



Percutaneous ASD closure in adult patients

Jou-Kou Wang, MD
Department of Pediatrics,
National Taiwan University Hospital









Considerations in the closure of ASD in adults (I)

- ◆ **Benefit vs. Risk**
- ◆ **Indications & contraindications**
- ◆ **Types and morphology of ASD**
- ◆ **Pulmonary artery pressure**
- ◆ **Presence of arrhythmia**
- ◆ **Ventricular function**
- ◆ **Systemic hypertension & Coronary artery lesions**
- ◆ **Other associated cardiovascular diseases**
- ◆ **Methods of closure**

Considerations in the closure of ASD in adults (II)

§ Benefit vs. Risks

- Above 40 years of age

** medical treatment vs. surgery*

** transcatheter closure vs. medical treatment*

** transcatheter closure vs. surgery*



Considerations in the closure of ASD in adults (III)

§ Indications

- * **Symptoms**
- * **Hemodynamic study $Q_p/Q_s \geq 1.5$**
- * **Right ventricular volume overload**

§ Contraindications

- * **Eisenmenger syndrome**
- * **Others**

Considerations in the closure of ASD in adults (IV)

§ Types of ASD

- * **Secundum type**
- * **Primum type**
- * **Sinus venosus type**
- * **Unroofed coronary sinus**

§ morphology of ASD

- * **single defect**
- * **multi-perforated defects**
- * **atrial septal aneurysm**
- * **deficiency in rims**

Considerations in the closure of ASD in adults (V)

§ Pulmonary hypertension

- * Pulmonary hypertension is quite common in patients aged > 40 years**
- * Reversibility of pulmonary hypertension after closure**

Considerations in the closure of ASD in adults (VI)

§ Presence of arrhythmia

- * **Atrial fibrillation (persistent/ paroxysmal)**
- * **Atrial flutter**
- * **Sick sinus syndrome**
- * **PSVT**
- * **Bigeminy / trigeminy**

Considerations in the closure of ASD in adults (VII)

§ Ventricular function

- * Impaired left ventricular function**
- * Impaired right ventricular function**

Considerations in the closure of ASD in adults (VIII)

§ Associated cardiovascular anomalies

- * Pulmonary stenosis**
- * Anomalous pulmonary venous connection**
- * Ebstein's anomaly**
- * ventricular septal defect**
- * patent ductus arteriosus**

Considerations in the closure of ASD in adults (IX)

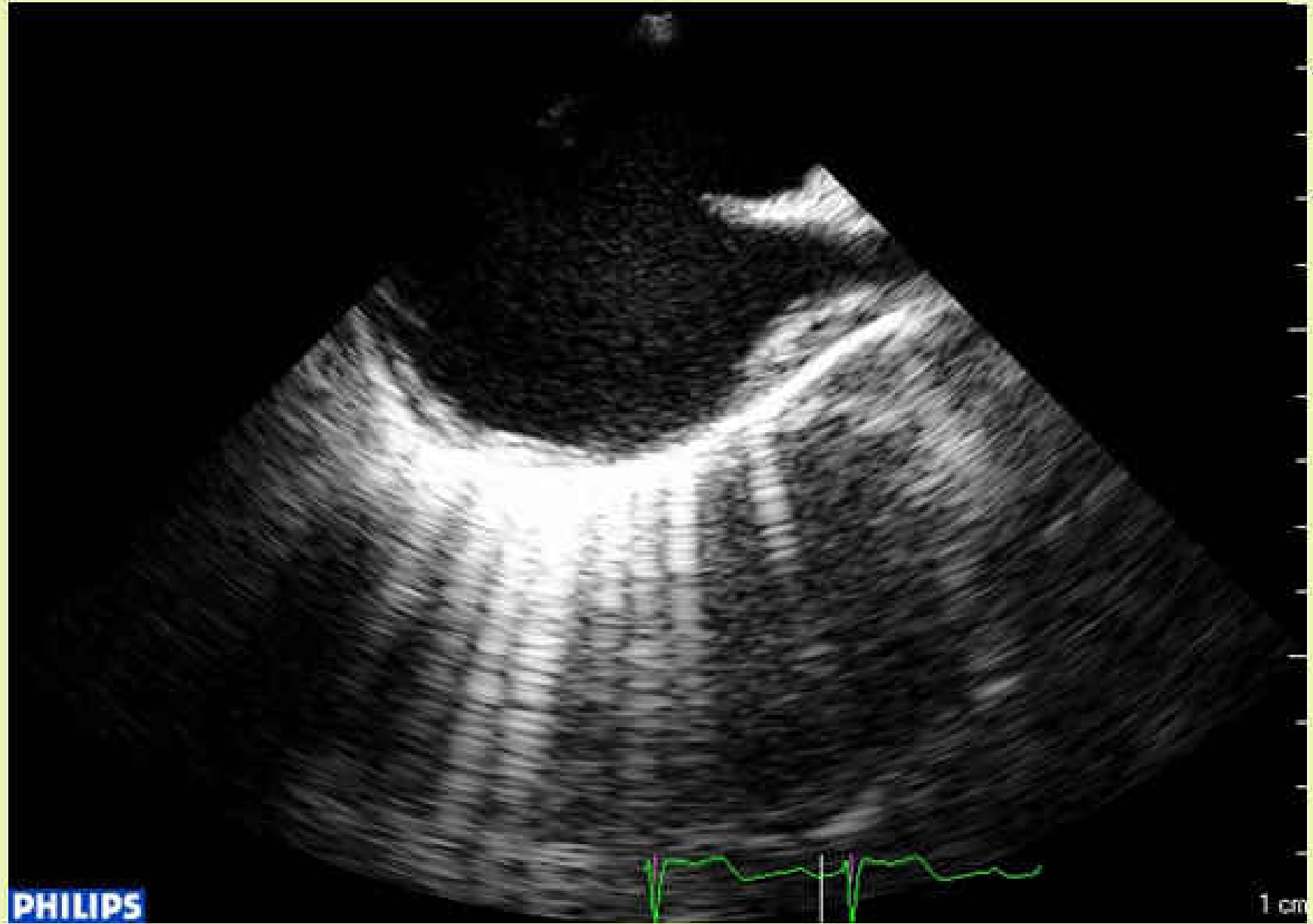
§ Methods of closure

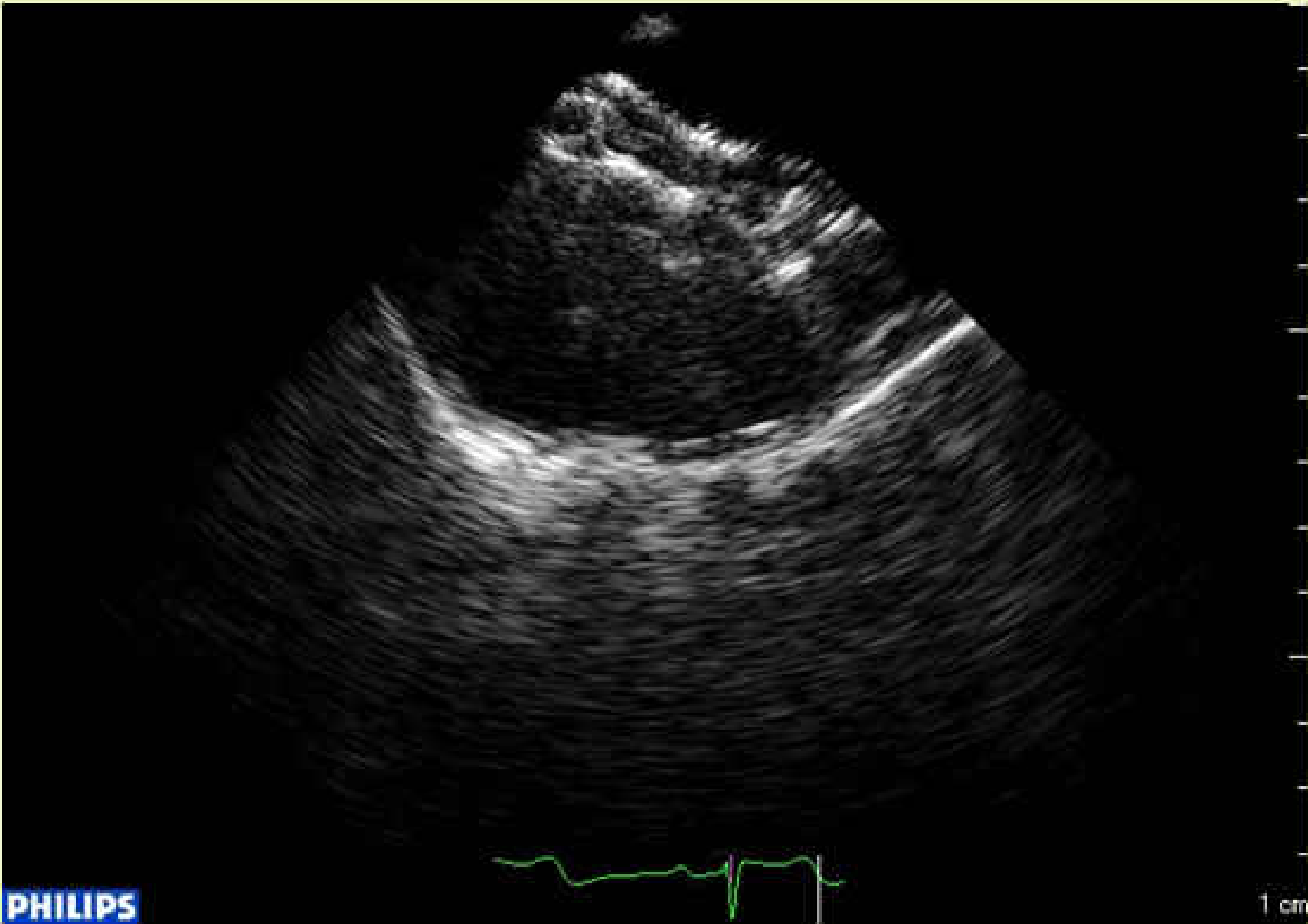
- * Transcatheter, what device ?*
- * Surgery*



Difficulties encountered during transcatheter closure of ASD in adults

- * **Large size of ASD**
- * **Complex morphology**
- * **Atrial fibrillation**
- * **Advanced pulmonary hypertension**
- * **Impaired ventricular function**
- * **Other systemic disease (H/T, DM, CAD...)**





PHILIPS

1 cm

Selection of Device Size (I)

- * **Sizing -- device diameter equal to or within 2 mm greater than stretched balloon diameter (stop flow)**
- * **No sizing**

Selection of Device Size (II)

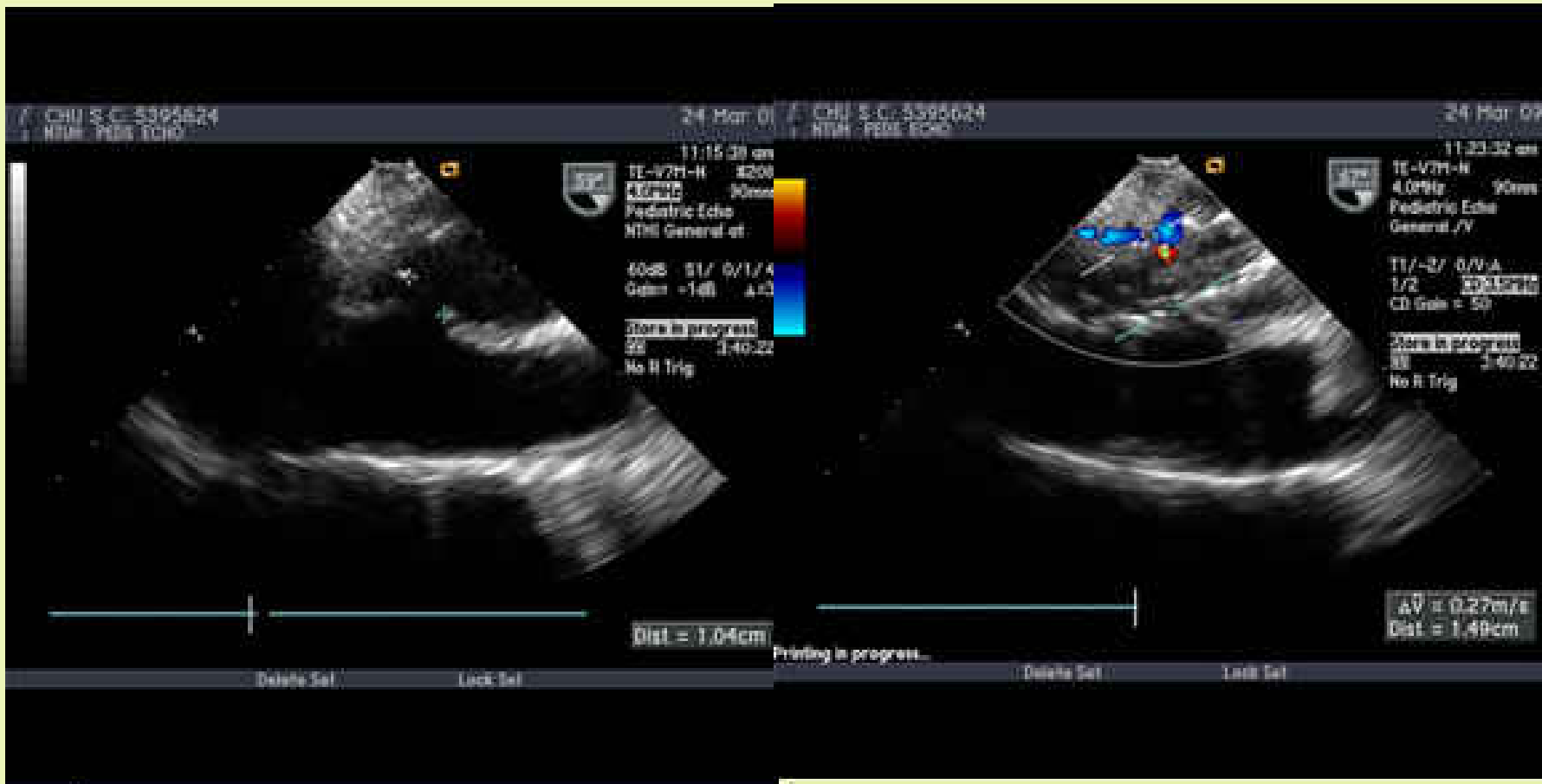
- * **No balloon sizing for single and simple defect**
Device diameter = 4 ~ 8 mm+ maximal defect diameter on TEE
- * **Multi-perforated defects: balloon sizing of defects measured > 5 mm in diameter**
- * **Using Cribriform device, no sizing, measure the dimension of aneurysm**

