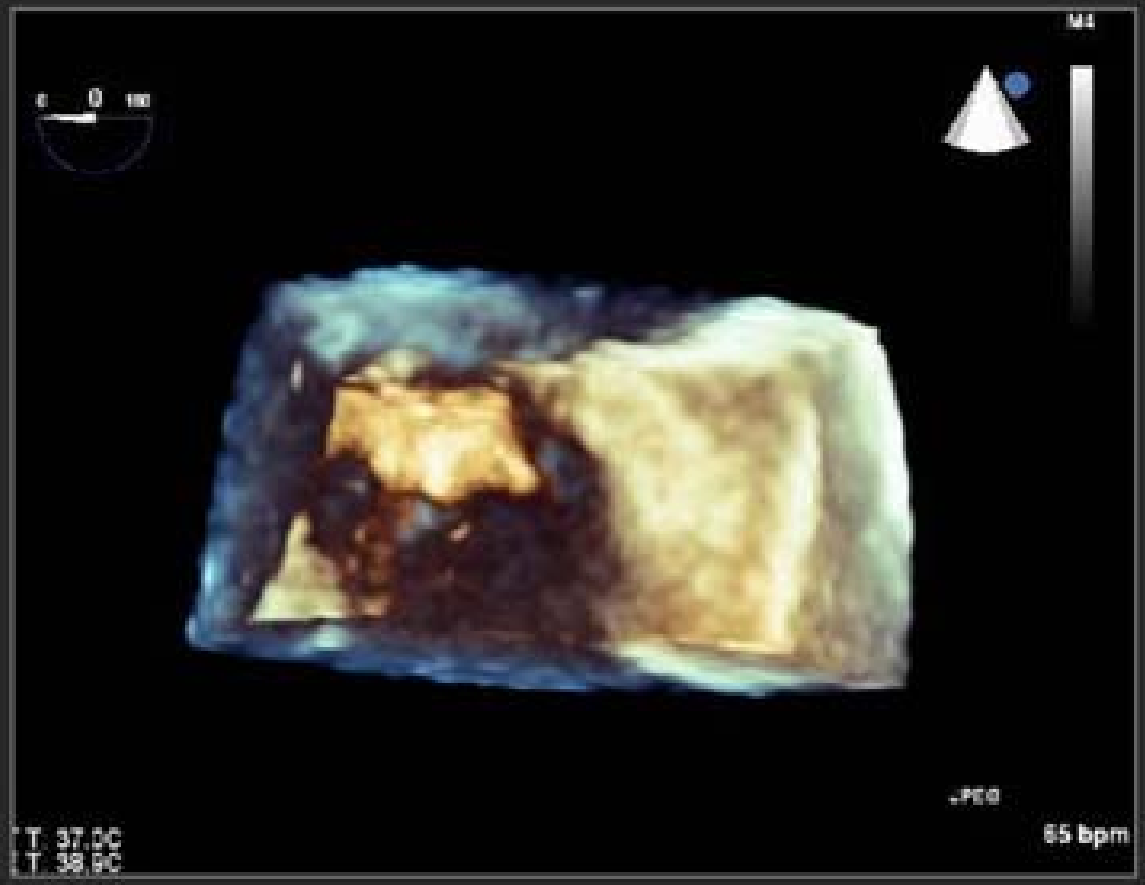
Zhu W, Pediatr Cardiol. 2000;21:465-9

Multiple ASD

Multiple ASD

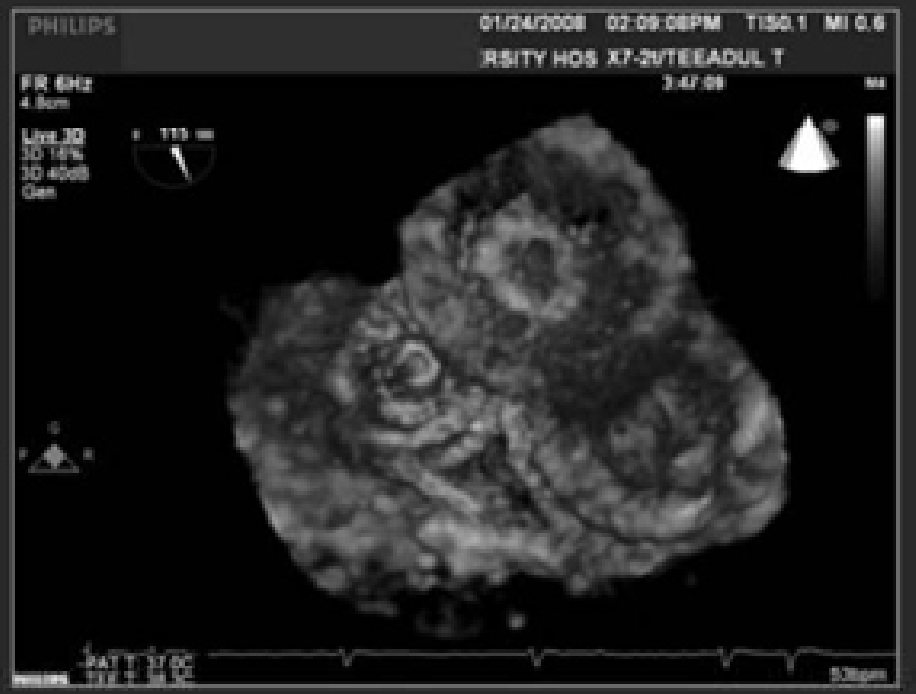


Multiple ASD



Multiple ASD

Device Occlusion of Multiple ASD



Georgakis A, Echocardiography 2010;27:590-593

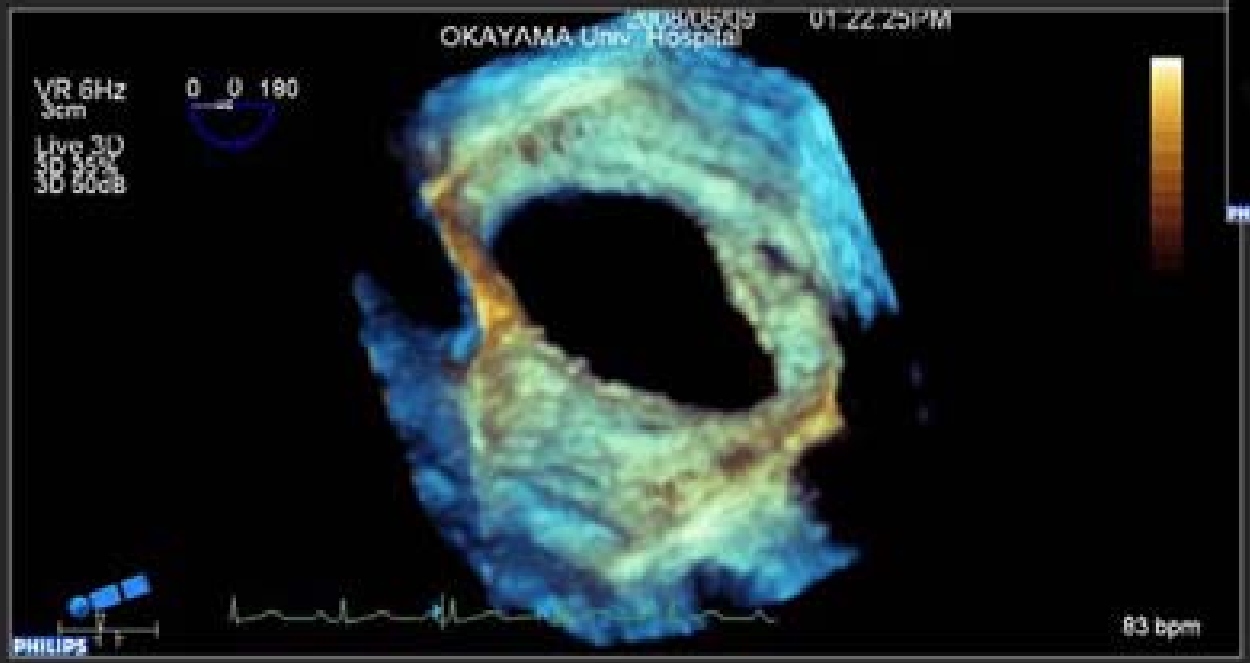
Torn ASD during ASD Occlusion Procedure

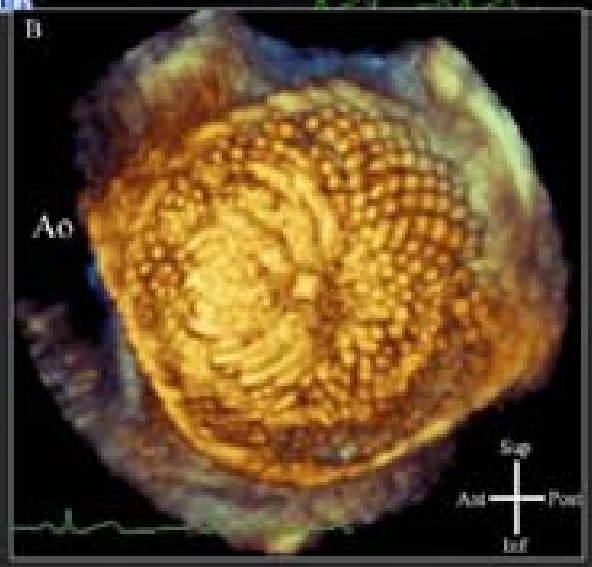
Kijima Y, J Am Soc Echocardiogr. 2010

Torn ASD during ASD Occlusion Procedure

Kijima Y, J Am Soc Echocardiogr. 2010

Torn ASD during ASD Occlusion Procedure





Kijima Y, J Am Soc Echocardiogr. 2010

Role of 3D TEE

- **Evaluation before procedure**
  - Number and shape of ASD
  - Geometric relations with adjacent structures
  - Measurement of maximal diameter
    - Deciding Amplatzer device size
- **Guidance of procedure**
  - Multiple ASD
    - Catheter position
  - Ensuring device position before detachment
  - Monitoring complications
    - Torn tissue
    - Thrombus


Thank you for your attention.