





Egyptian Society of  
CARDIOLOGY

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## Imaging Guidance During Congenital and Structure Intervention & Its Limitations



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## Cardiac Imaging Modalities


- Transthoracic ECHO
- Transesophageal ECHO
- 3 Dimensional Echo
- Intracardiac ECHO
- Fluoroscopy/Angiography
- MRI

Adjunctive  
Imaging

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## ASE RECOMMENDATIONS FOR CLINICAL PRACTICE

## Echocardiography-Guided Interventions

2009

Interventional Procedure	TTE	TEE	ICE
Transseptal catheterization	+	++	++ (radial or phased array)
PMBV	++	+++	++
Transcatheter closure of ASD, ventricular septal defect, and PFO	+	++	++ (phased array)
Alcohol septal ablation in HOCM	++	++	-
Percutaneous mitral valve repair	+	+++	+
Percutaneous left ventricular assist device placement	-	++	++
Percutaneous stented aortic valve prosthetic placement	-	+	+
Balloon or blade atrial septostomy	++	++	++
Placement of LAA occlusion devices	-	++	++
Myocardial and intravascular biopsy	++	++	++ (phased array)
Congenital heart disease applications (completion of Fontan procedure, coarctation repair)	+	+	+
Placement of aortic endograft	-	-	+(radial or phased array)

-, No documented role or benefit in the literature; +, anecdotal reports of use and benefit exist, but further study is needed to delineate; ++, advantages favor use when available; +++, clearly documented benefit or role.


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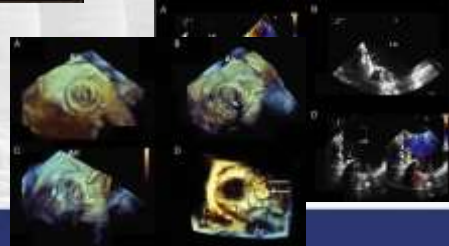
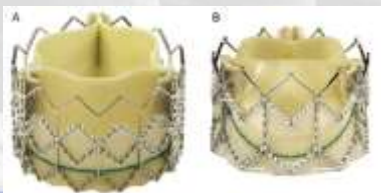
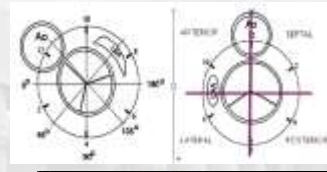
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## EXPERT CONSENSUS STATEMENT

## EAE/ASE Recommendations for the Use of Echocardiography in New Transcatheter Interventions for Valvular Heart Disease

2012



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## Current Structural Heart Disease Interventions

- ASD Occlusion
- Balloon Atrial Septostomy
- Muscular VSD Occlusion
- Membranous VSD Occlusion
- Mitral valve balloon Valvuloplasty
- Periprosthetic Leak Occlusion
- Percutaneous Aortic Valve Sinus of Valsalva Fistula Occlusion
- Aortic Valvuloplasty
- Aortic Aneurysm Occlusion
- Prosthesis Implantation
- LA Appendage Occlusion
- Alcohol Septal Ablation
- PFO Occlusion
- Percutaneous Edge-to-Edge Mitral Valve Repair



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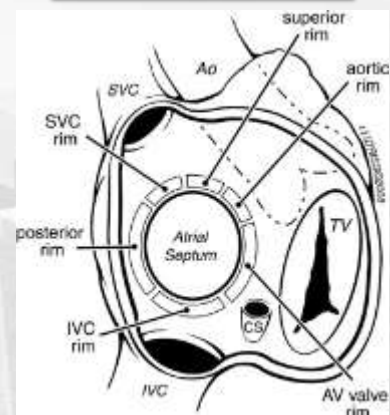
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## Atrial Septal Defect

- Evaluation of Anatomy:
  - Shape, Location
  - Number of Defects
  - Size: Max & Min Diameter
- Rim Assessment
- ASD Suitable for Device?

Zahid Amin 2006



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# IntraCardiac ECHO - ICE



AcuNav



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# Intra-Cardiac ECHO ( ICE )



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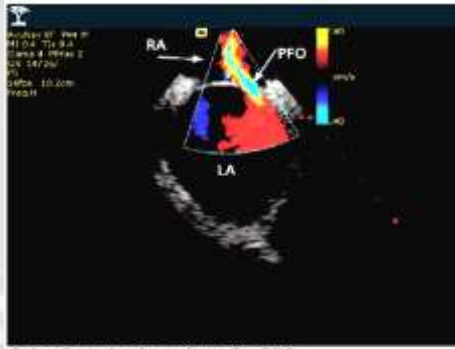
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# Interventional Cardiology

