Multimodality imaging in infective endocarditis

Cases of the week

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La Timone Hospital
Marseille - France

Nice 27st March 2015

The multidisciplinary endocarditis team

Imaging in Infective Endocarditis

1. case 1: prosthetic valve endocarditis
2. case 2: nuclear imaging
3. case 3: imaging embolic risk
4. case 4: mitral perforation
5. case 5: TAVI endocarditis
6. case 6: right-sided IE
7. case 7: suspected NVE, coronary embolism
8. case 8: bicuspid aortic valve IE - abscess

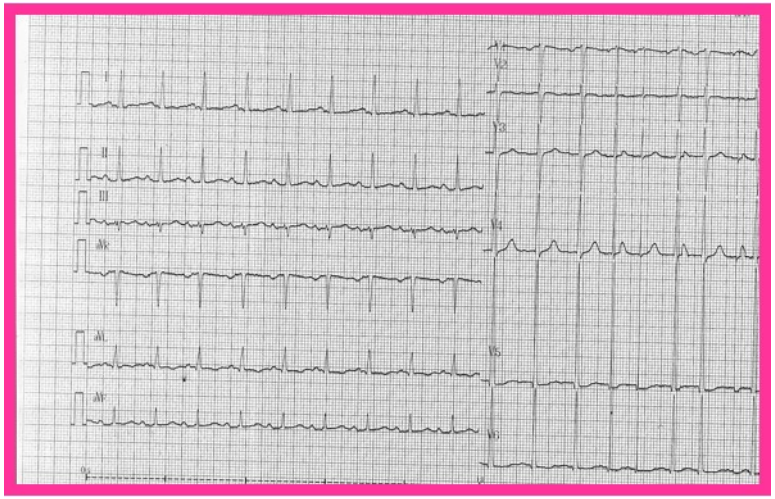
Imaging in Infective Endocarditis

1. case 1: ***prosthetic valve endocarditis***
2. **case 2: nuclear imaging**
3. **case 3: PVE, abscess**
4. **case 4: mitral perforation**
5. **case 5: TAVI endocarditis**
6. **case 6: right-sided IE**
7. **case 7: suspected NVE, coronary embolism**
8. **case 8: bicuspid aortic valve IE - abscess**

Case1: echocardiography

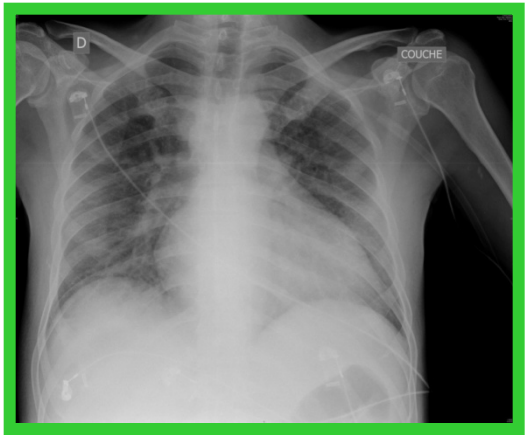
History of the disease

- 65 year-old woman,
- sutureless aortic Intuity valve 8 months ago
- no previous known cardiac disease
- weight loss