Multi-perforated defects

- * **Two or more devices for hemodynamically significant defects ≥ 7 mm apart**
- * **A cribriform device is useful in patients with atrial septal aneurysm and complex morphology**

TEE vs ICE monitoring

- ◆ **General anesthesia is usually required for TEE.**
- ◆ **ICE costly, but provides a better images for defects not centrally located**



CHU S C: 5395624
NTUH PEDI ECHO

24 Mar 09

11:08:44 am

TE-V7M-N #188

40cm 90mm

Pediatric Echo

NTHI General at

60dB S1/ 0/1/ 4

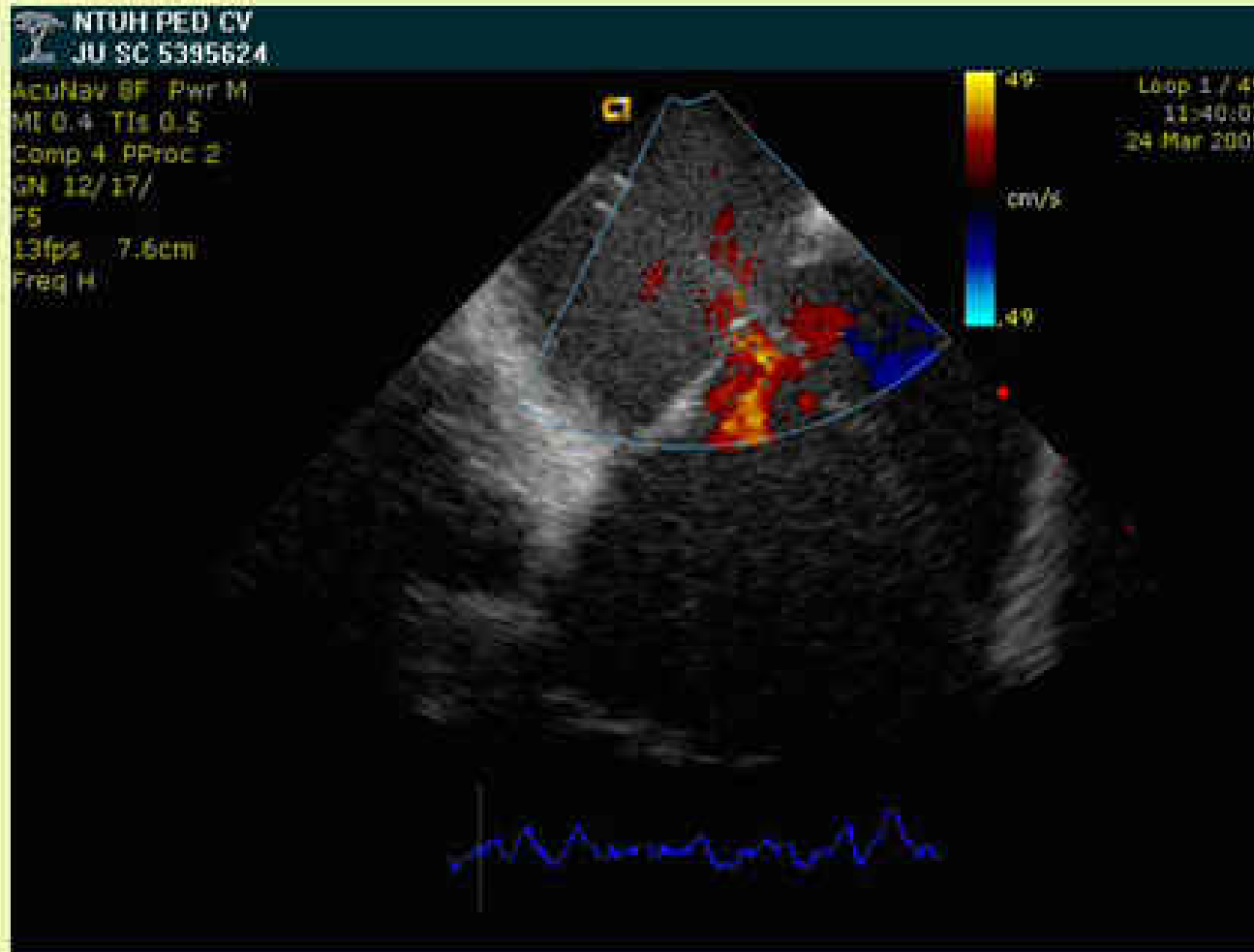
Gain= 2dB Δ=3

Store in progress

3:40:22

No R Trig





CHU S.C. 5395624
NTM PEDS ECHO

24 Mar 09

11:58:17 am

TE-V7H-N 101Hz

4.0MHz 80mm

Pediatric Echo
General

Store in progress

3:40:22

No R Trig

No trigger detected - defaulting to 1 second capture(s)

CD Pan

CD Pos/Size



PHILIPS

16/12/2007 02:19:28PM TIS0.4 MI 0.7

Demo X7-2U/3DTEE

FR 11Hz
12cm

1:36:56

M4 M4
+61.6

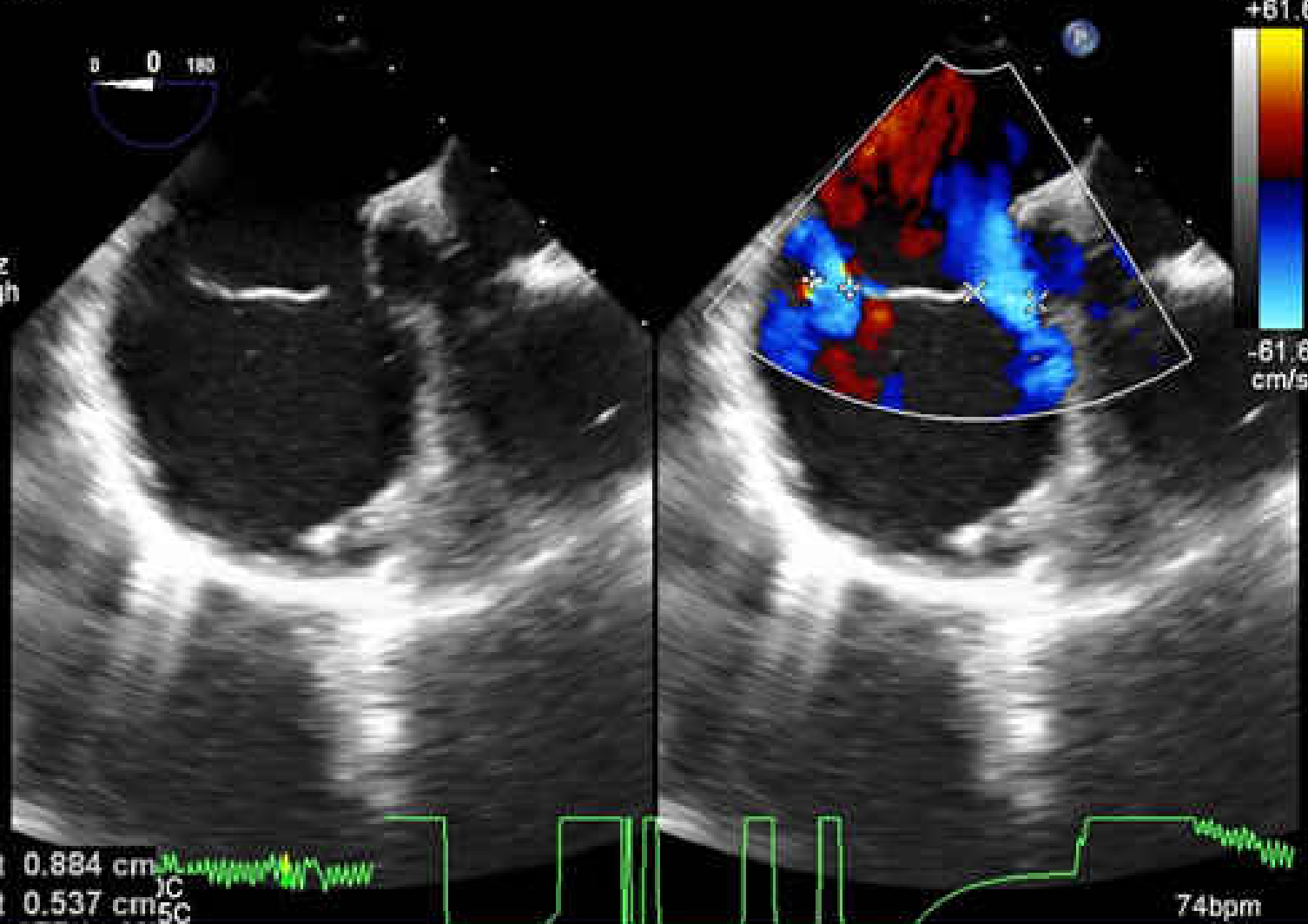
2D
74%
C 50
P Off
Gen
CF
63%
4.4MHz
WF High
Med