Patent Foramen Ovale – ASD Closure  
More interventions .... VSD, MV, Ao



Color Doppler imaging of a PFO



PFO Closure Device Fully Deployed

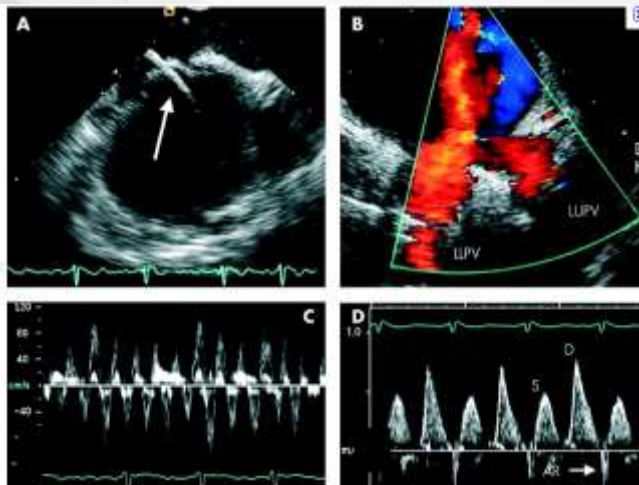


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# ICE in EP Studies



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## Live Transmission at KACC

### ECHO Workshop 2009



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## Comparison Between ECHO Modalities

	Advantages	Disadvantage
TEE	<ul style="list-style-type: none"> <li>- Low cost</li> <li>- Familiar to most Echocardiographers</li> </ul>	<ul style="list-style-type: none"> <li>- Not convenient to pat.</li> <li>- General Anesthesia</li> <li>- Poor IVC Rim</li> </ul>
ICE	<ul style="list-style-type: none"> <li>- Convenient for patient</li> <li>- Local anesthesia</li> <li>- No additional staff</li> </ul>	<ul style="list-style-type: none"> <li>- Expensive</li> <li>- Single plane imaging</li> <li>- Additional venous access</li> <li>- Catheter interference</li> </ul>
3DTEE	<ul style="list-style-type: none"> <li>- Easier detection / immediate understanding of anatomy and spacial relationship</li> </ul>	<ul style="list-style-type: none"> <li>- Same as TEE</li> <li>- Learning curve</li> </ul>



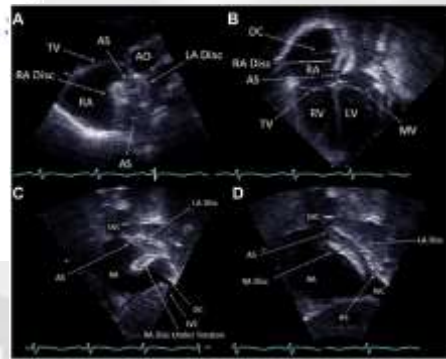
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## Prospective Randomized Trial of Transthoracic Echocardiography Versus Transesophageal Echocardiography for Assessment and Guidance of Transcatheter Closure of Atrial Septal Defects in Children Using the Amplatzer Septal Occluder

- Small Sample size
- Selected patients only
  - 44 pts. excluded out 84 pt.
- Single ASD and no multiple ASD's



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## Transthoracic echocardiographic guidance during transcatheter closure of atrial septal defects in children and adults

Abdullah Erdem · Turkyay Saritas · Cenap Zeybek ·  
Ilker Kemal Yucel · Nurdan Erol · Halil Demir ·  
Ender Odemis · Yalin Yalcin · Ahmet Celebi

Table 1. Patient characteristics, procedure variables, and follow-up

	Patients used TTE (n = 206)	Patients used TEE (n = 131)	P
Age (year)	9 (1.5-64)	16 (3-73)	<0.001
Gender (female)	63.5% (131)	68.7% (90)	0.3
ASD diameter (mm)	14.9 ± 4 (7.5-27)	17.2 ± 5 (4.8-30)	<0.001
Color flow defect's dimension (mm)	16.6 (9-33)	21 (8-33)	<0.001
Total septal diameter (mm)	41 ± 6 (31-58)	45 ± 7 (30-70)	<0.001
Stretch balloon size (mm)	18.7 (10-34)	21 (12-39)	0.003
ASD device diameter (mm)	19 (10-34)	22 (11-36)	<0.001
ASD device diameter/total septum	0.49 (0.2-0.7)	0.49 (0.2-0.7)	0.6
Right ventricle end-diastolic diameter index (mm/m <sup>2</sup> )	27 (14-51)	24 (15-50)	0.005
Ratio of complex atrial septal defect, n (%)	30/206, 14%	45/131, 34%	0.01
Qp/Qs ratio	1.8 (1.5-4)	2 (1.5-5)	<0.001
Mean pulmonary artery pressure (mmHg)	16 (7-36)	16.5 (8-45)	0.68
Procedure time (min)	60 (20-180)	73 (30-210)	<0.001
Fluoroscopy time (min)	13 (4-65)	16.5 (8-62)	<0.001
Procedural success, n (%)	206/206 100%	128/131, 97.7%	0.6
Complication rate	5/206, 2.4%	13/131, 9.9%	0.007
Follow-up time (month)	24 ± 18	30 ± 24	0.014
Residual shunt %			
Before discharge—1, day	9.4, 3%	7.5, 3%	0.4
1 month	7.5, 3%	3.3%,	0.8
6 month	4.1, 5%	2.1, 5%	0.5
At the end of follow-up	4.1, 5%	2.1, 5%	0.5