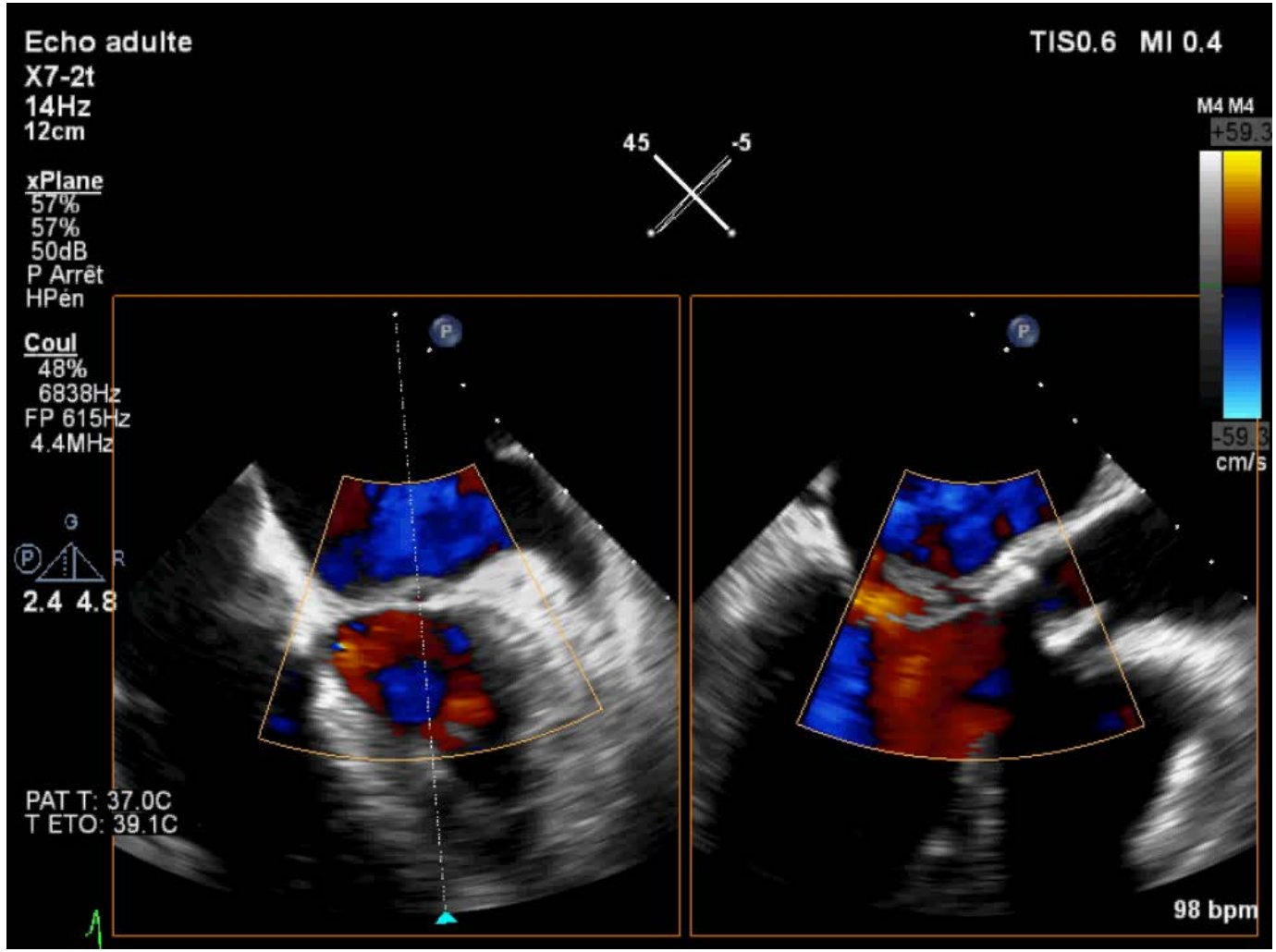


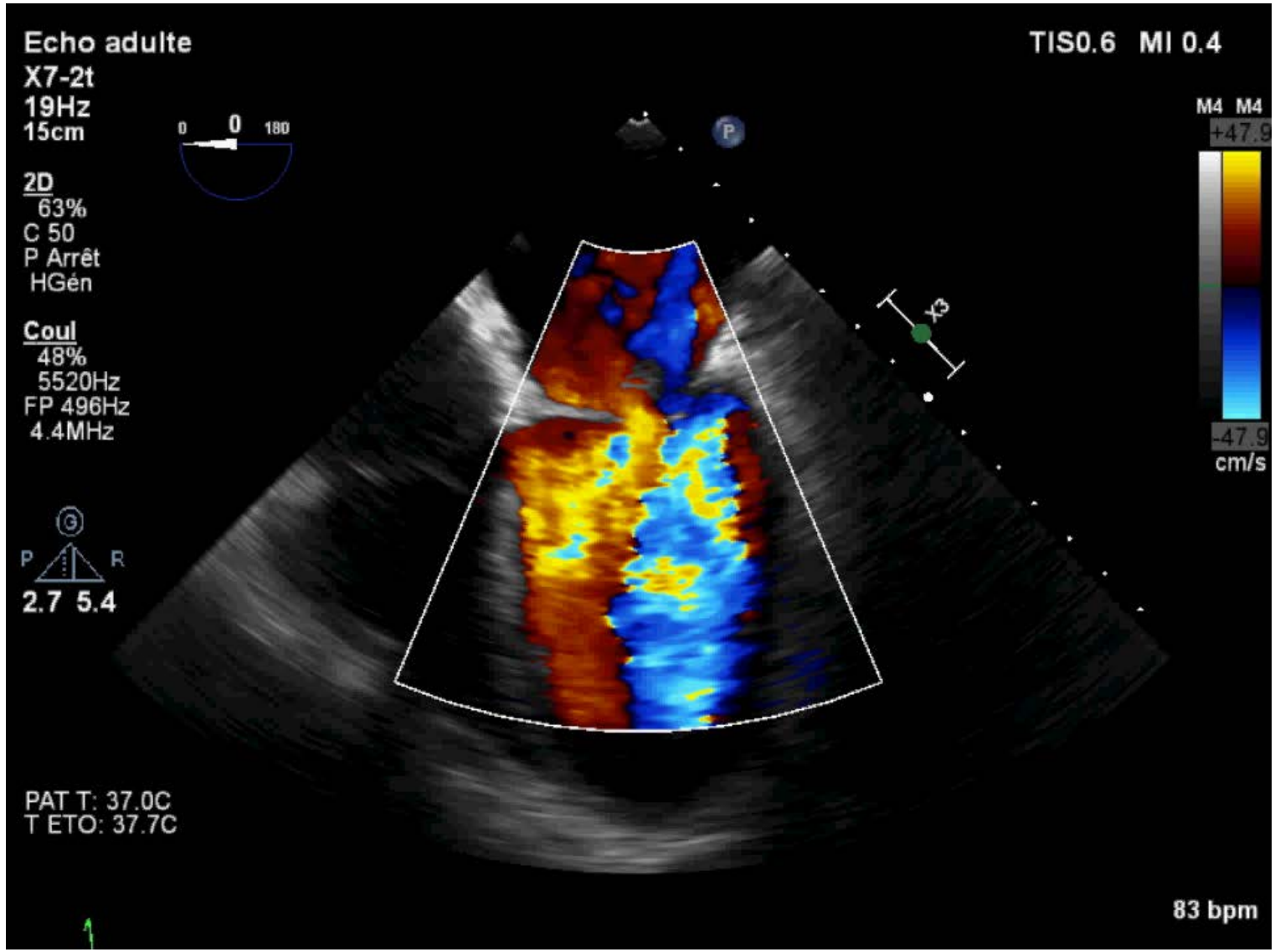
Clinical examination

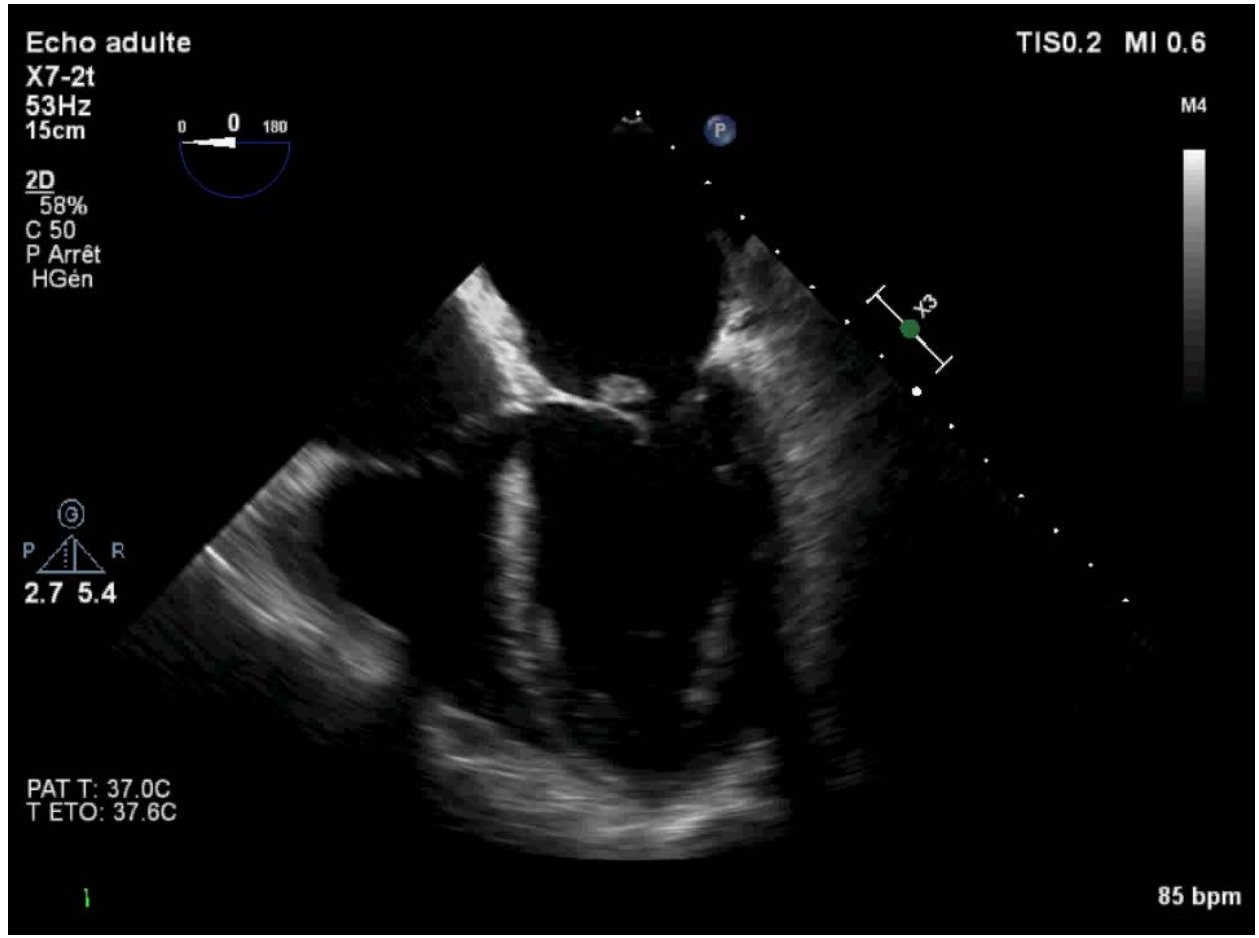
- severe CHF
- fever = 38°5
- systolic mitral murmur 3/6
- arterial pressure: 120 / 80 mmHg
- normal neurological examination

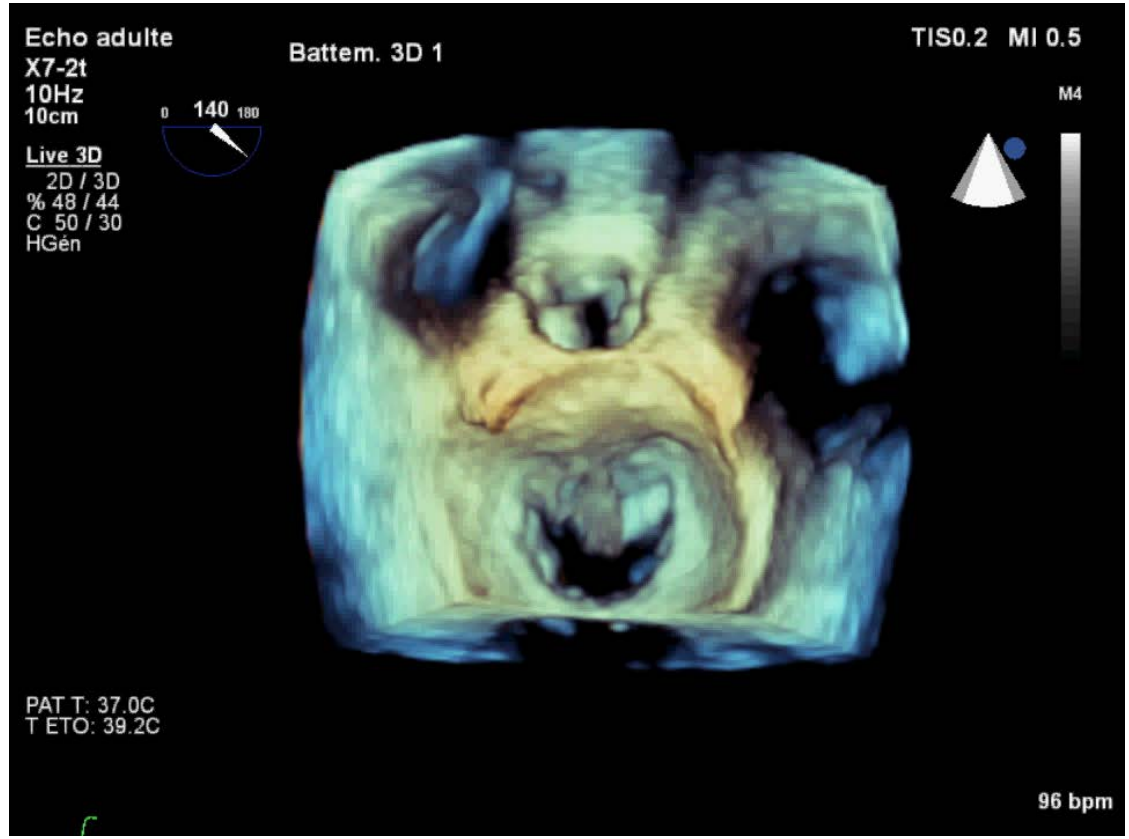


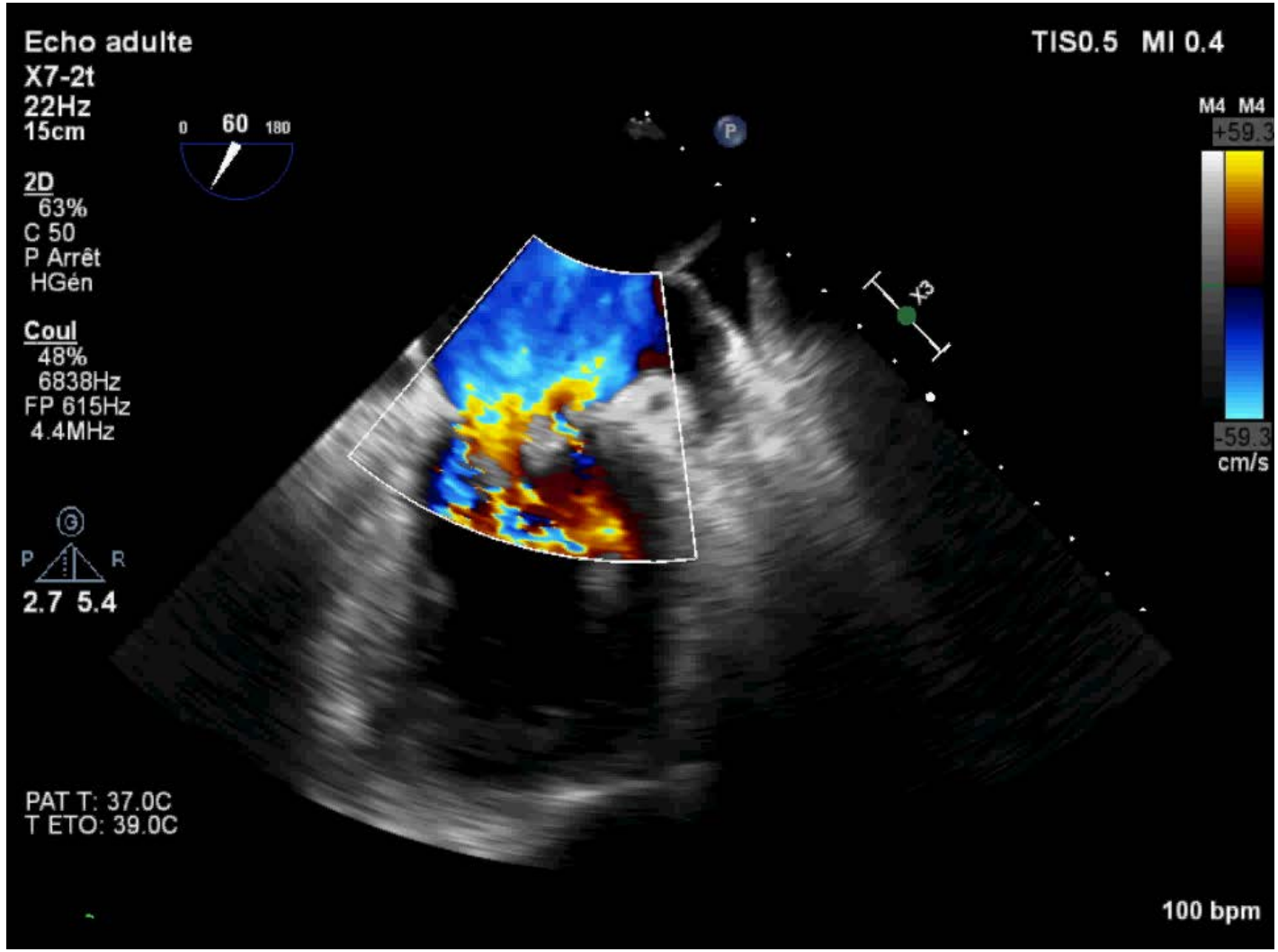
Blood cultures: negative

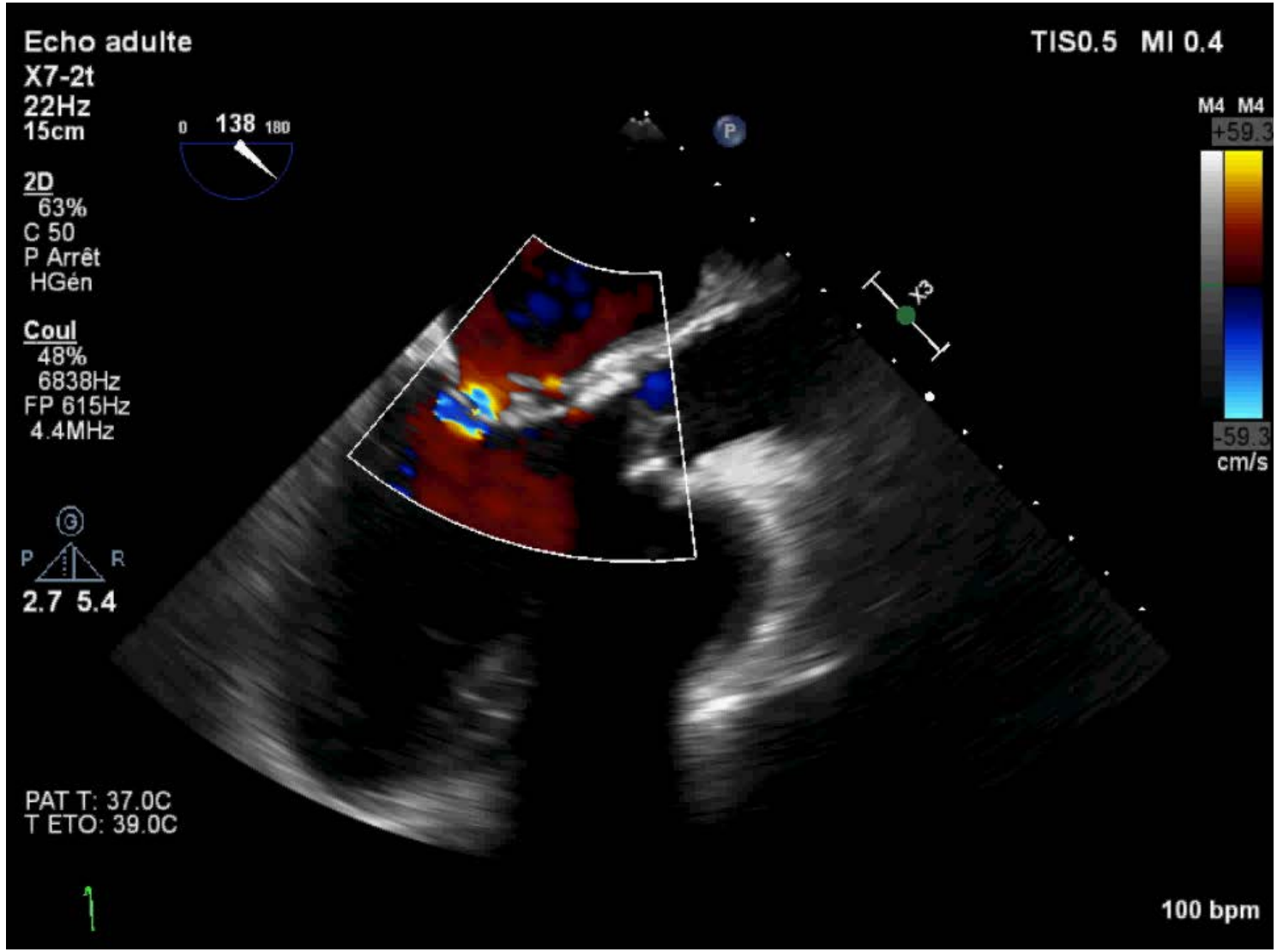

Echo adulte
X7-2t
14Hz
12cm
xPlane
57%
57%
50dB
P Arrêt
HPén
Coul
48%
6838Hz
FP 615Hz
4.4MHz
2.4 4.8
TIS0.6 MI 0.4
45
-5
M4 M4
+59.3
-59.3
cm/s
PAT T: 37.0C
T ETO: 39.1C
98 bpm