0 0 180

-61.6
cm/s

PHILIPS
Dist 0.884 cm
Dist 0.537 cm

74bpm



PHILIPS

16/12/2007 02:21:24PM TIS0.4 MI 0.7

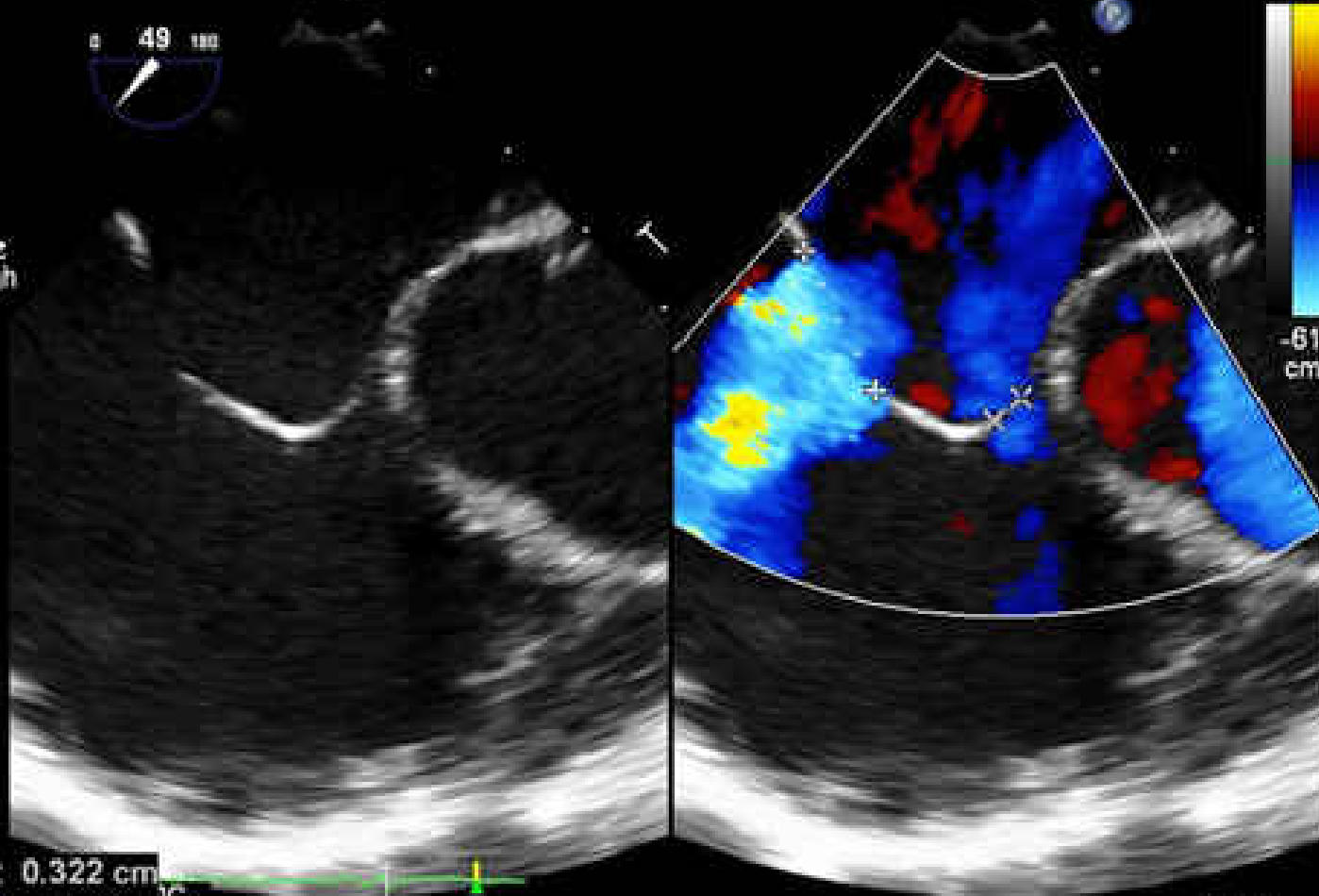
Demo X7-2U3DTEE

FR 11Hz
8.1cm

1:36:56

M4 M4
+61.6

2D
68%
C 50
P Off
Gen
CF
63%
4.4MHz
WF High
Med



Dist 0.322 cm

PHILIPS Dist 1.40 cm

65bpm

PHILIPS

16/12/2007 02:36:20PM TIS0.2 MI 0.5

X7-2U3DTEE

FR 30Hz
9.0cm

1:36:56

M4

Full Volume 0 35 100
3D 53%
3D 40dB



F# 19

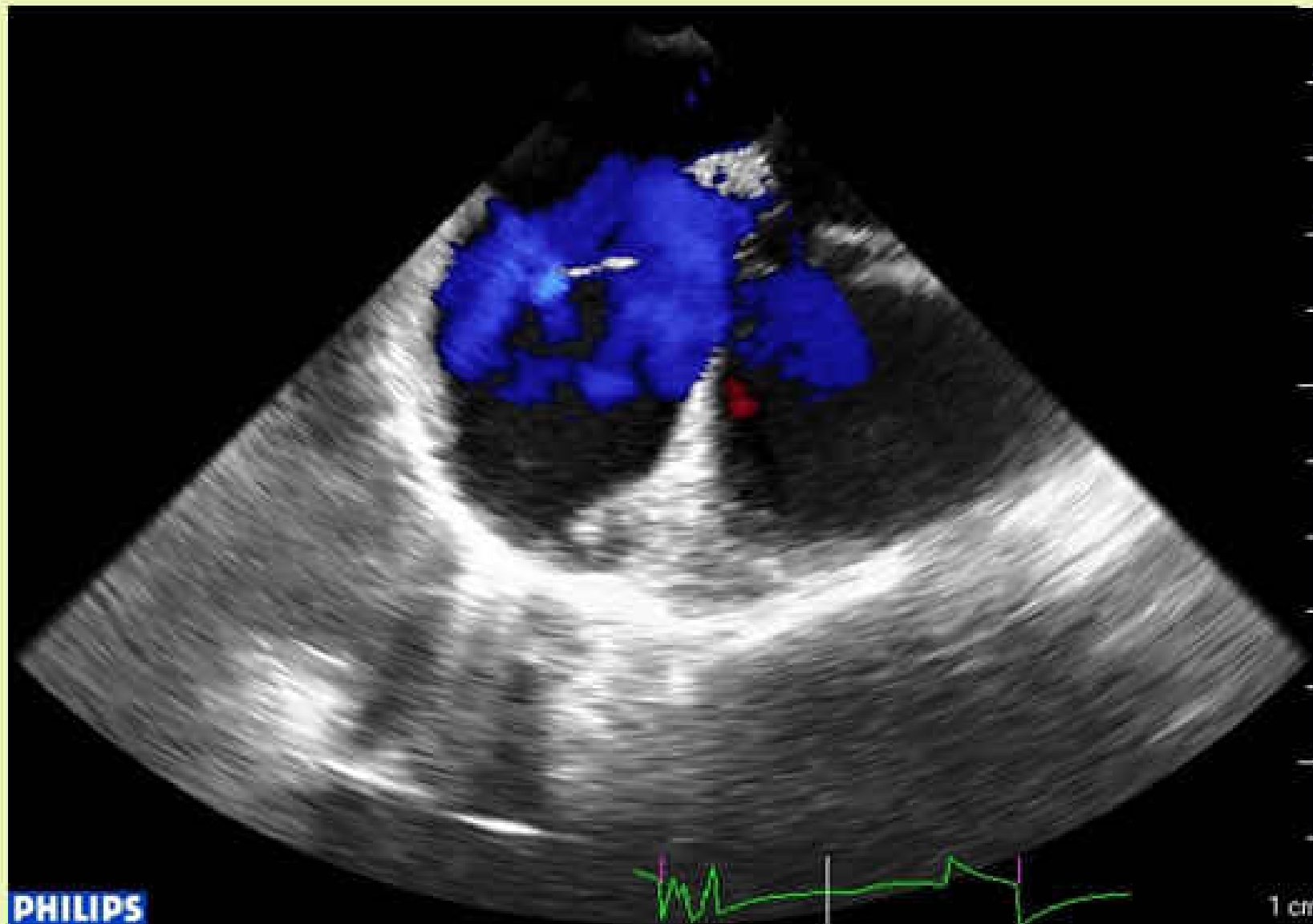


PAT T: 37.0C
ITEE T: 38.9C

9

76 bpm

PHILIPS



PHILIPS

16/12/2007 02:36:20PM TISO.2 MI 0.5

X7-2t/3DTEE

FR 30Hz 5 mm

1:36:56

M4

9.0cm

Full Volume 0 35 100

3D 48%

3D 40dB



F# 2

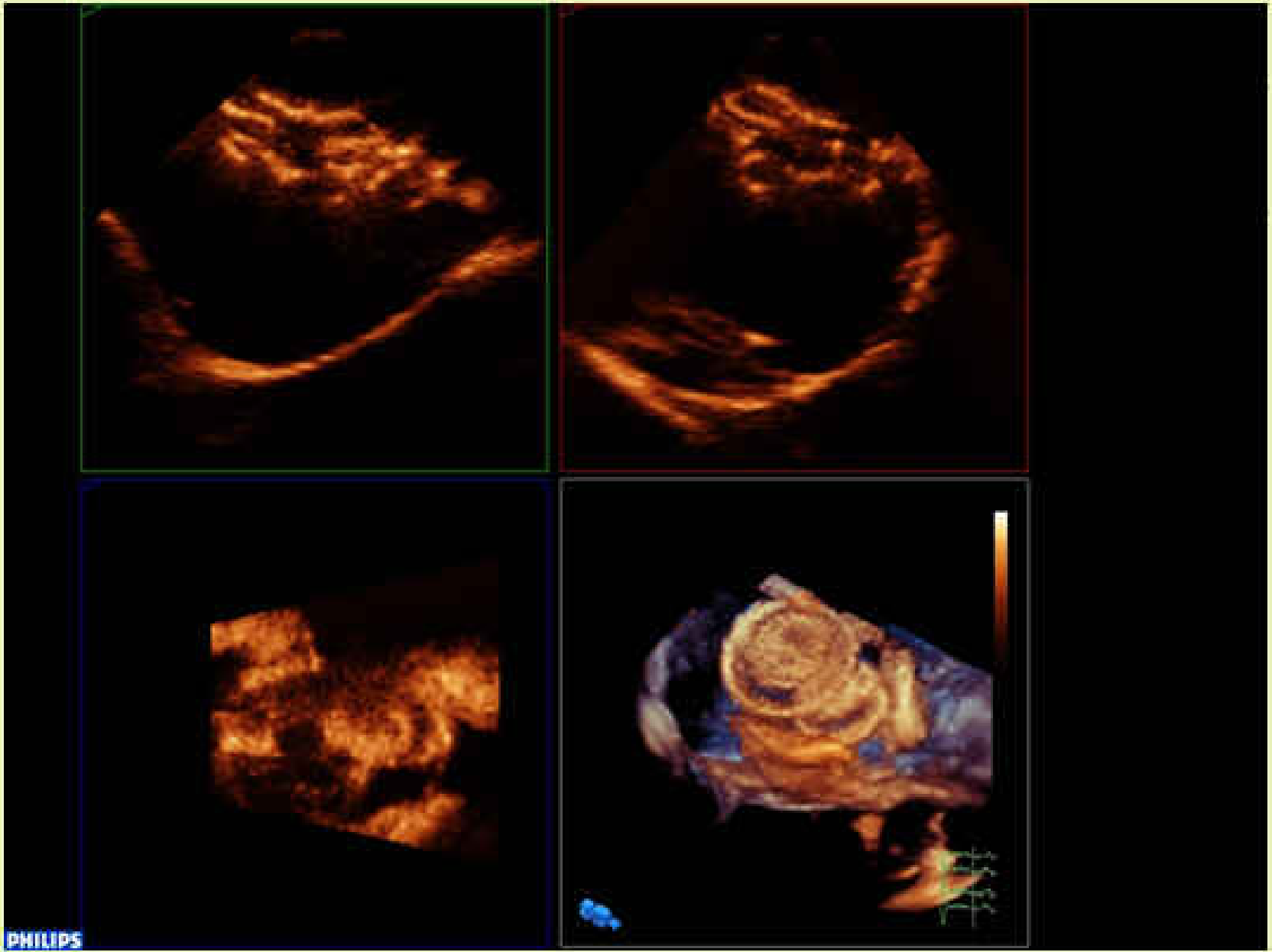
PAT T: 37.0C

ITEE T: 38.9C

26

76 bpm

PHILIPS



PHILIPS

Modified methods of device deployment in patients with large defects

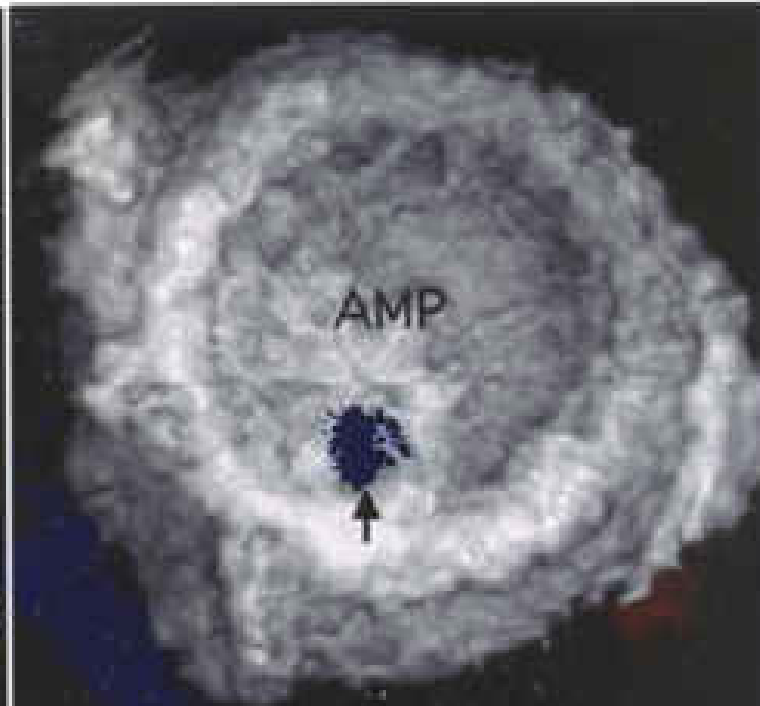
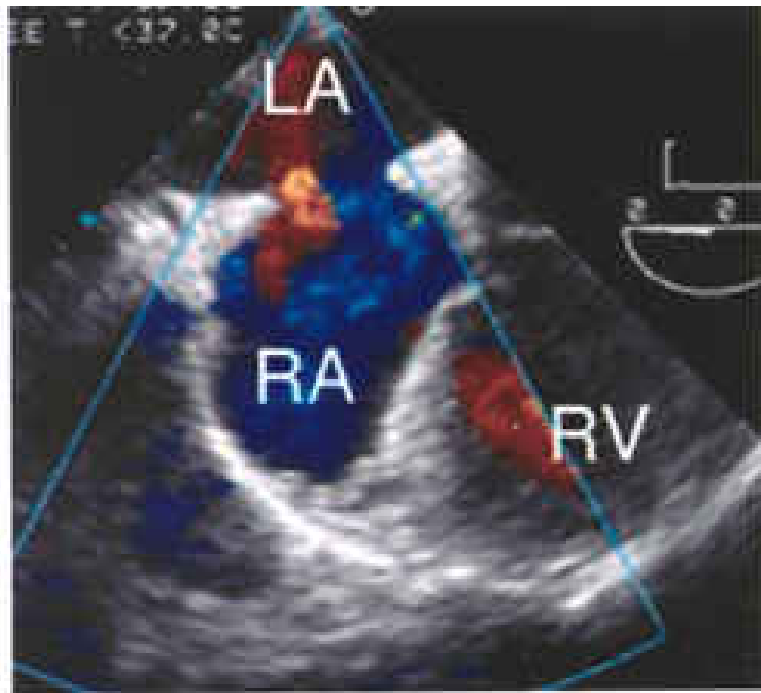
- * **Deployment of left disk from left or right upper pulmonary vein**
- * **Hausdorf sheath**
- * **Balloon assisting technique**