Number in bolds are statistically significant



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## Transthoracic ECHO during ASD device Closure

- X-Ray radiation exposure to Echo- cardiographer (in field of operation)
- Oversizing of ASD devices
- Wastage of Devices due to lack of accurate measurement



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## Available Resources Charity Missions



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## Debate: ASD Closure by TTE Vs TEE



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## ASD Closure – TEE versus Transthoracic ECHO

	Advantages	Disadvantages
TEE	Good Acoustic Window	Esophageal Pathology
	Single View	General Anesthesia
Transthoracic ECHO	Esophageal Pathology	Cumbersome
	Moderate Sedation	Poor Acoustic Window
	Small Patient Size	Multiple Window
		Complex ASD's

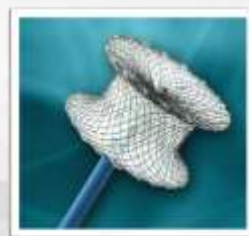
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## Transcatheter VSD Closure

- Chamber size
- Evaluation nearby structure
  - Aortic valve
  - A-V valves
- Measurement of defect:
  - End of the diastole
- Morphology of MVSD
- Multiple defects
- Device deployment



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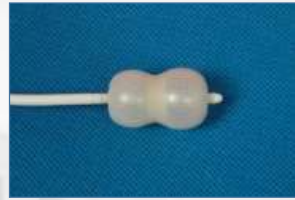
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## Septal Puncture



- MV Balloon Dilatation
- Para-valve Leak Occlusion
- Electrophysiological Studies – Ablation
- LA Appendage Occlusion

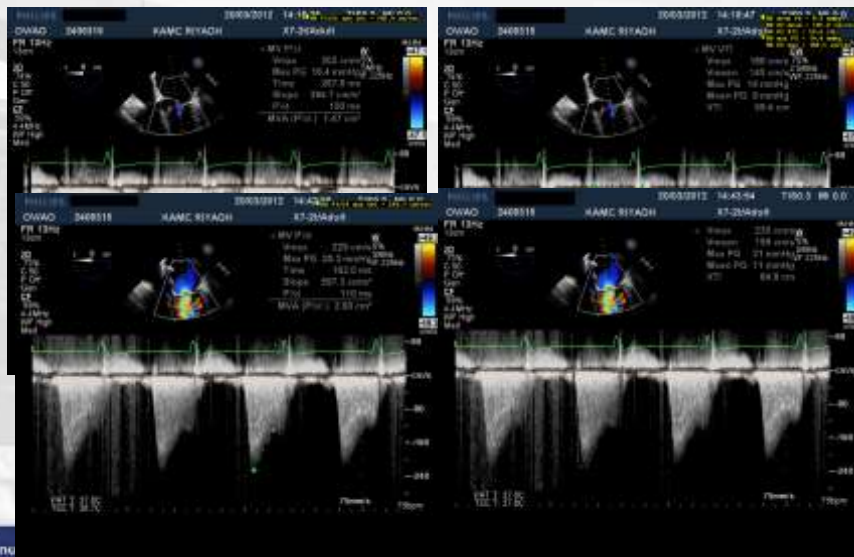


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## Mitral Valve Balloon Dilatation



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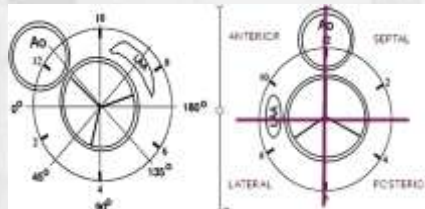
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## Paravalvular Regurgitation (Leak)

- Dehiscence is best described in relation to internal landmarks:
  - Left atrial appendage
  - Aortic valve
  - Crux of the heart



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## Conclusion

- Advances in Device therapy for cardiac disease impose a great demand on imaging modalities
- Each modality has its own advantages and limitations
- Body wt. in children limit the choices for imaging modality



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# ICHHD – Dubai 2016



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