Echo adulte
X7-2t
19Hz
15cm
0 0 180
2D
63%
C 50
P Arrêt
HGén
Coul
48%
5520Hz
FP 496Hz
4.4MHz
P R
2.7 5.4
TIS0.6 MI 0.4
M4 M4
+47.9
-47.9
cm/s
PAT T: 37.0C
T ETO: 37.7C
83 bpm

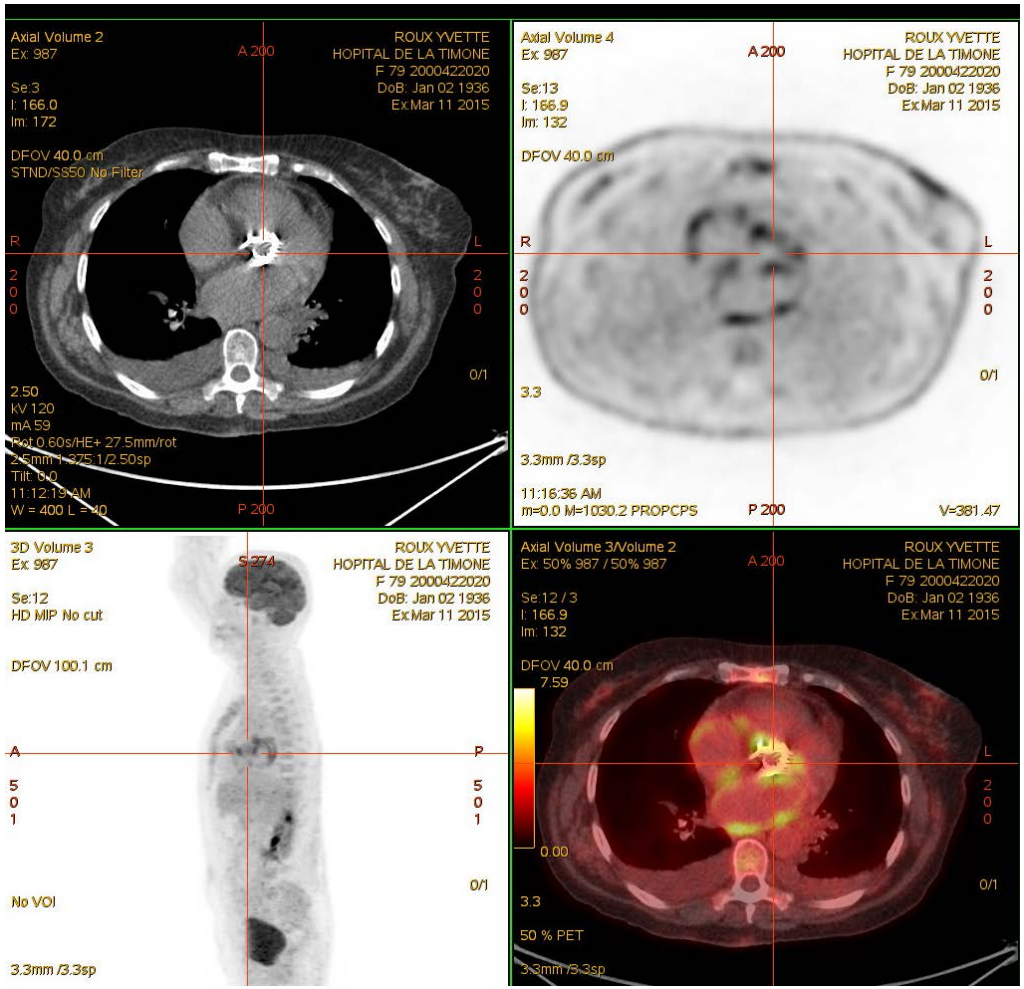

Echo adulte
X7-2t
53Hz
15cm
2D
58%
C 50
P Arrêt
HGén
TIS0.2 MI 0.6
M4
2.7 5.4
PAT T: 37.0C
T ETO: 37.6C
85 bpm


Echo adulte
X7-2t
10Hz
10cm
Live 3D
2D / 3D
% 48 / 44
C 50 / 30
HGén
0
140
180
Battem. 3D 1
TIS0.2 MI 0.5
M4
PAT T: 37.0C
T ETO: 39.2C
96 bpm


Echo adulte
X7-2t
22Hz
15cm
2D
63%
C 50
P Arrêt
HGén
Coul
48%
6838Hz
FP 615Hz
4.4MHz
2.7 5.4
TIS0.5 MI 0.4
M4 M4
+59.3
-59.3
cm/s
PAT T: 37.0C
T ETO: 39.0C
100 bpm


Echo adulte
X7-2t
22Hz
15cm
0 138 180
2D
63%
C 50
P Arrêt
HGén
Coul
48%
6838Hz
FP 615Hz
4.4MHz
P R
2.7 5.4
TIS0.5 MI 0.4
M4 M4
+59.3
-59.3
cm/s
PAT T: 37.0C
T ETO: 39.0C
100 bpm

^{18}FDG-PET-CT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Se:3
I: 166.0
Im: 172
DFOV 40.0 cm
STND/SS50 No Filter
2.50
kV 120
mA 59
Rot 0.60s/HE+ 27.5mm/rot
2.5mm I .375:1/2.50sp
Tilt: 0.0
11:12:19 AM
W = 400 L = 40
ROUX YVETTE
HOPITAL DE LA TIMONE
F 79 2000422020
DoB: Jan 02 1936
Ex:Mar 11 2015
Axial Volume 4
Ex: 987
Se:13
I: 166.9
Im: 132
DFOV 40.0 cm
3.3
3.3mm /3.3sp
11:16:36 AM
m=0.0 M=1030.2 PROPCPS
V=381.47
3D Volume 3
Ex: 987
Se:12
HD MIP No cut
DFOV 100.1 cm
No VOI
3.3mm /3.3sp
Axial Volume 3/Volume 2
Ex: 50% 987 / 50% 987
Se:12 / 3
I: 166.9
Im: 132
DFOV 40.0 cm
7.59
0.00
3.3
50 % PET

Duke criteria

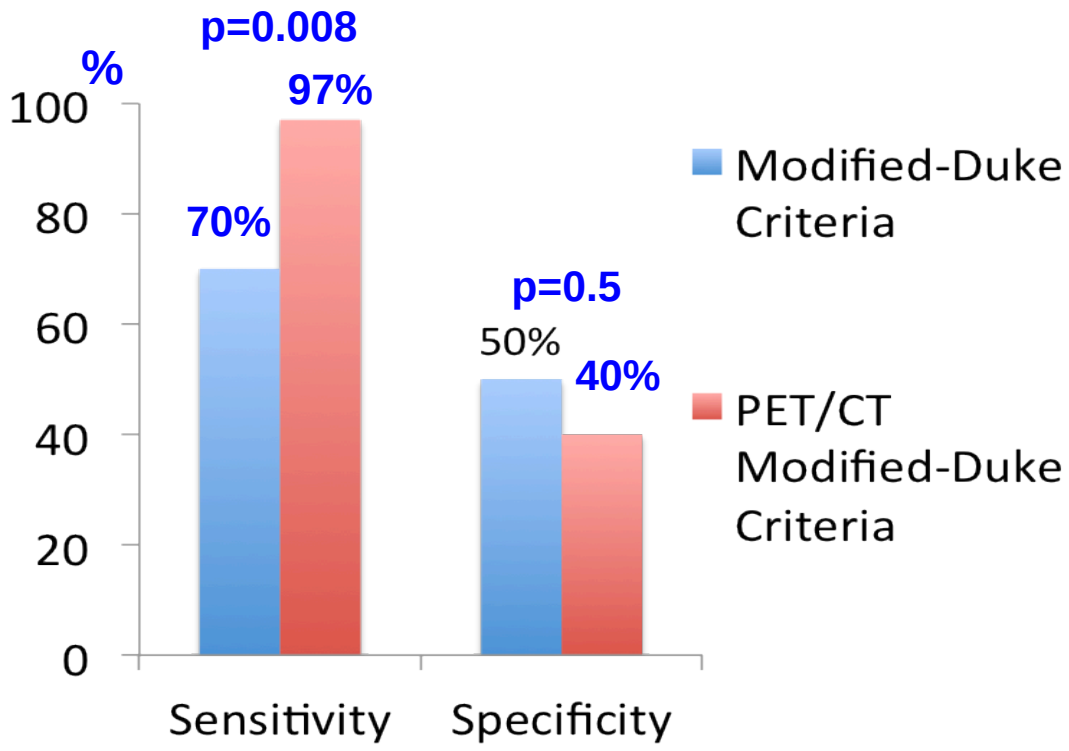
Li JS , CID 2000 ; 30 : 633-8

MAJOR CRITERIA
Blood cultures positive for IE:
Evidence of endocardial involvement • Echocardiogram positive for IE Vegetation - Abscess - New partial dehiscence of prosthetic valve • New valvular regurgitation
MINOR CRITERIA
• Predisposition: predisposing heart condition, injection drug use • Fever: temperature > 38°C • Vascular phenomena: major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial haemorrhages, conjunctival haemorrhages, Janeway lesions • Immunologic phenomena: glomerulonephritis, Osler's nodes, Roth spots, rheumatoid factor • Microbiological evidence: positive blood culture but does not meet a major criterion or serological evidence of active infection with organism consistent with IE

^{18}FDG-PET-CT in endocarditis

Saby L, Thuny F, Habib G - J Am Coll Cardiol. 2013; 11;61:2374-82

PET/CT as a novel major criterion



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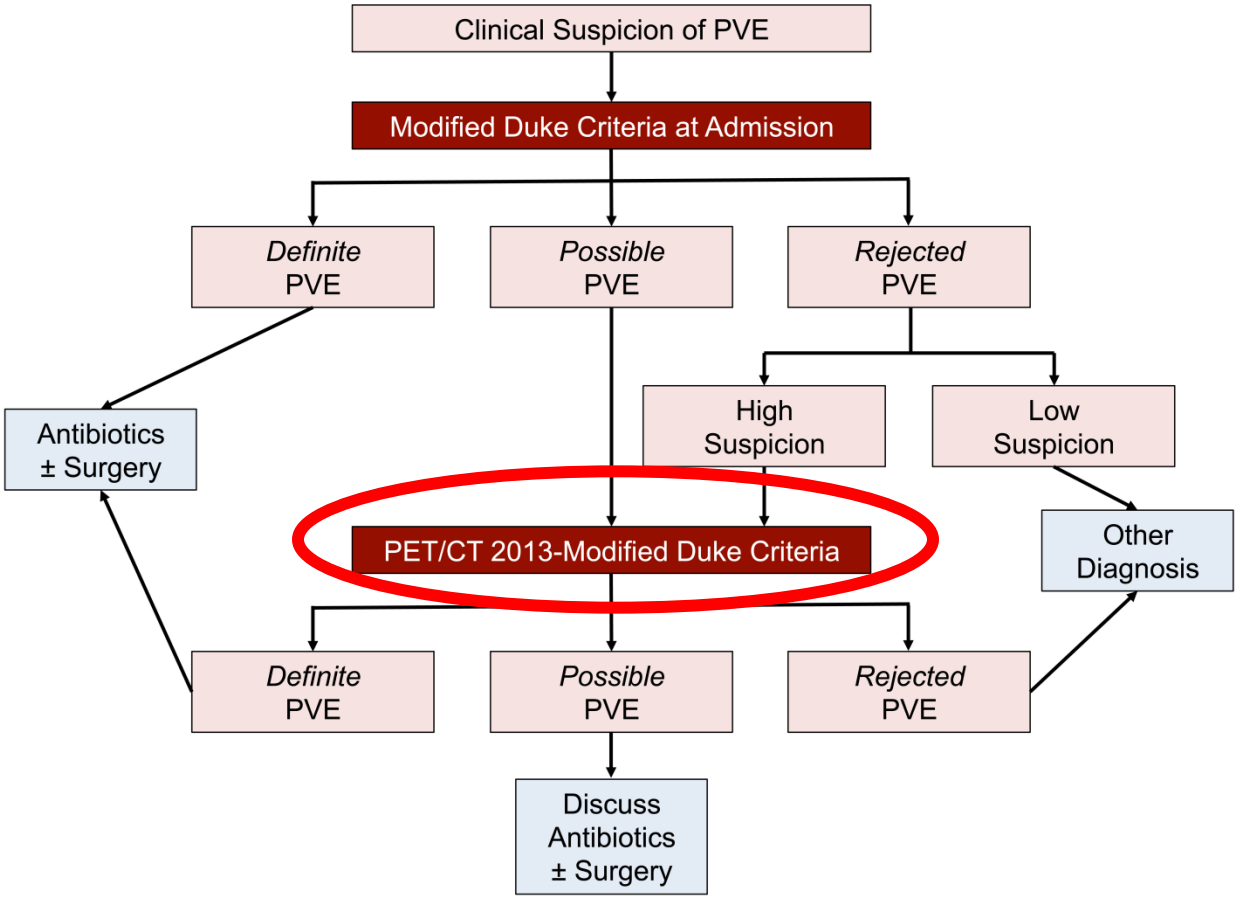