Fenestrated device

- * **Severe pulmonary hypertension**
- * **Heart failure with elevated RA pressure**







PHILIPS

10/23/2007

12:18:27

TIS1.4 MI 0.7

S7-2omnl/Adult

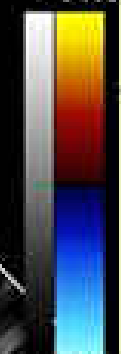
FR 11Hz
14cm

2D
70%
C 50
P Off
Gen
CE
70%
4.9MHz
WF High
Med

0 95 180



M3 M4
+61.6



-81.6
cm/s

JPEG

104 bpm

PHILIPS

PHILIPS

10/23/2007 12:57:37 TIS1.3 MI 0.7

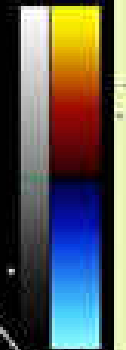
S7-2omni/Adult

FR 16Hz
10cm

2D
51%
C 50
P Off
Gen
CF
70%
4.9MHz
WF High
Med



M3 M4
+61.6



PHILIPS PAT T: 37.0C
TEE T: 38.5C

JPEG

92 bpm

PHILIPS

10/23/2007

12:34:48

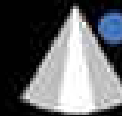
TIS0.6 MI 1.1

X3-1/Adult

FR 12Hz
14cm

Live 3D
3D 0%
3D 50dB
HGen

M2



JPEG

100 bpm



PHILIPS

Arrhythmia before closure

- * **Paroxysmal AF** → **close the defect with or without ablation for AF**
- * **Persistent AF**
 - **RF Ablation**
 - **Close the defect after ablation**

Transcatheter closure of ASD in adults (I)

- * **Between 1999 and March 2009, transcatheter closure was attempted in 413 adult patients (ASDII n=403, CS type ASD n=10)**
- * **106 males, 307 females**
- * **Exclusion for attempted closure during this period of time n= 11**

Demographic features of adults with ASD (I)

- * **Ages** **40.41 ± 15.00 years (18-81 years)**
- * **Qp/Qs** **2.93 ± 1.18**
- * **PAP systolic** **29.2 ± 12.8 mmHg**
- * **PAP mean** **20.1 ± 9 mmHg**

Demographic features of adults with ASD (II)

- * **Hypertension** **n = 41**
- * **History of CVA** **n = 6**
- * **Malignancy** **n = 6**
- * **PTCA/ stent** **n = 5**
- * **moderate MR** **n = 2**
- * **NYHA III/IV** **13/2**

Transcatheter closure of ASD in adults (II)

§ Results

Success **n = 395**

Failure **n = 18 (embolization n = 5
op n = 4 cath retrieval n = 1)**

- * second procedure with success n = 2**
- * operation in others n = 13**
- * awaiting for second procedure n = 3**
- * Final success n = 397 (96.1%)**



Complications of transcatheter closure of ASD in adults

- * tamponade requiring drainage n = 1 (guide wire perforated pulmonary vein)
- * CVA within 6 months n = 2 (1 paroxysmal AF, 1 mortality)
- * Arrhythmia following device closure n=30 (22, 8)
- * Distal embolization of a device n=5
 - requiring emergent surgery n=4
 - percutaneous retrieval n=1
- * Migraine/ headache n=24
- * No late erosion
- * One developed sick sinus syndrome requiring pacemaker implantation