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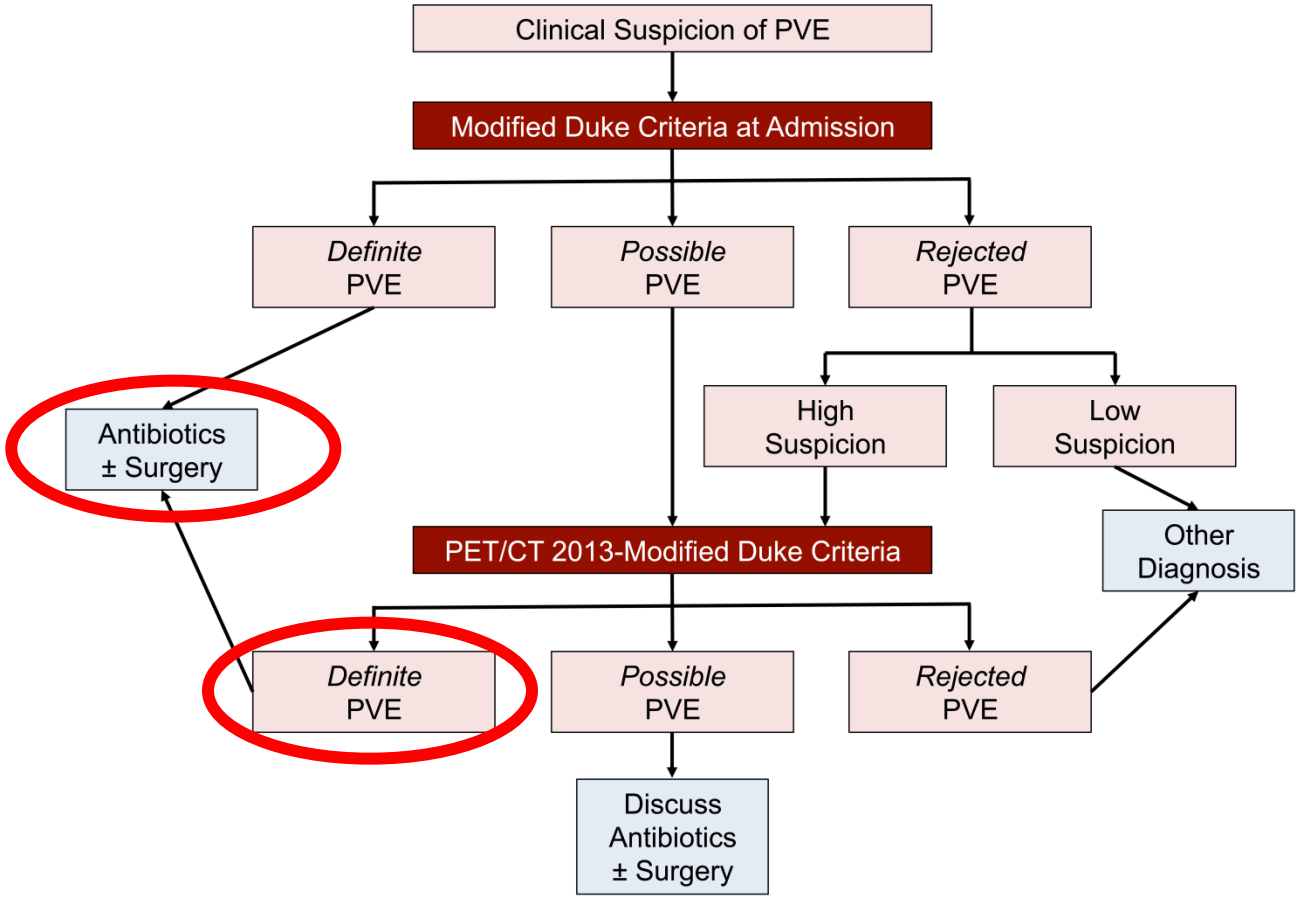


Prosthetic valve endocarditis (PVE)

Indications for surgery in PVE	Timing	Class	Level
A. HEART FAILURE			
PVE with severe prosthetic dysfunction (dehiscence or obstruction) causing refractory pulmonary oedema or cardiogenic shock.	Emergency	I	B
PVE with fistula into a cardiac chamber or pericardium causing refractory pulmonary oedema or cardiogenic shock.	Emergency	I	B
PVE with severe prosthetic dysfunction and persisting heart failure.	Urgent	I	B
Severe prosthetic dehiscence without heart failure.	Elective	I	B
B. UNCONTROLLED INFECTION			
Locally uncontrolled infection (abscess, false aneurysm, enlarging vegetation).	Urgent	I	B
PVE caused by fungi or multiresistant organisms.	Urgent/elective	I	B
PVE with persisting fever and positive blood culture > 7-10 days.	Urgent	I	B
PVE caused by *staphylocci* or gram *negative bacteria*: (most cases of early PVE).	Urgent/elective	I	C
C. PREVENTION of EMBOLISM			
PVE with recurrent emboli despite appropriate treatment.	Urgent	I	B
PVE with large vegetations (10 mm) and other predictors of complicated course (HF, persistent infection, abscess).	Urgent	I	B
PVE with isolated very large vegetations (> 15 mm).	Urgent	IIb	C

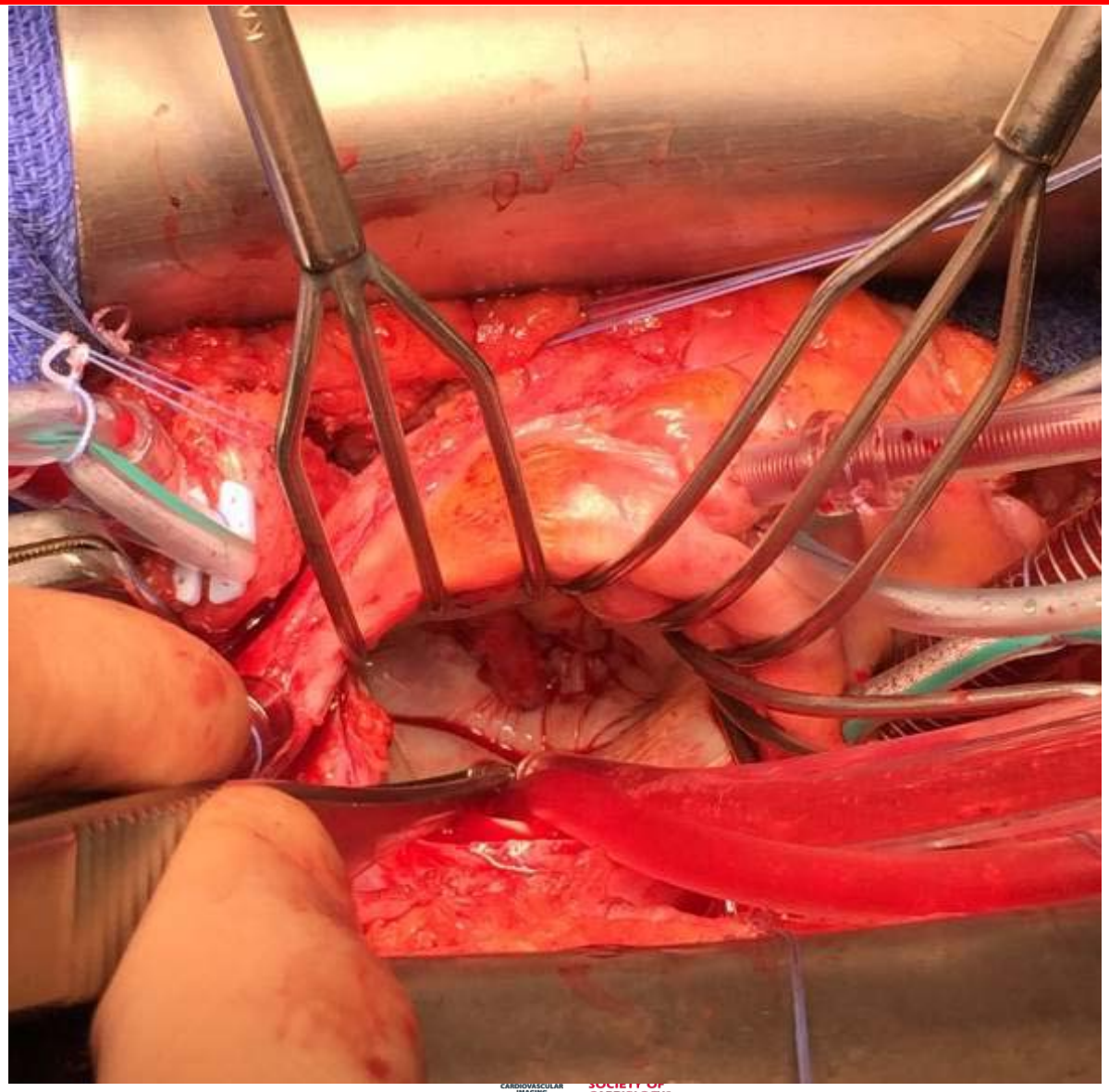
Adapted from European Heart Journal (2009) 30:2369–2413

Decision: urgent surgery

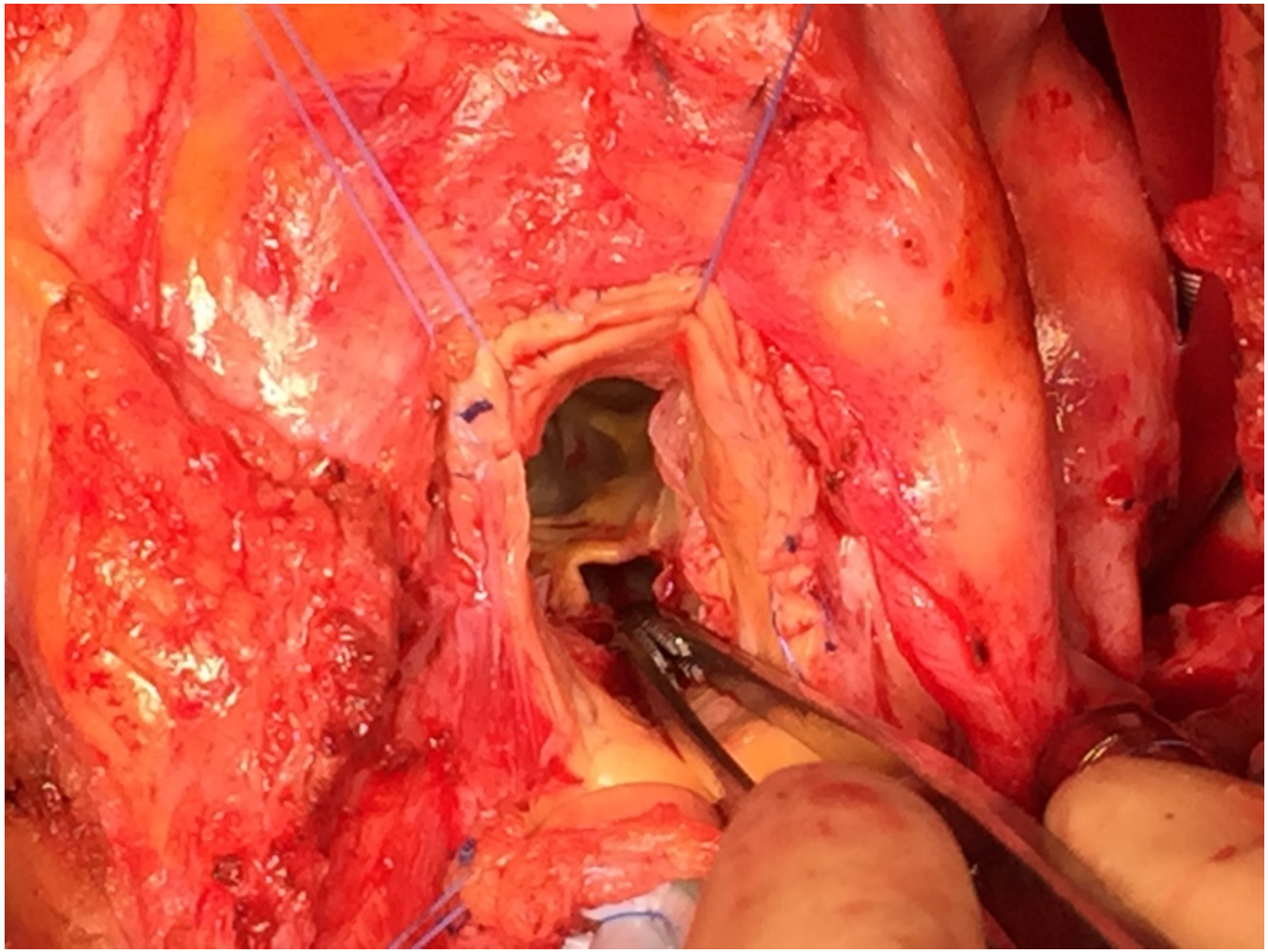
ATB (amoxicillin 12g IV / day + gentamycin 3 mg/kg/day)

- prosthetic valve endocarditis
- persistent fever → **Urgent surgery planned**
- perivalvular involvement

Decision: urgent surgery



Decision: urgent surgery



Imaging in Infective Endocarditis

1. **case 1: prosthetic valve endocarditis**
2. ***case 2: nuclear imaging***
3. **case 3: PVE, abscess**
4. **case 4: mitral perforation**
5. **case 5: TAVI endocarditis**
6. **case 6: right-sided IE**
7. **case 7: suspected NVE, coronary embolism**
8. **case 8: bicuspid aortic valve IE - abscess**

Case 2: MV repair IE

History of the disease

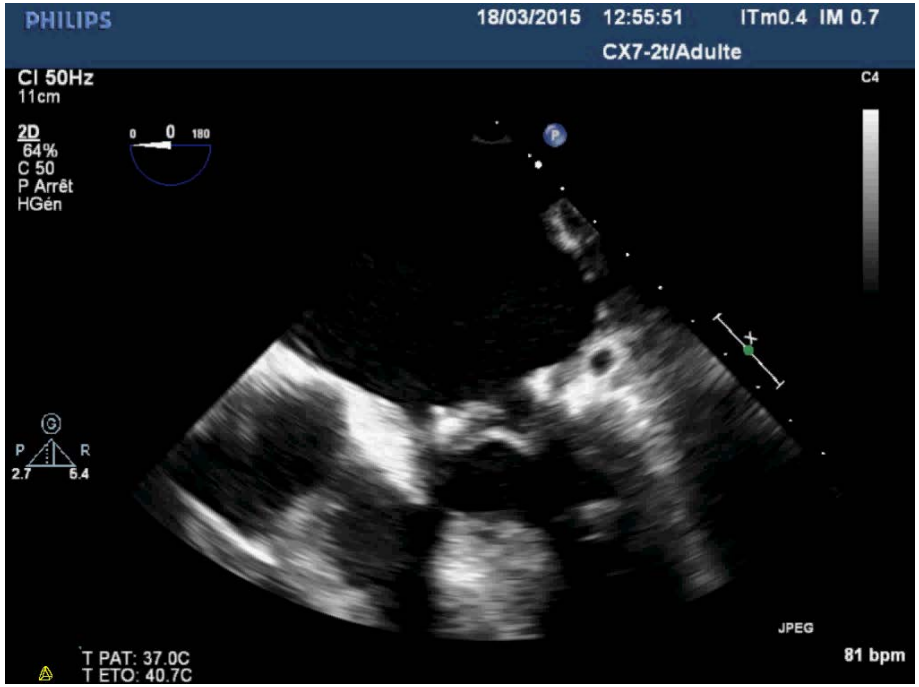
- 80 year-olf woman
- mitral valve repair with annulus in 2013
- lombalgia
- persistent fever

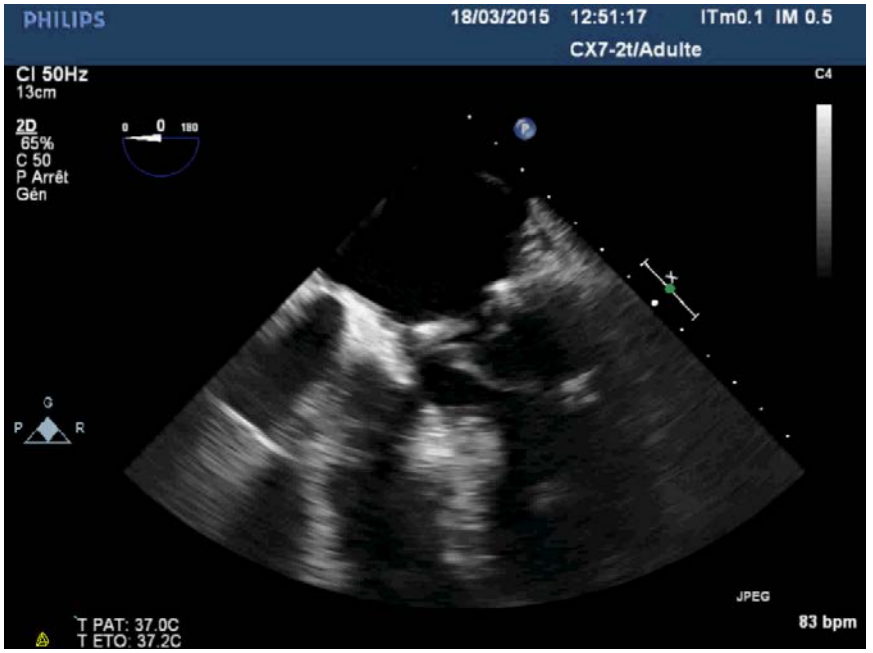
Clinical examination

- no CHF
- fever = 38°5
- systolic murmur 3/6

Blood cultures: Staphylococcus methi-S

Echocardiography





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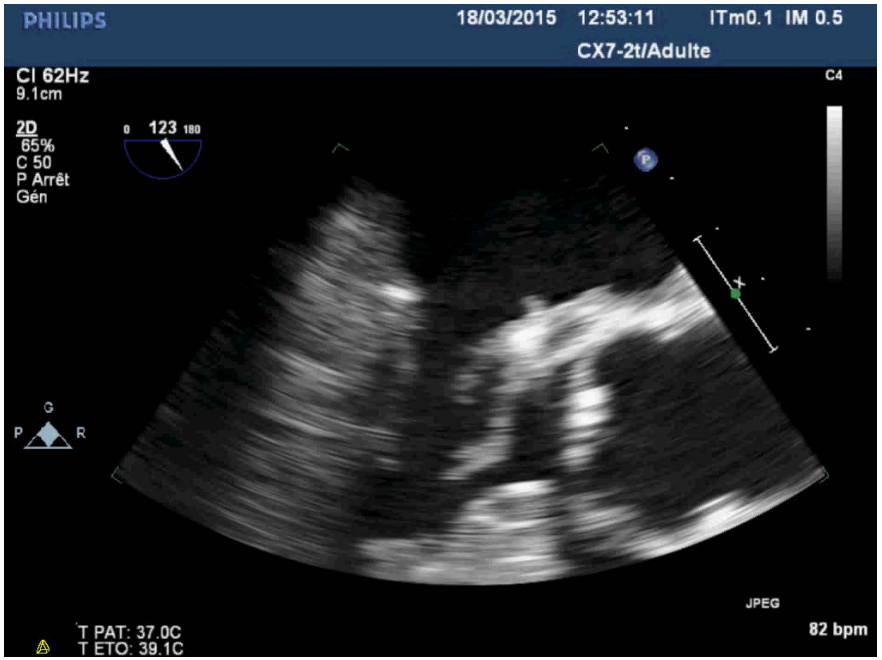
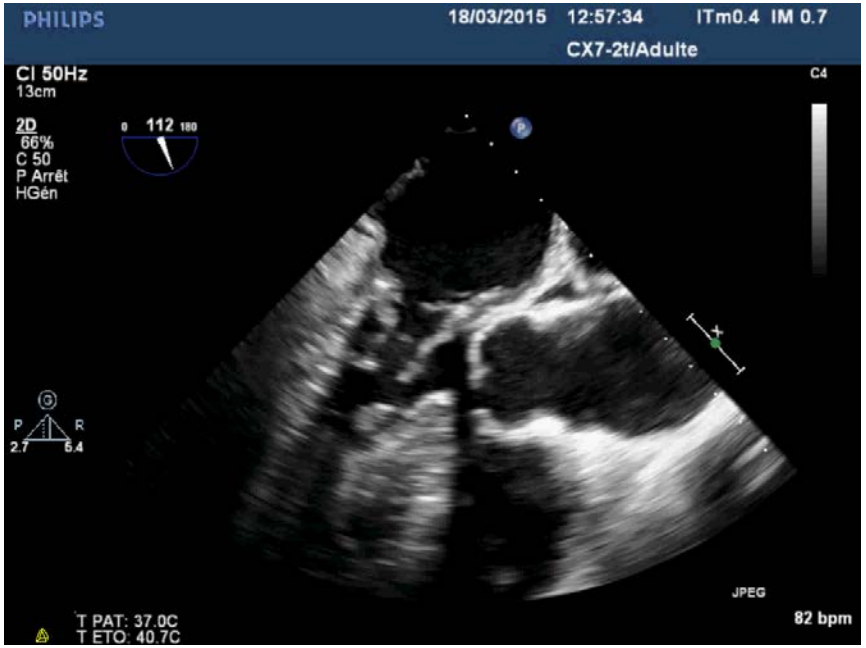
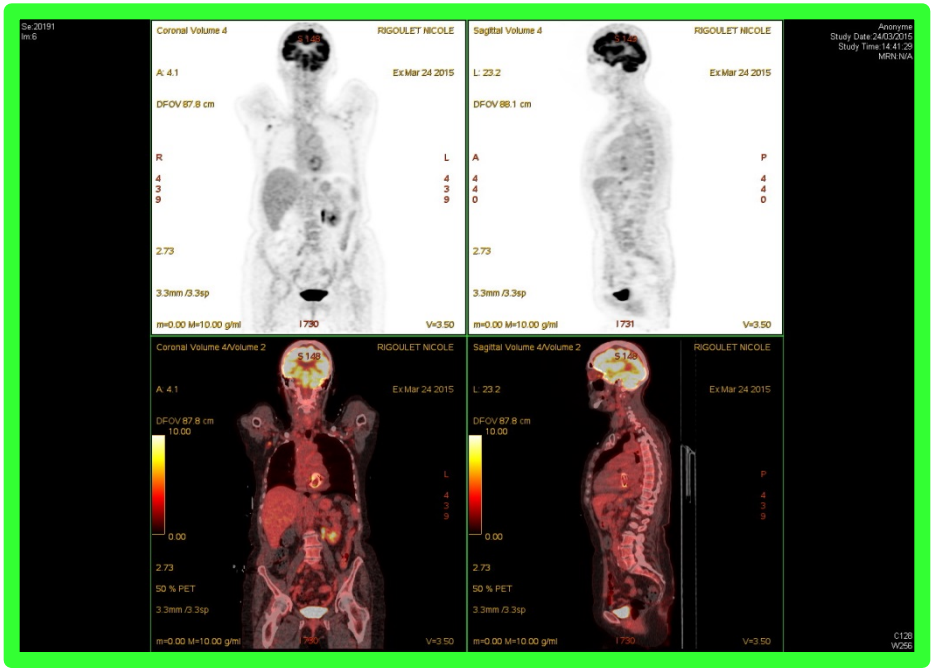
Echocardiography