PHILIPS

03/25/2008 09:57:04AM TIS1.4 MI 0.7

S7-2omni/Adult

FR 11Hz
14cm

2D
66%
C 50
P Off
Gen
CF
70%
4.9MHz
WF High
Med

119 100

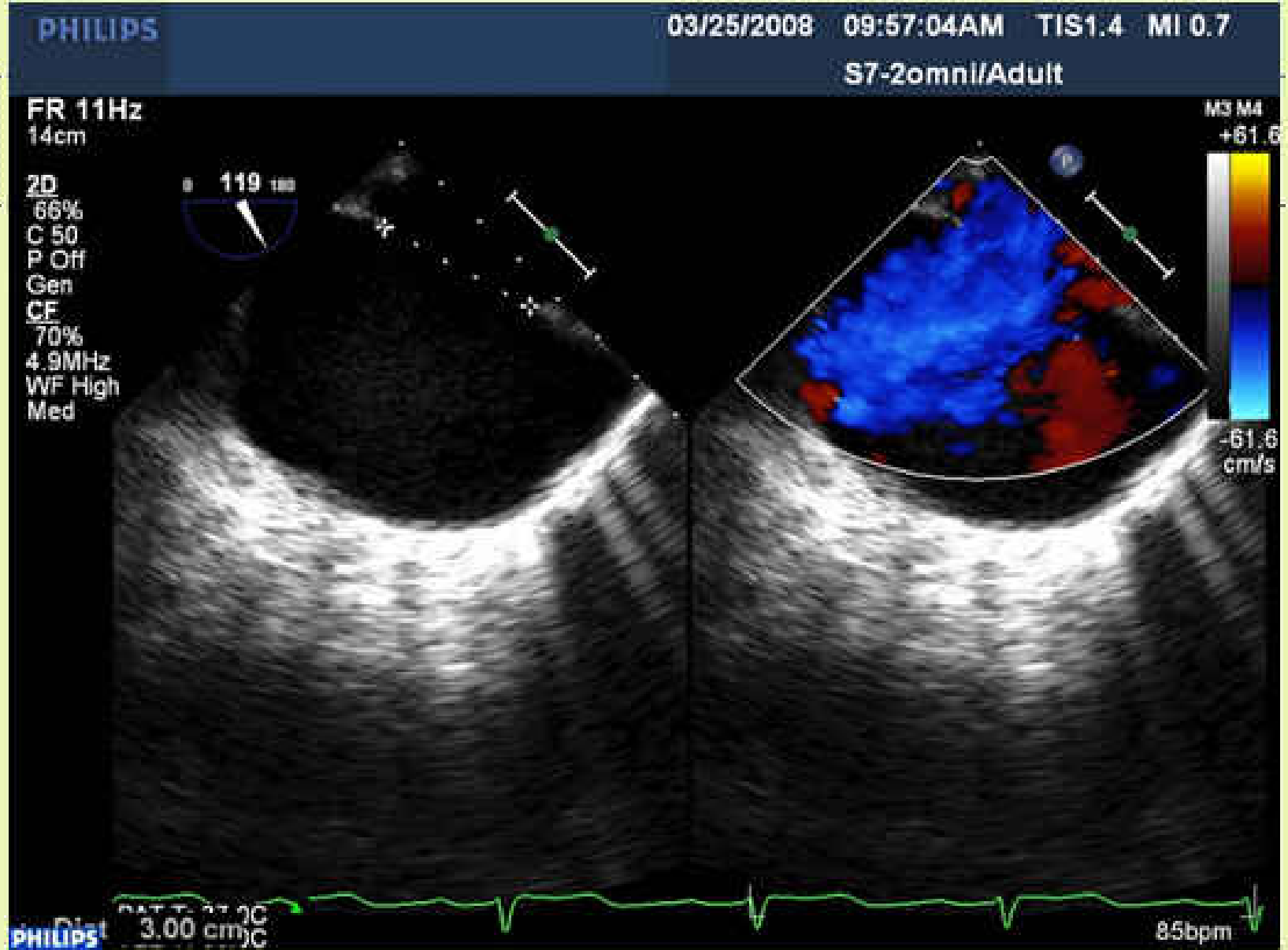
M3 M4
+61.6

-61.6
cm/s

PHILIPS

3.00 cm/s

85bpm

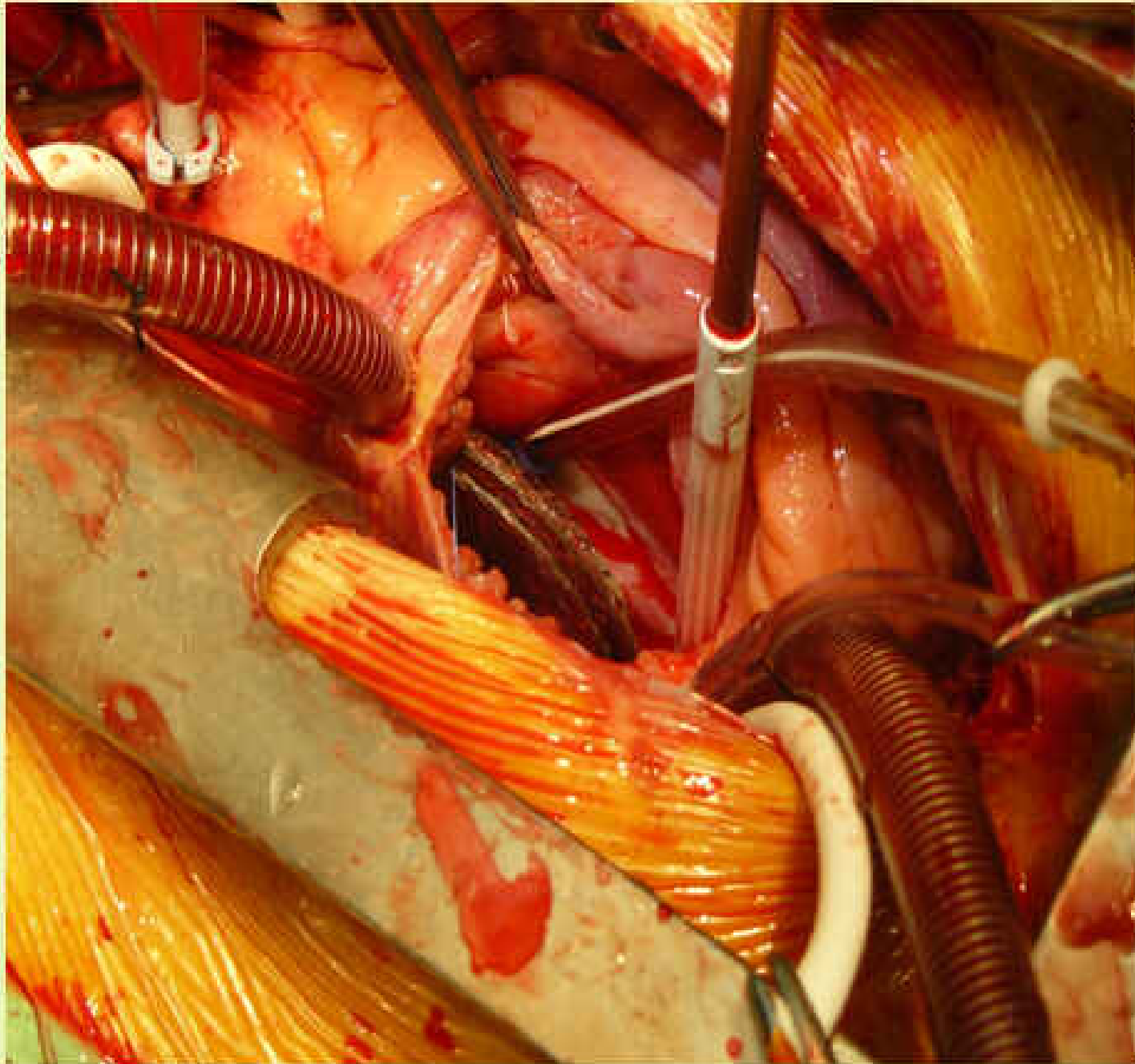


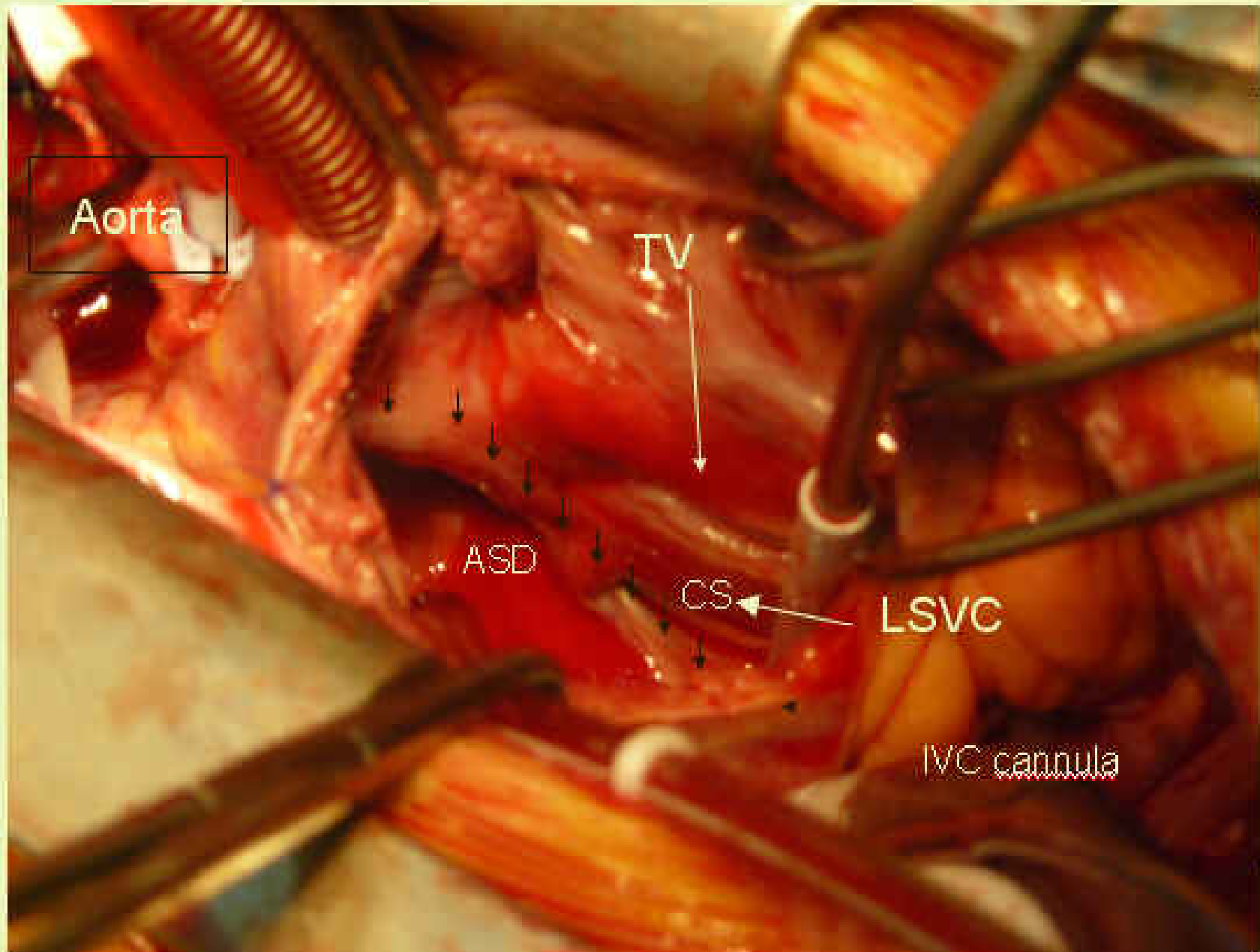


PHILIPS

5 mm







Transcatheter closure of ASD in adults (III)

- * **Ages > 40 years n = 183 (group I)**
Ages < 40 years n = 230 (group II)

* Group I n = 183	success	179
	failure	4
Group II n = 230	success	218
	failure	12

Pulmonary Hypertension (mPAP ≥ 25)

- * **Group I (> 40 years) n = 43 / 183**
 - * **Group II (< 40 years) n = 23 / 230**
- p < 0.0001**

Comparison of hemodynamics between 2 groups

	<u>Qp/Qs</u>	<u>m PAP(mmHg)</u>
◆ Group I (> 40 yrs)	2.85 ± 1.09	21.4 ± 8.6
◆ Group II (< 40 yrs)	2.99 ± 1.24	18.3 ± 8.4
	P= 0.178	P< 0.0001

Significant pre-existing Arrhythmia before ASD closure

Group I (> 40 yrs) n = 31 (16.9 %)

persistent AF n = 9

paroxysmal AF n = 12

atrial flutter AF n = 4

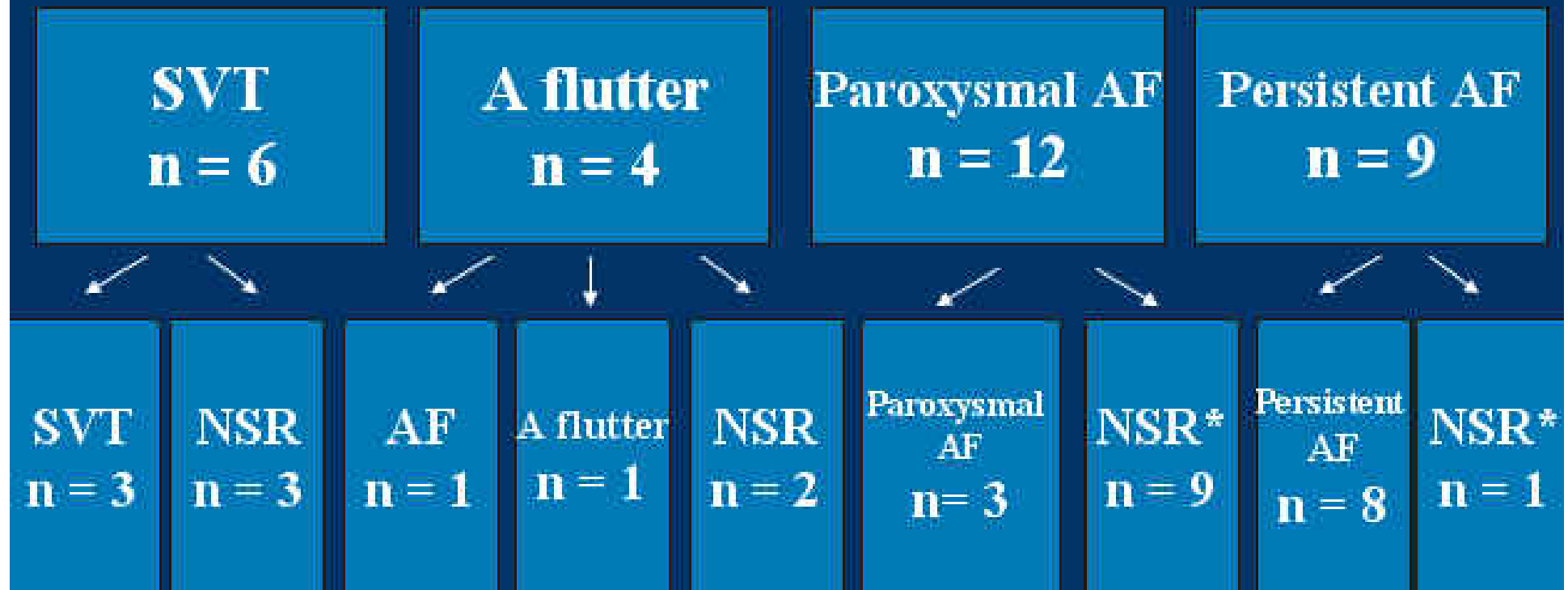
supraventricular tachycardia n = 6

Group II (< 40 yrs) n = 4 (1.7 %)

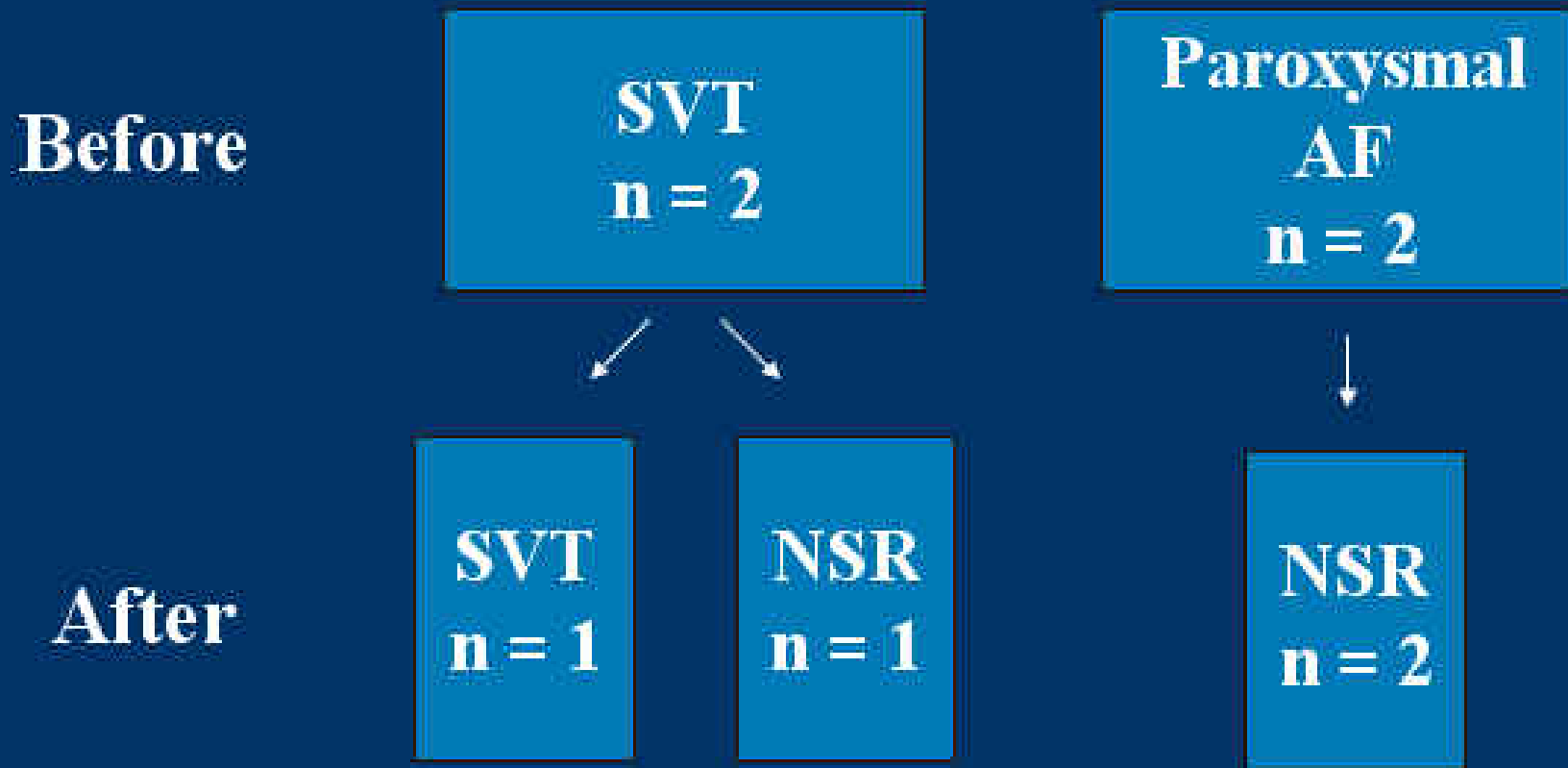
supraventricular tachycardia n = 2

paroxysmal AF n = 2

Outcomes of pre-existing arrhythmia following ASD closure (group I n=31)



Outcomes of pre-existing arrhythmia following ASD closure (group II)



61 years
Female

Heart rate: 63 bpm
PR interval: * ms
QRS duration: 94 ms
QT/QTc: 422/421 ms
P-R-T axis: * 72 45