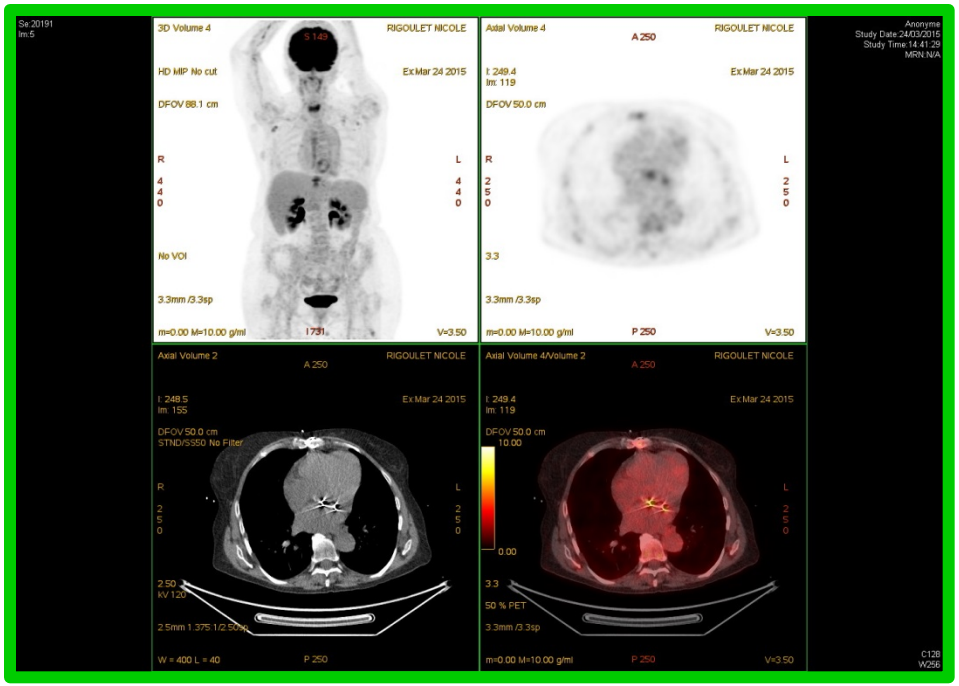
Multimodality Imaging

CT scan : negative

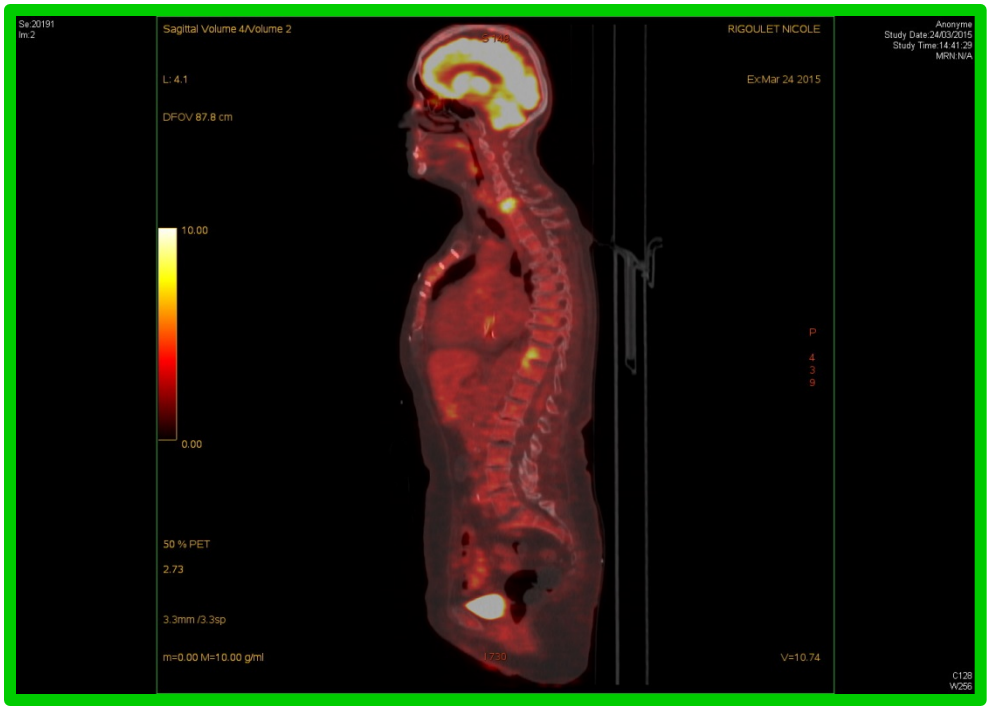


PET CT: positive

Multimodality Imaging



Annulus uptake

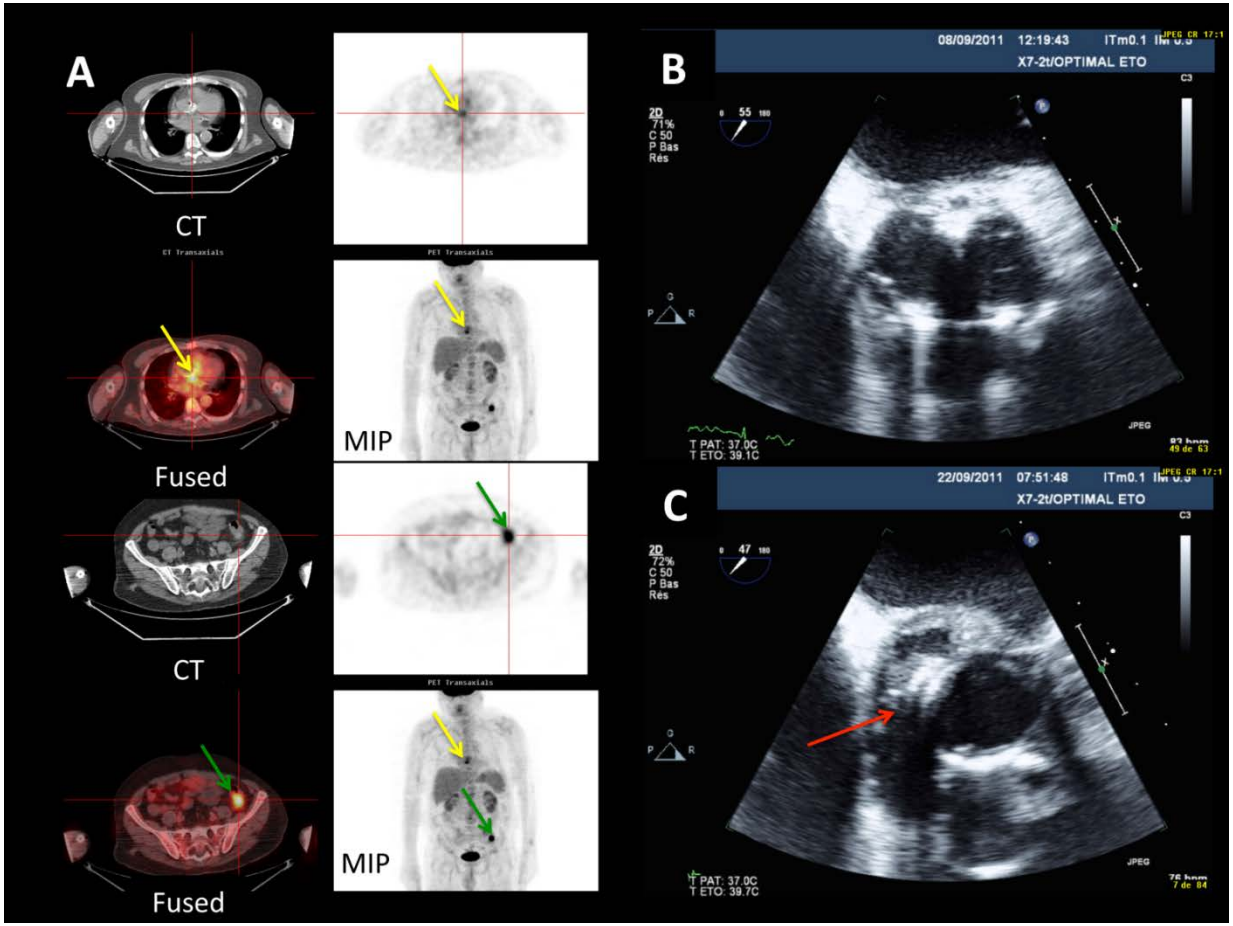


Spondylitis

^{18}FDG-PET-CT in endocarditis

1. **Early diagnosis of perivalvular lesions**

2. **Detection of secondary lesions**



Imaging in Infective Endocarditis

1. case 1: prosthetic valve endocarditis
2. case 2: nuclear imaging
3. ***case 3: PVE, abscess***
4. case 4: mitral perforation
5. case 5: TAVI endocarditis
6. case 6: right-sided IE
7. case 7: suspected NVE, coronary embolism
8. case 8: bicuspid aortic valve IE - abscess

Case 3: PVE - abscess

History of the disease

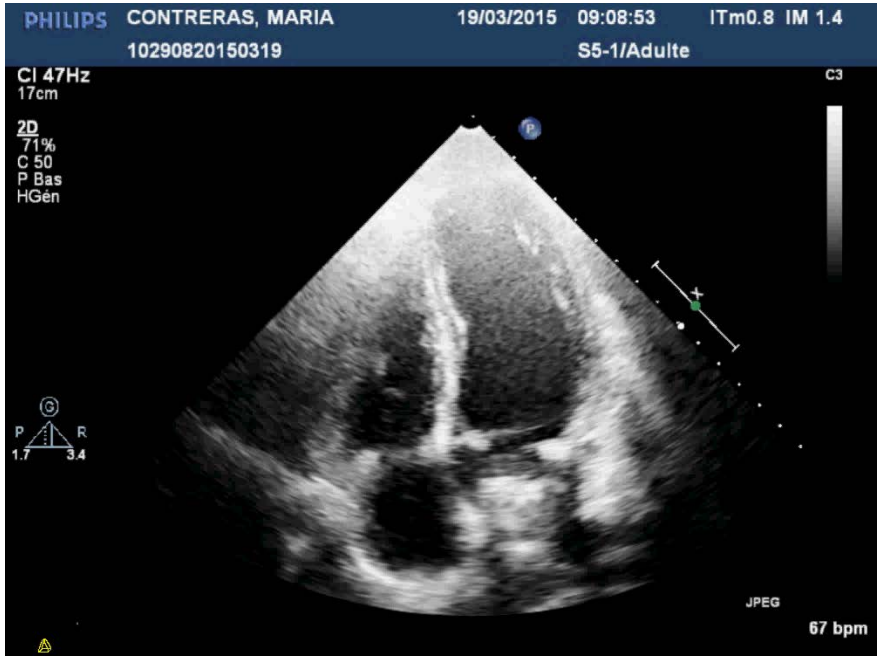
- 75 year-old woman
- mechanical mitral valve 2006
- fever
- dyspnea

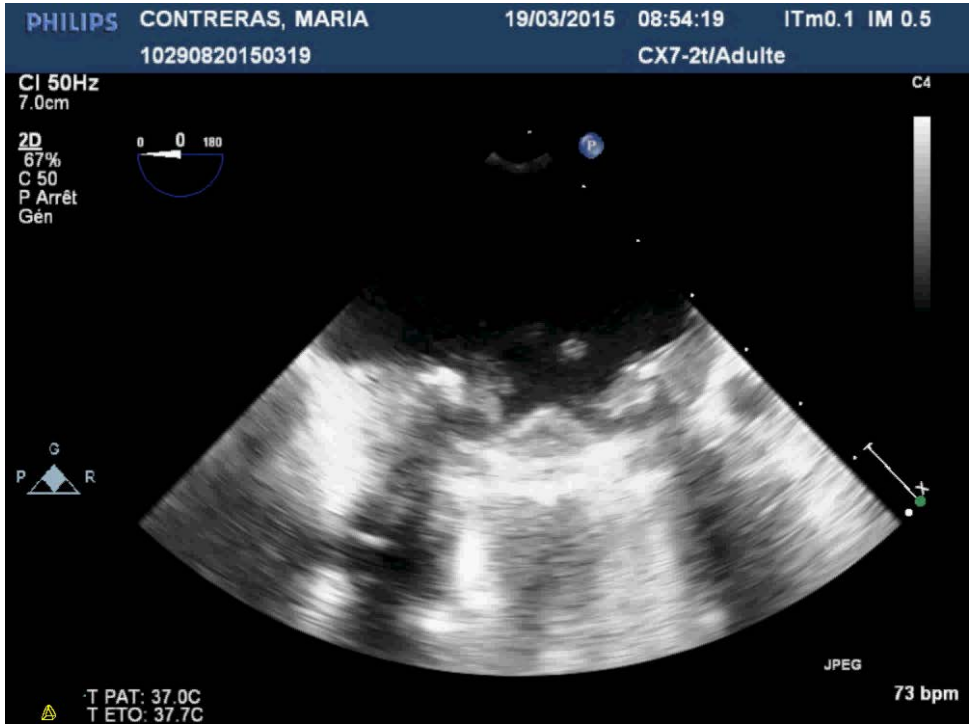
Clinical examination

- no CHF
- fever = 38°5
- mitral systolic murmur 2/6

Blood cultures: Enterococcus faecalis

Echocardiography





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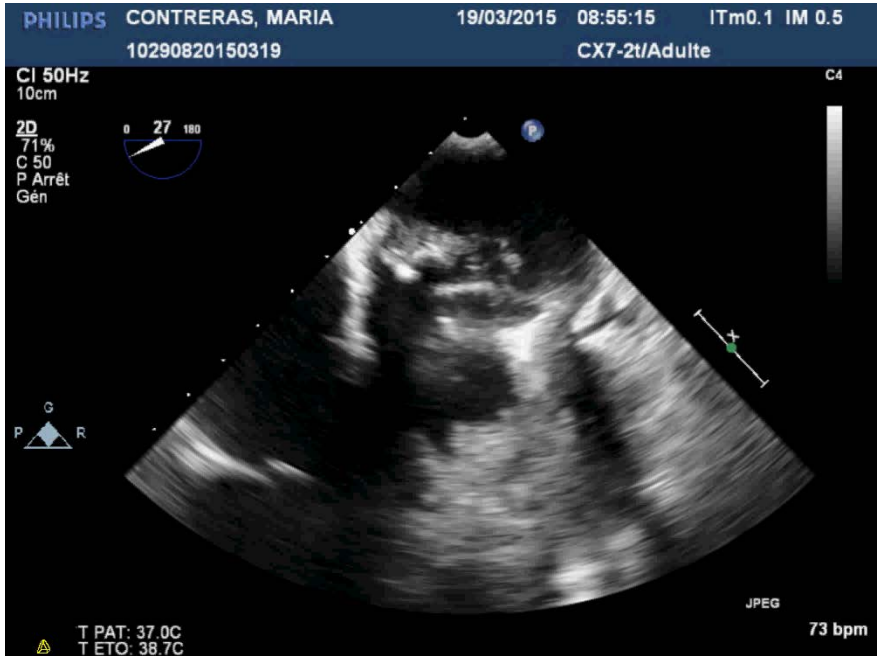
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C 50
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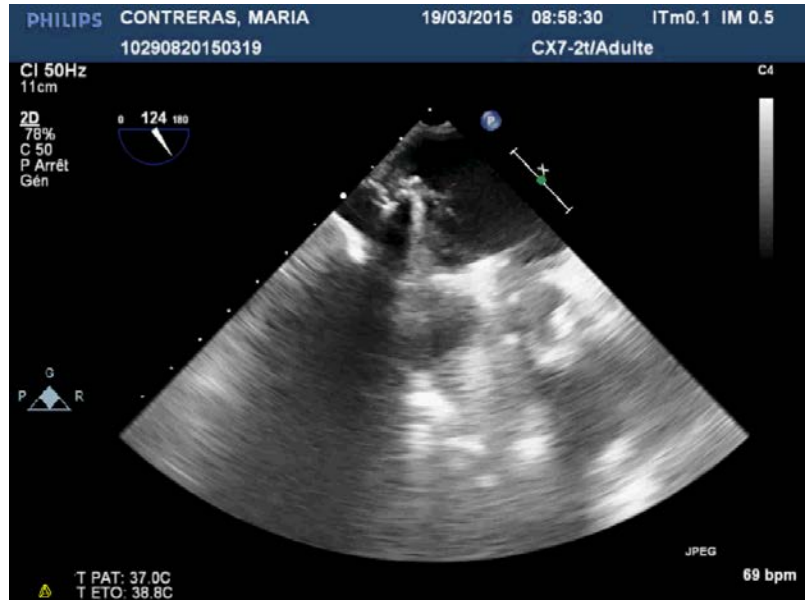
JPEG
T PAT: 37.0C
T ETO: 38.7C
73 bpm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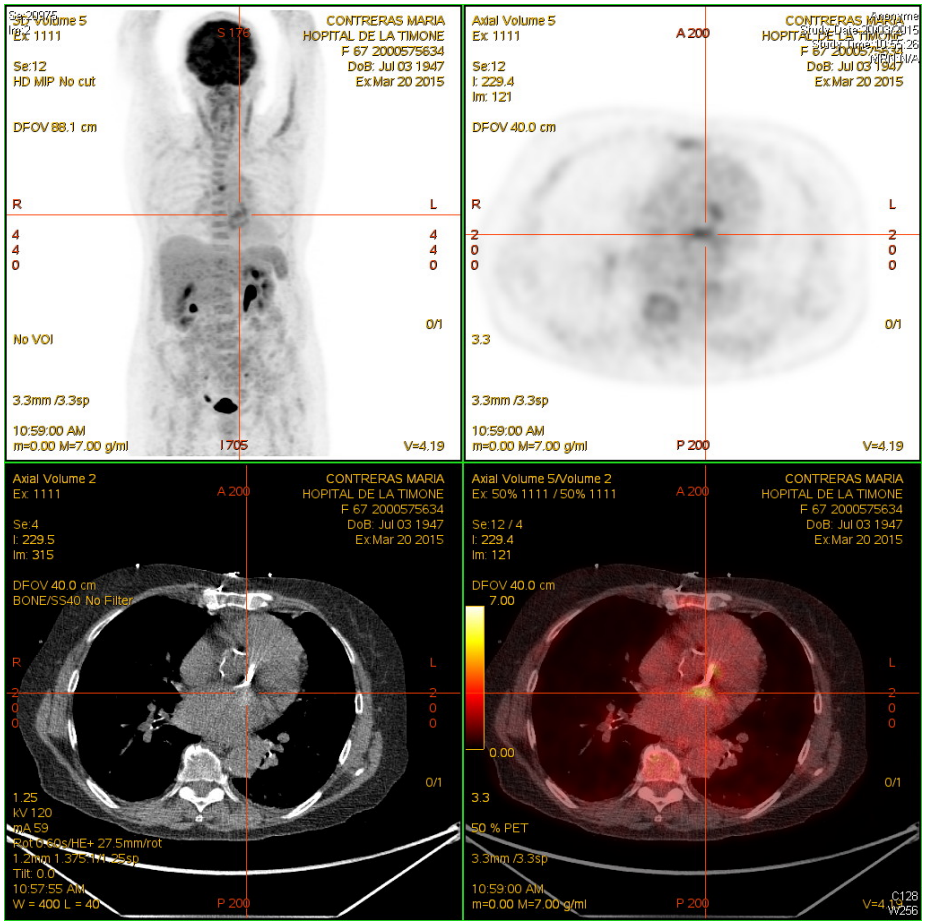
2D
78%
C 50
P Arrêt
Gén
0 124 180
G
P R
JPEG
T PAT: 37.0C
T ETO: 38.8C
69 bpm

^{18}FDG-PET-CT



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Prosthetic valve endocarditis (PVE)

Indications for surgery in PVE	Timing	Class	Level
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Locally uncontrolled infection (abscess, false aneurysm, enlarging vegetation).	Urgent	I	B
PVE caused by fungi or multiresistant organisms.	Urgent/elective	I	B
PVE with persisting fever and positive blood culture > 7-10 days.	Urgent	I	B
PVE caused by *staphylocci* or gram *negative bacteria*: (most cases of early PVE).	Urgent/elective	I	C
C. PREVENTION of EMBOLISM			
PVE with recurrent emboli despite appropriate treatment.	Urgent	I	B
PVE with large vegetations (10 mm) and other predictors of complicated course (HF, persistent infection, abscess).	Urgent	I	B
PVE with isolated very large vegetations (> 15 mm).	Urgent	IIb	C

Adapted from European Heart Journal (2009) 30:2369–2413

Decision: urgent surgery

ATB (amoxicillin 12g IV / day + gentamycin 3 mg/kg/day)

- prosthetic valve endocarditis
- large vegetation → **Urgent surgery planned**
- abscess

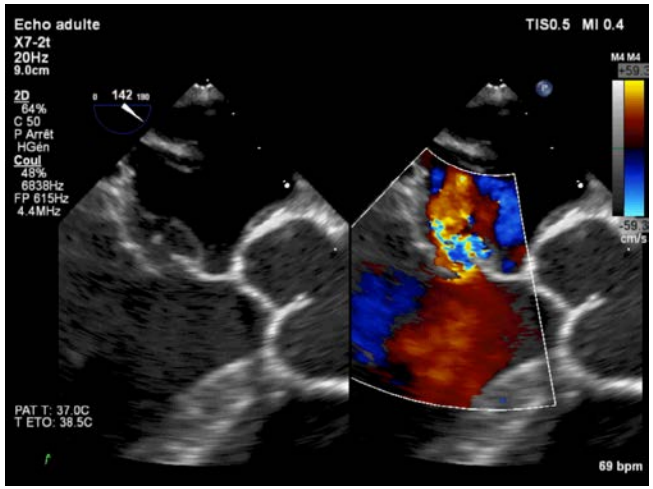
Decision: urgent surgery

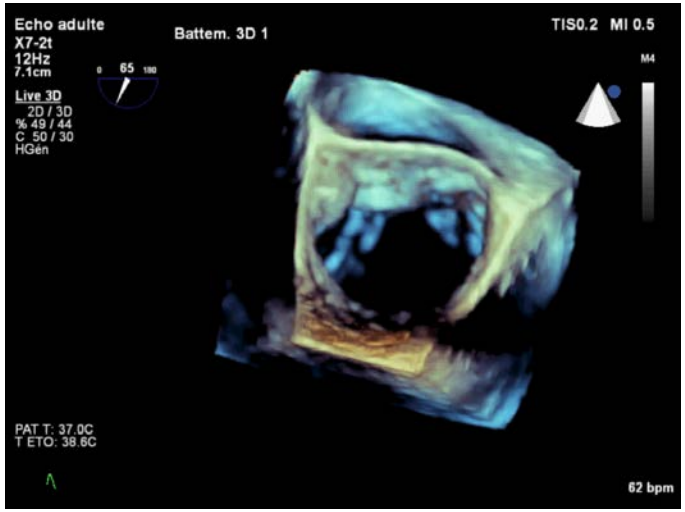
Imaging in Infective Endocarditis

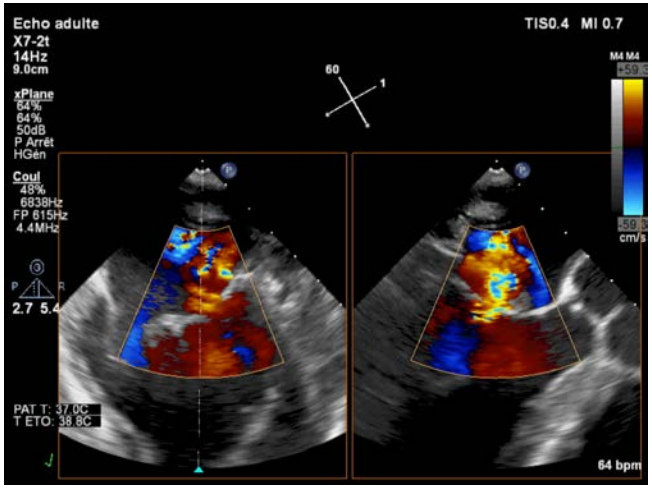
1. case 1: prosthetic valve endocarditis
2. case 2: nuclear imaging
3. case 3: imaging embolic risk
4. case 4: ***mitral perforation***
5. case 5: TAVI endocarditis
6. case 6: right-sided IE
7. case 7: suspected NVE, coronary embolism
8. case 8: bicuspid aortic valve IE - abscess

Case 4: mitral perforation

- 56 year-old man
- spondylitis
- elevated troponin
- fever = 38°
- BC: staphylococcus Meti-R







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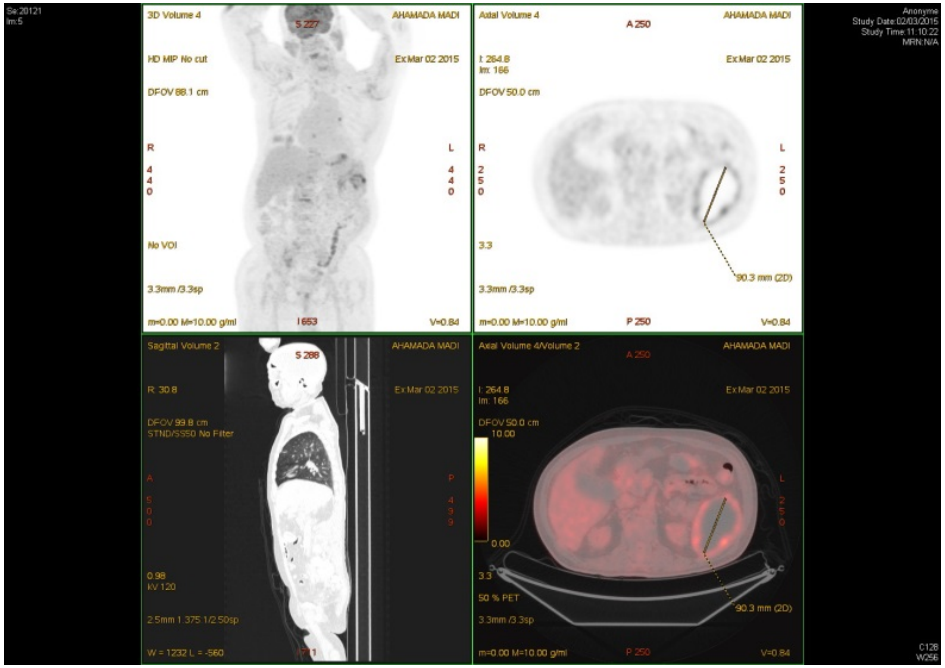
Case 4: mitral perforation