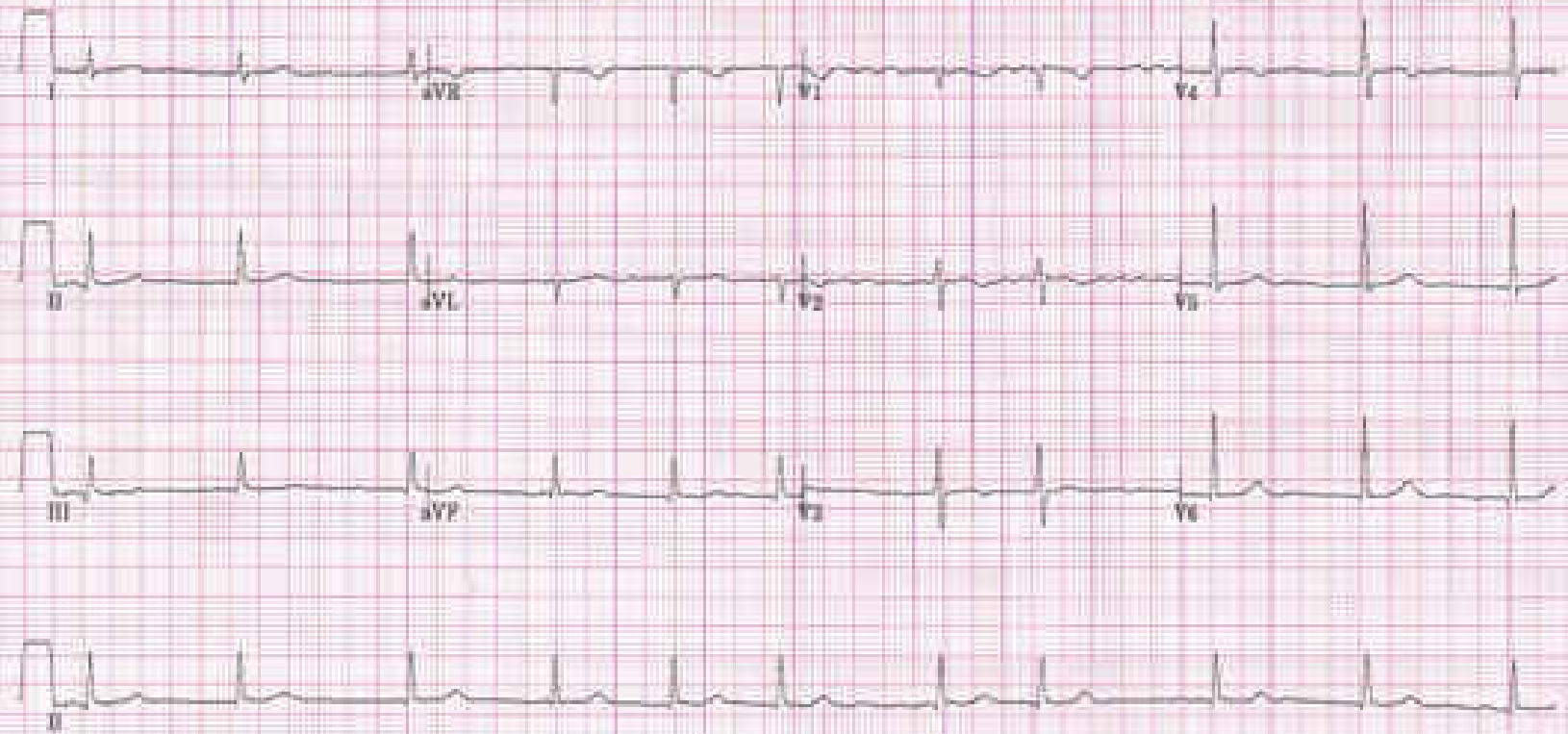
Atrial fibrillation
Nonspecific T wave abnormality, probably digitalis effect
Abnormal ECG

非正式資料
請勿存於病歷

38
AF 2/6

姜玉霞

Unrecorded



*New-onset (within 6 months)
arrhythmia after ASD closure (I)*

Group I (> 40 yrs) n = 22 (12%)

supraventricular tachycardia n= 2

paroxysmal AF n= 19

sick sinus syndrome n= 1

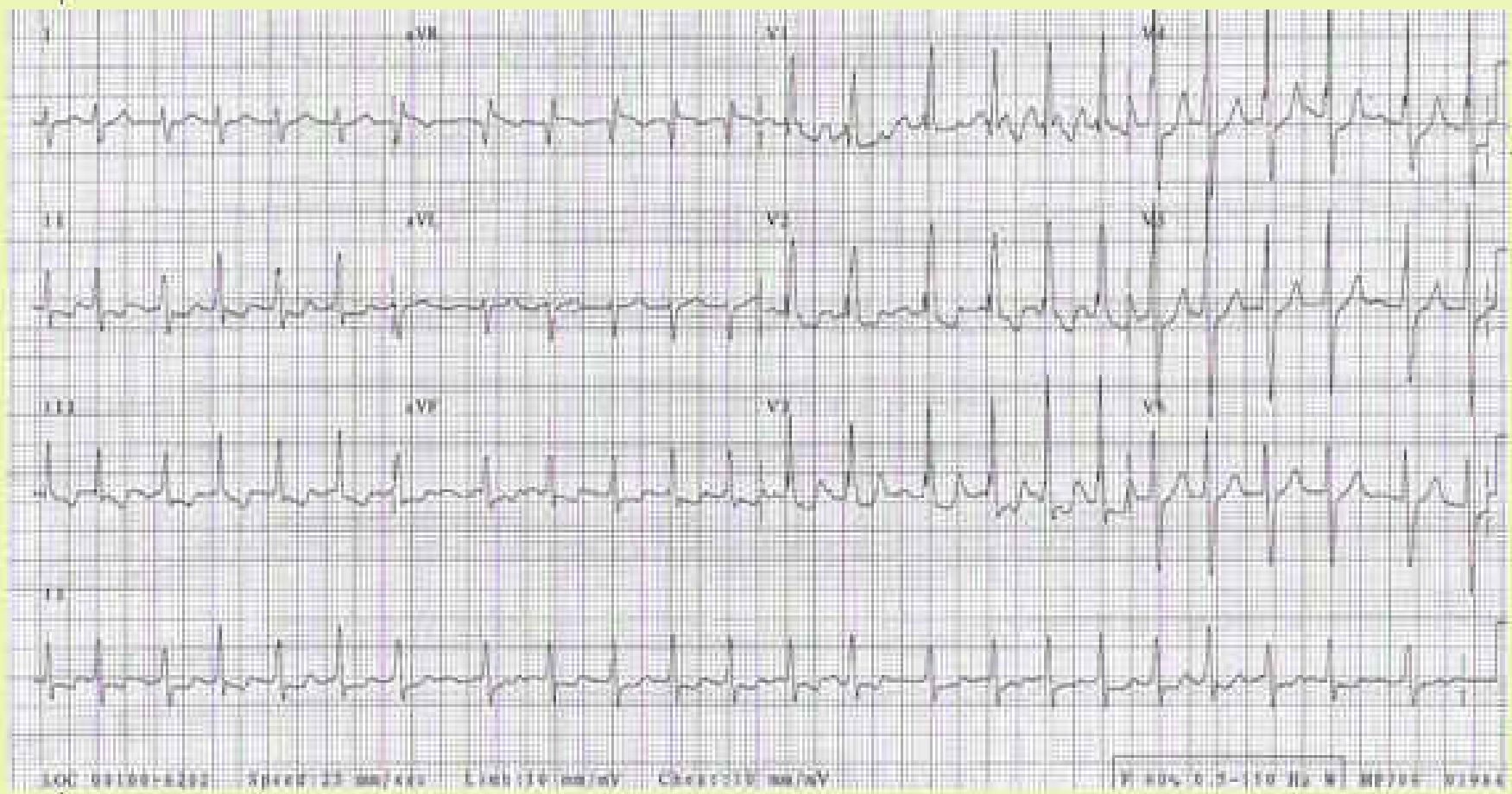
Group II (< 40 yrs) n= 8 (3.5%)

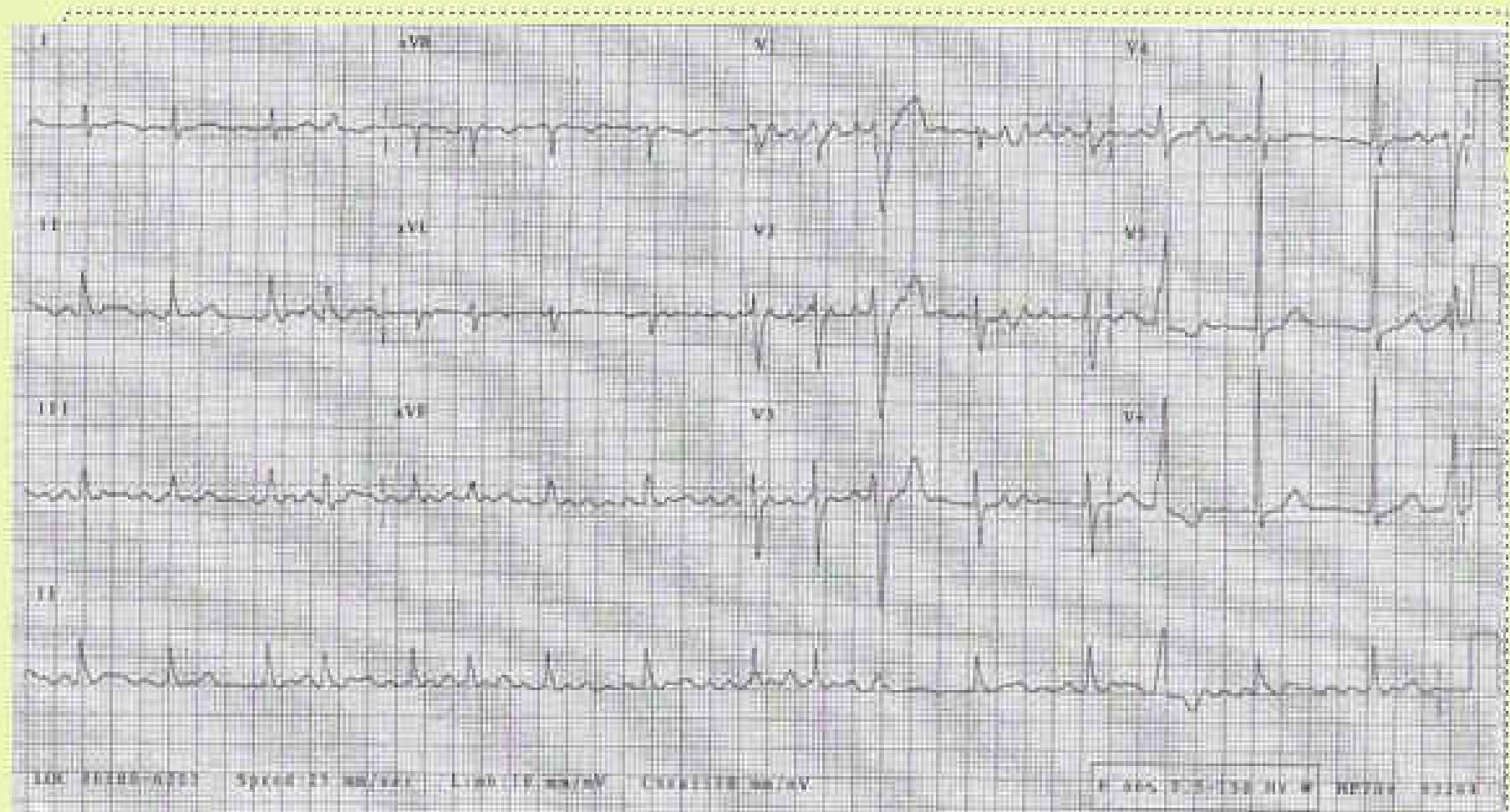
supraventricular tachycardia n =4

paroxysmal AF n =4

Outcomes of new-onset AF after ASD closure

- ◆ **Group I n = 22**
 - supraventricular tachycardia n= 2
 - persistent n= 1
 - sinus rhythm n= 18
 - pace maker n= 1
- ◆ **Group II n = 8**
 - supraventricular tachycardia n= 2
 - sinus rhythm n= 5
 - paroxysmal AF n=1
- ◆ **One of group I with trigeminy prior to closure developed persistent AF 1.5 years later.**





Follow up results of transcatheter closure of ASD in adults patients

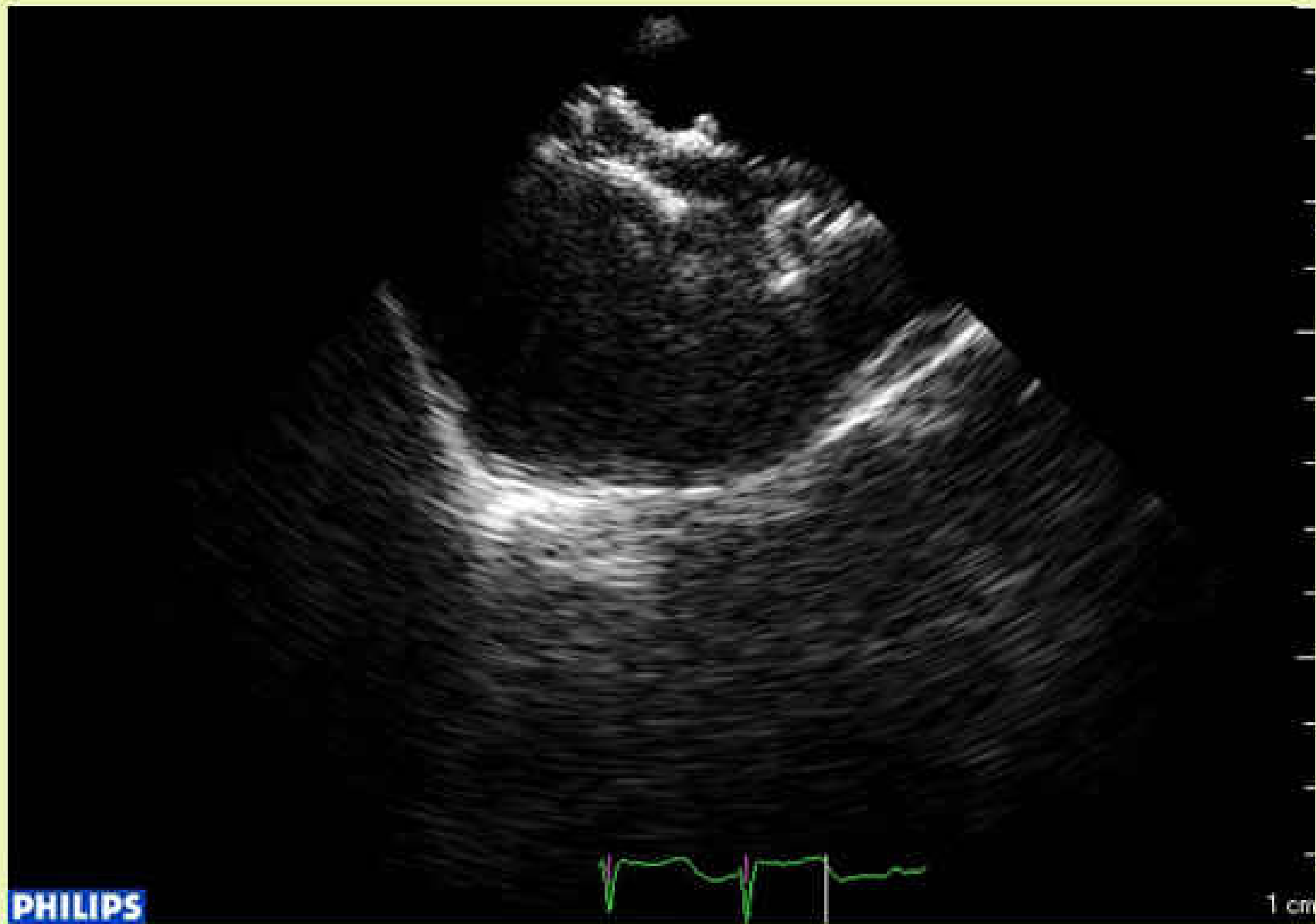
- One mortality due to CVA 4.5 months after the procedure
- One died of lung cancer & one died of COPD
- Residual shunt in 10
- Three underwent a second procedure to close the fenestration
- Persisted severe Pulmonary hypertension requiring Viagra or Bosentan (n= 7)
- One underwent mitral valve repair (MR with PAH prior to closure)
- One developed right heart failure 3 years after device closure

Conclusions (I)

- **Transcatheter closure of ASD in adults is safe and provides relief in symptoms in most patients**
- **Closure of ASD in adults should be performed earlier to prevent occurrence of significant arrhythmia and pulmonary hypertension**
- **TEE vs ICE**

Conclusions (II)

- ◆ **New-onset arrhythmia is significant less in patients < 40 years**
- ◆ **New-onset arrhythmia subsided in majorities of patients**
- ◆ **Persistent AF will persist after closure in patients above 40 years of age.**



PHILIPS

1 cm

PHILIPS

10/23/2007

12:22:57

TIS1.4 MI 0.7

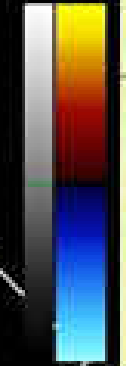
S7-2omni/Adult

FR 11Hz
14cm

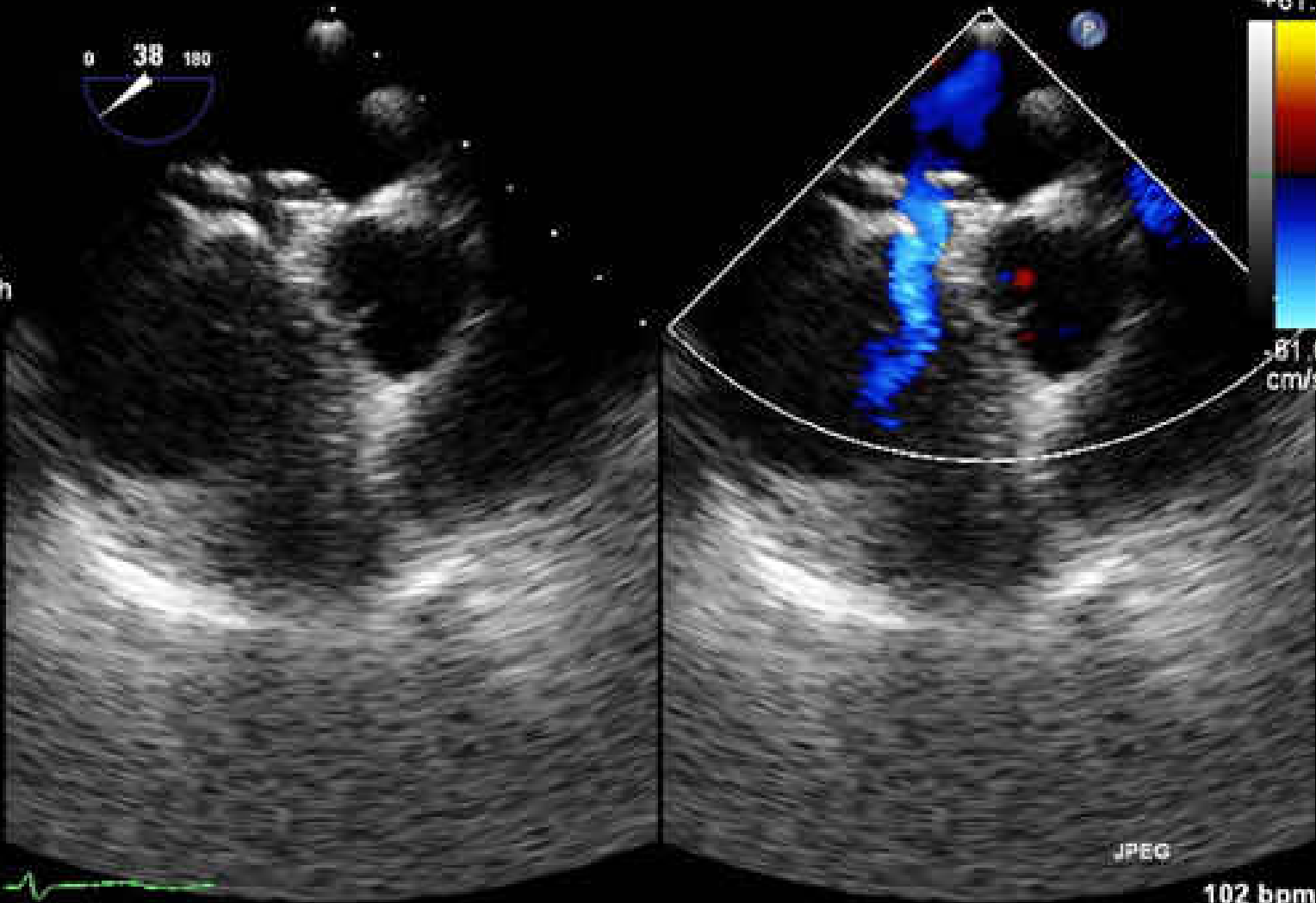
2D
70%
C 50
P Off
Gen
CF
70%
4.9MHz
WF High
Med



M3 M4
+61.6



-61.6
cm/s



JPEG

102 bpm

PHILIPS

PHILIPS

10/23/2007

12:18:20

TIS1.4 MI 0.7

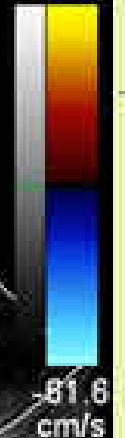
S7-2omni/Adult

FR 11Hz
14cm

2:25:36

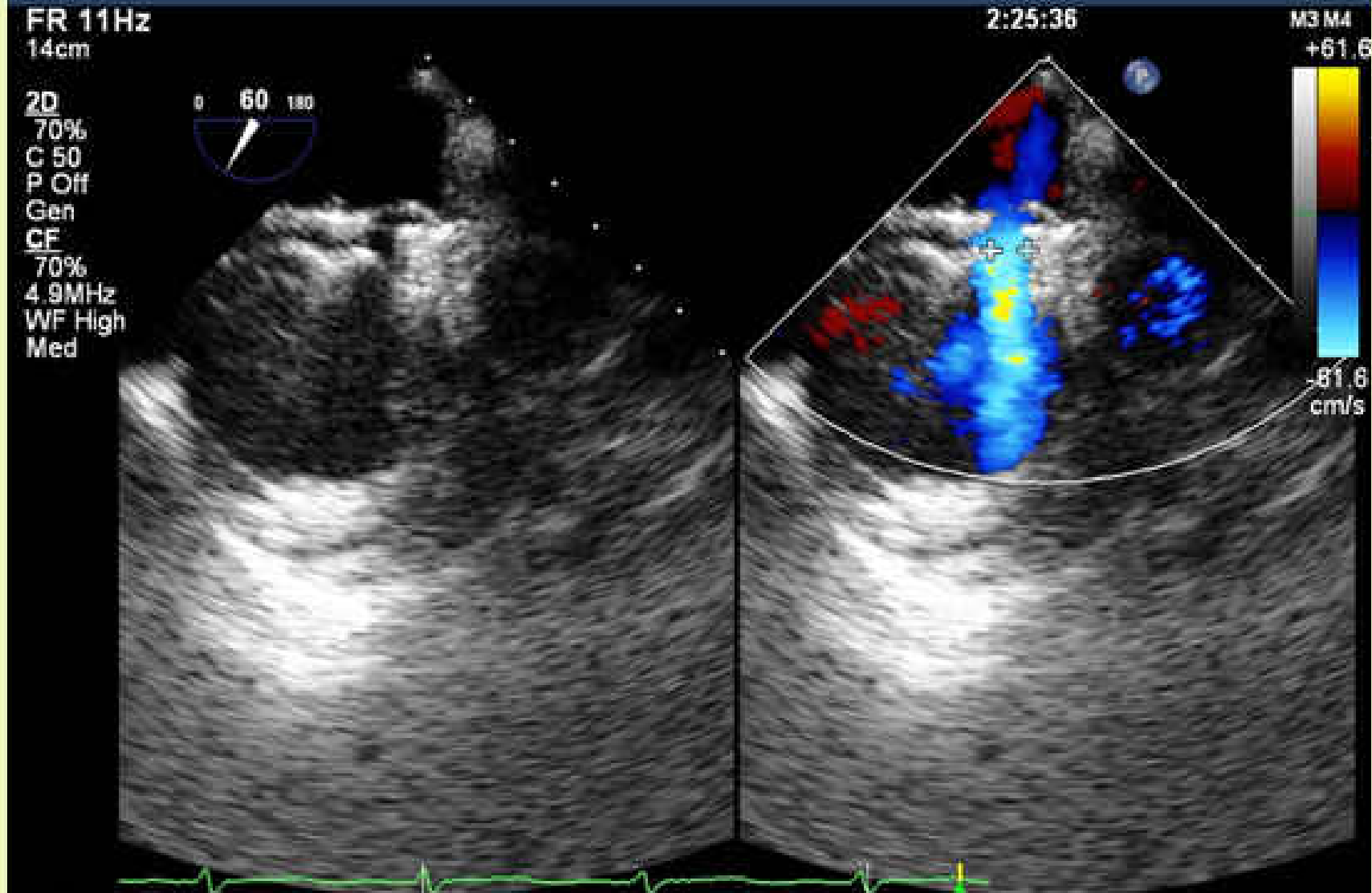
M3 M4
+61.6

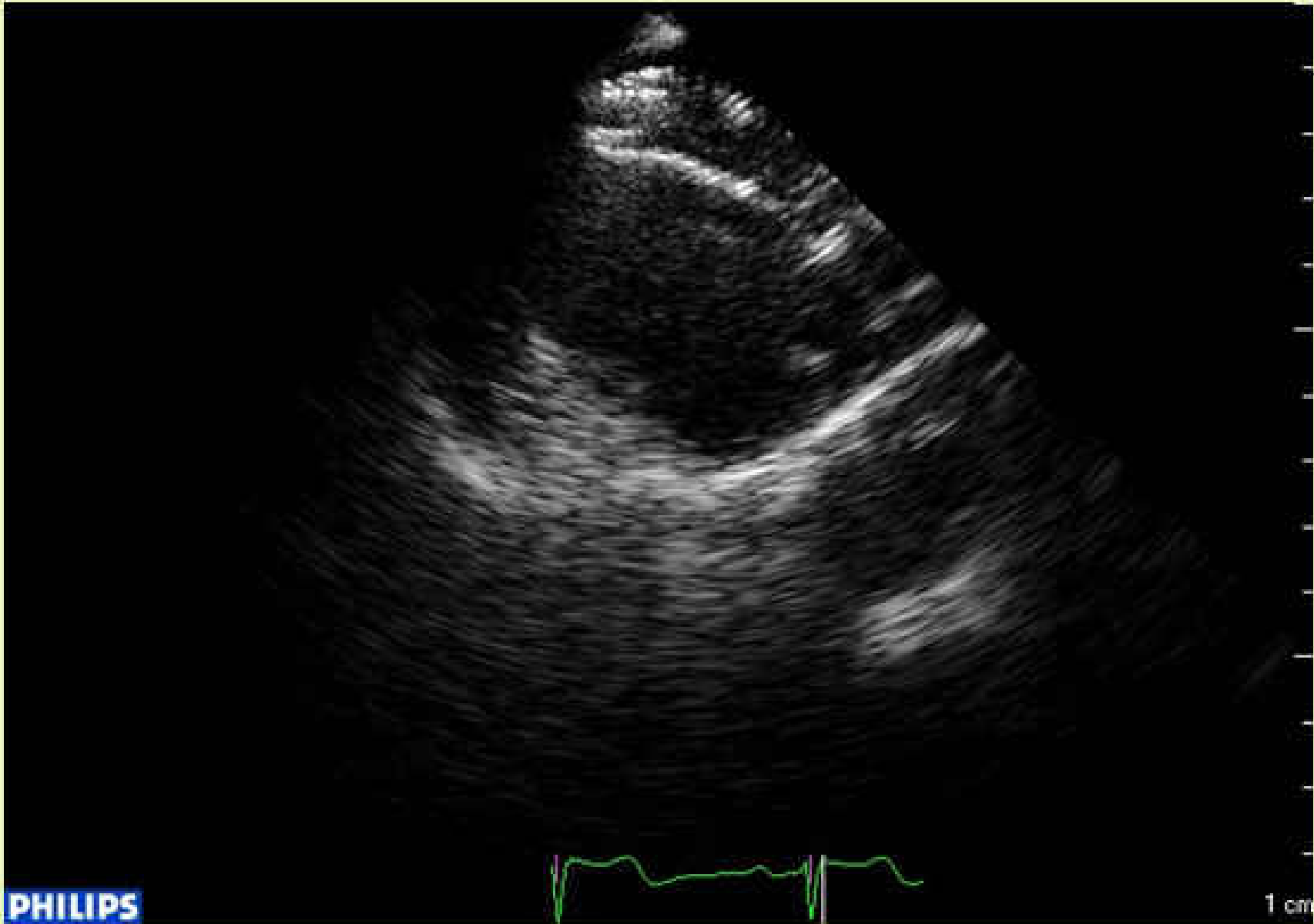
2D
70%
C 50
P Off
Gen
CF
70%
4.9MHz
WF High
Med



PHILIPS Dist 0.629 cm

104bpm





PHILIPS

1 cm

2008/03/25 10:28:08AM

Philips Medical

VR 19Hz
15cm

Live 3D
3D 36%
3D 50dB



3D†



65 bpm

PHILIPS

Balloon sizing or no sizing

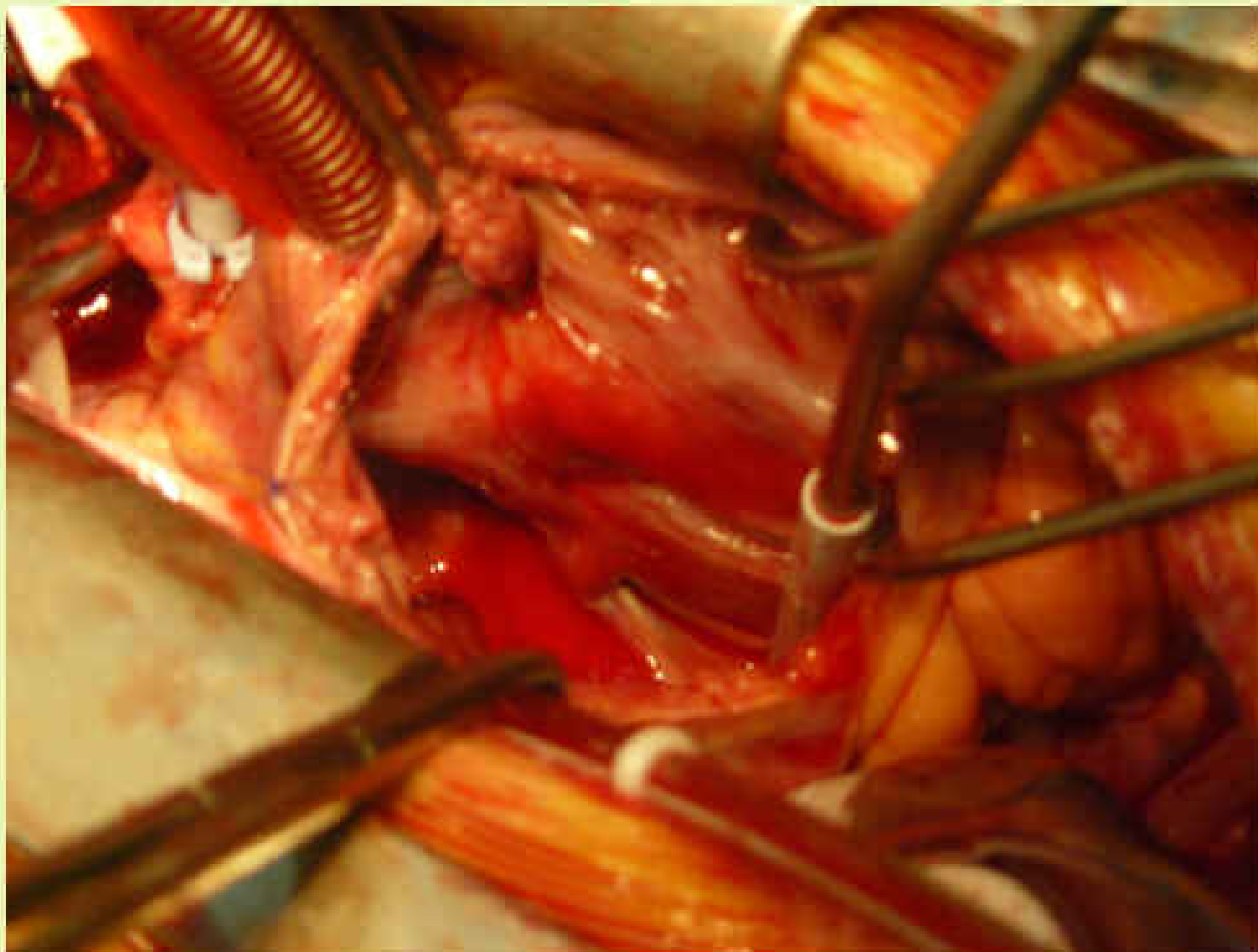
* **Balloon sizing** n = 64

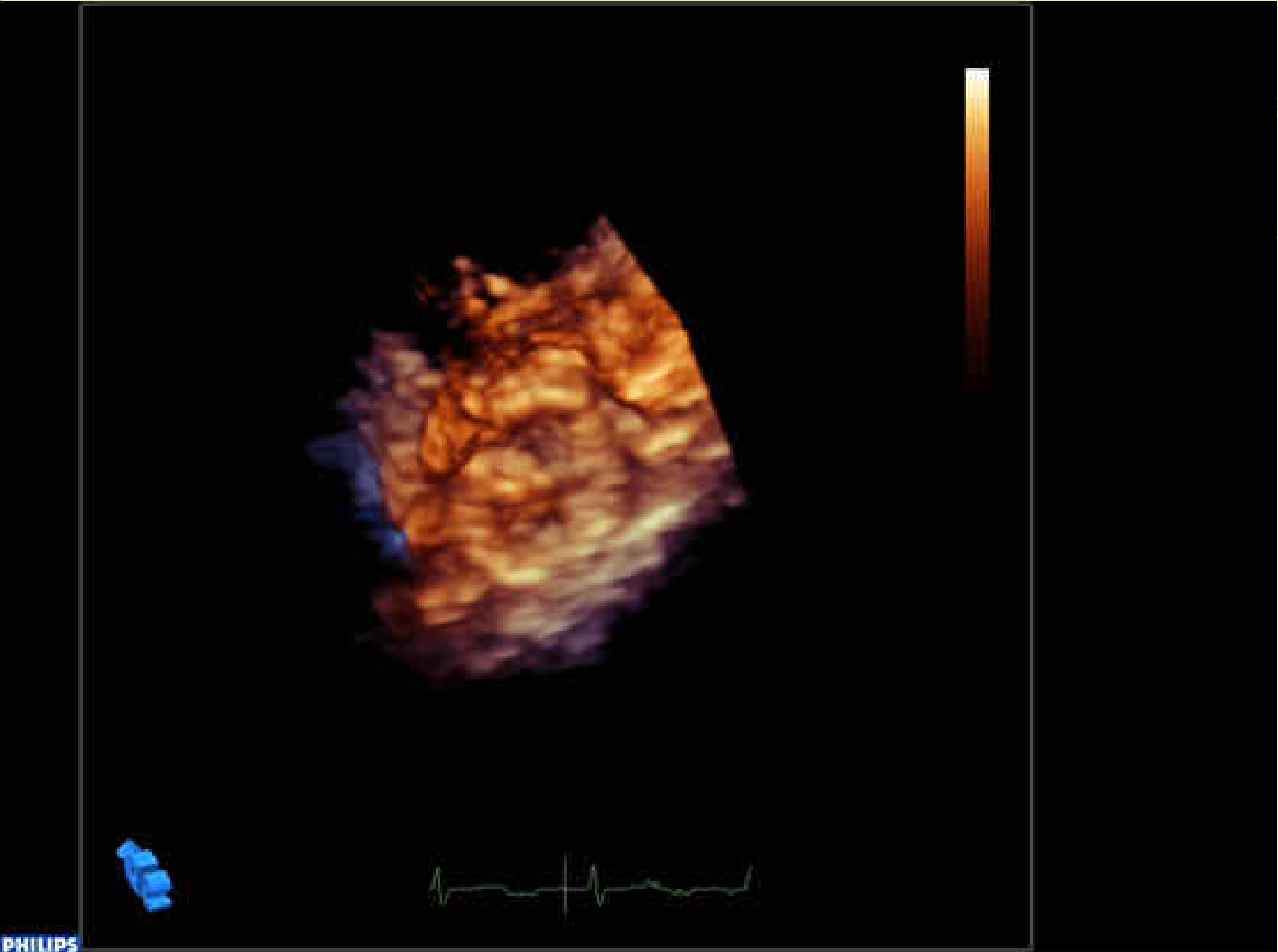
No sizing n = 119

* **TEE in all**

Supplementary ICE in 19

* **Precordial Echo in most**





PHILIPS

Results of transcatheter closure of ASD in patients above 40 years of age (I)

§ Results

- **Success n = 179**

* **186 devices, mean 26 ± 7 mm**

* **Fenestrated device in 6**

* **Cribriform device in 2**

- **Failure n = 4**

* **3 failure in implantation**

* **1 embolization**