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Imaging in Infective Endocarditis

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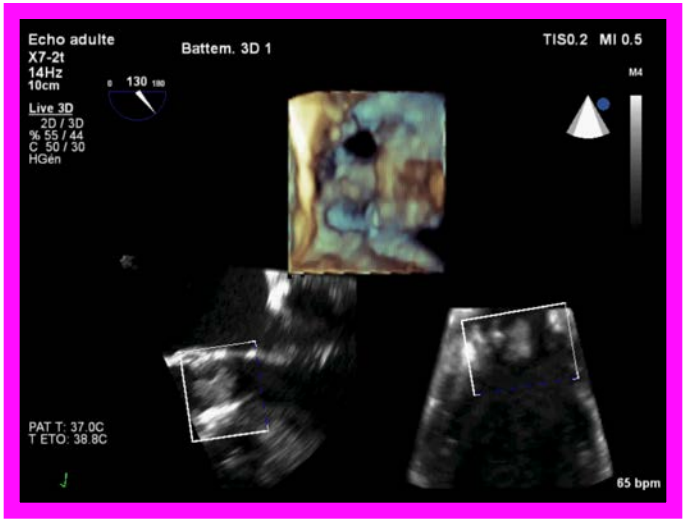
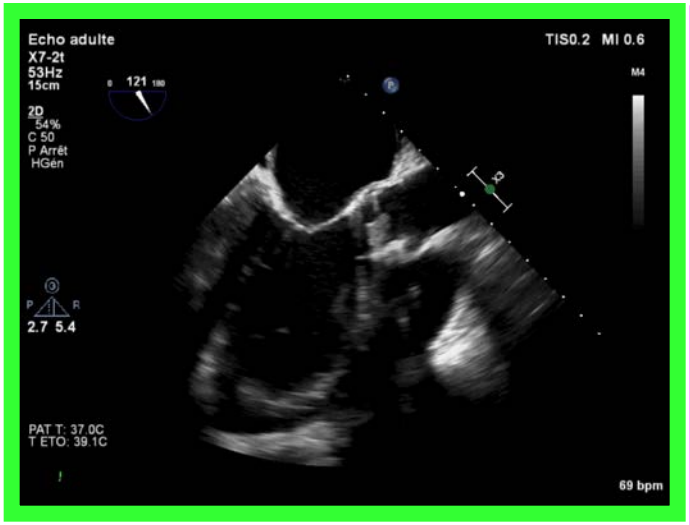
4. case 4: mitral perforation
5. ***case 5: TAVI endocarditis***
6. case 6: right-sided IE
7. case 7: suspected NVE, coronary embolism
8. case 8: bicuspid aortic valve IE - abscess

Case 5: TAVI endocarditis

- 80 year-olf man
- CHF
- TAVI 2 years ago
- fever = 38°
- BC: staphylococcus coagulase -





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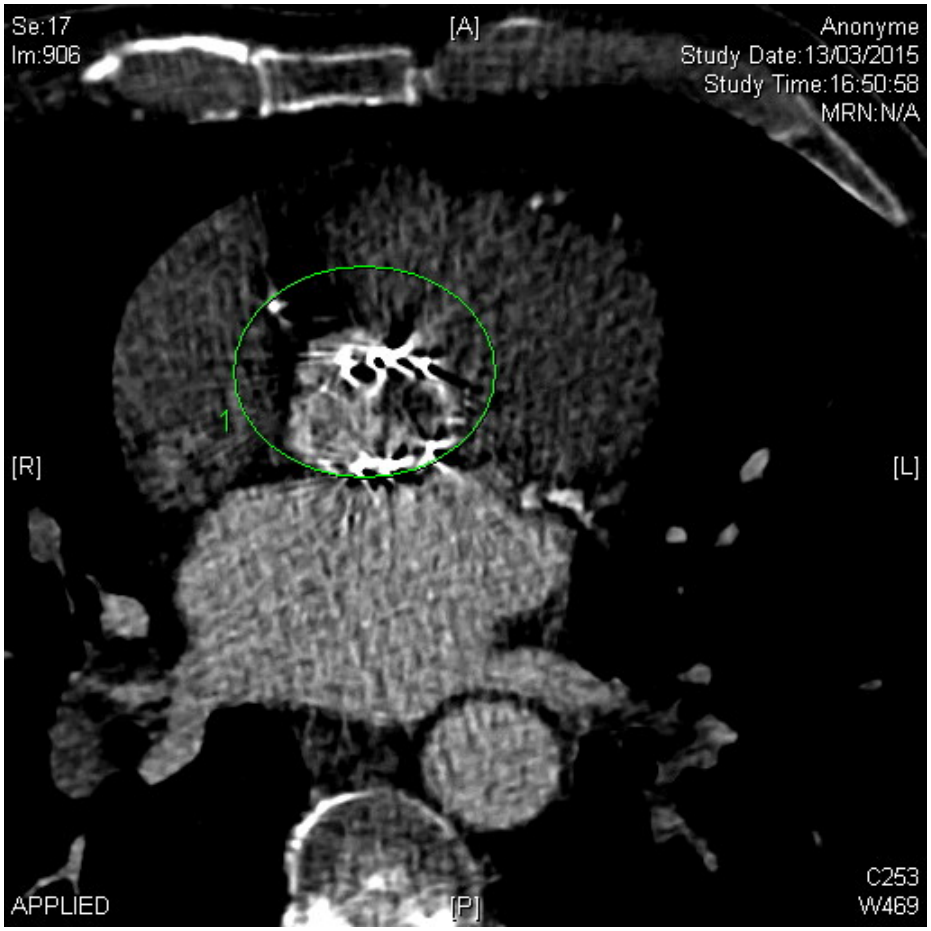
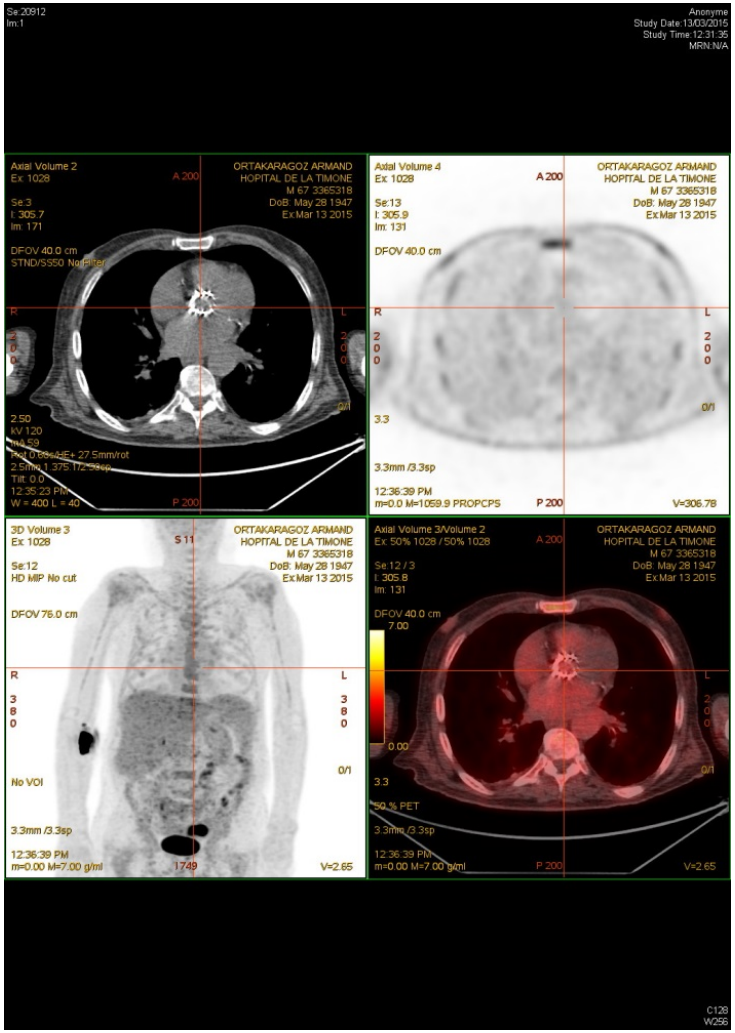
Case 5: TAVI endocarditis



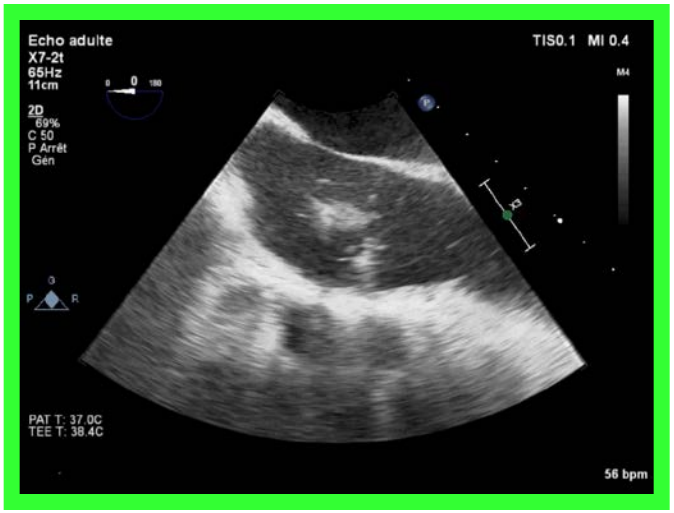


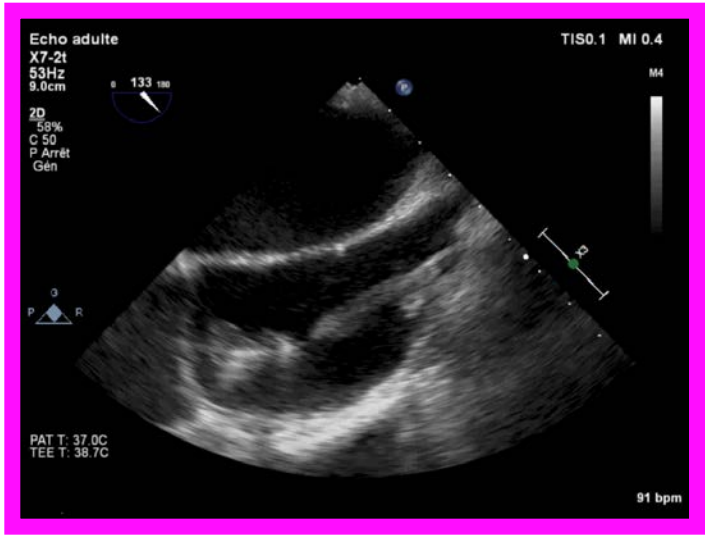
Imaging in Infective Endocarditis

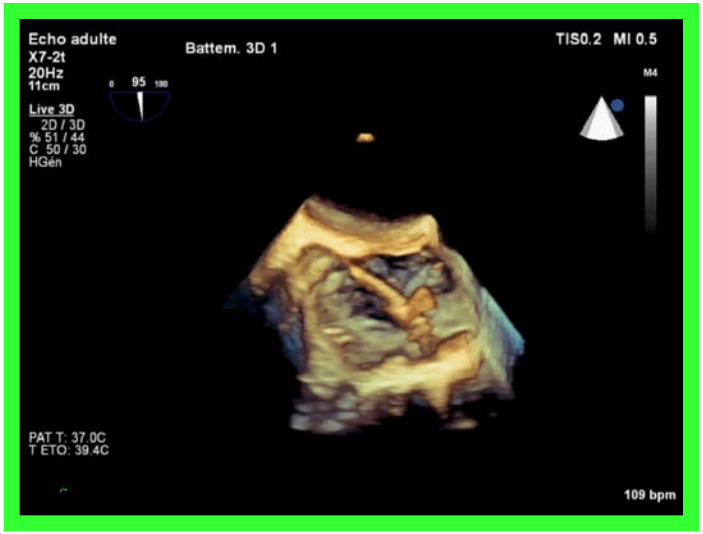
1. case 1: prosthetic valve endocarditis
2. case 2: nuclear imaging
3. case 3: imaging embolic risk
4. case 4: mitral perforation
5. case 5: TAVI endocarditis
6. ***case 6: right-sided IE***
7. case 7: suspected NVE, coronary embolism
8. case 8: bicuspid aortic valve IE - abscess

Case 6: PMLIE

- 47 year-olf woman
- Steinert myopathy
- ASD operated 1980
- PM for AV block 1997
- fever
- AF
- peripheral embolism
- BC: staphylococcus coagulase -







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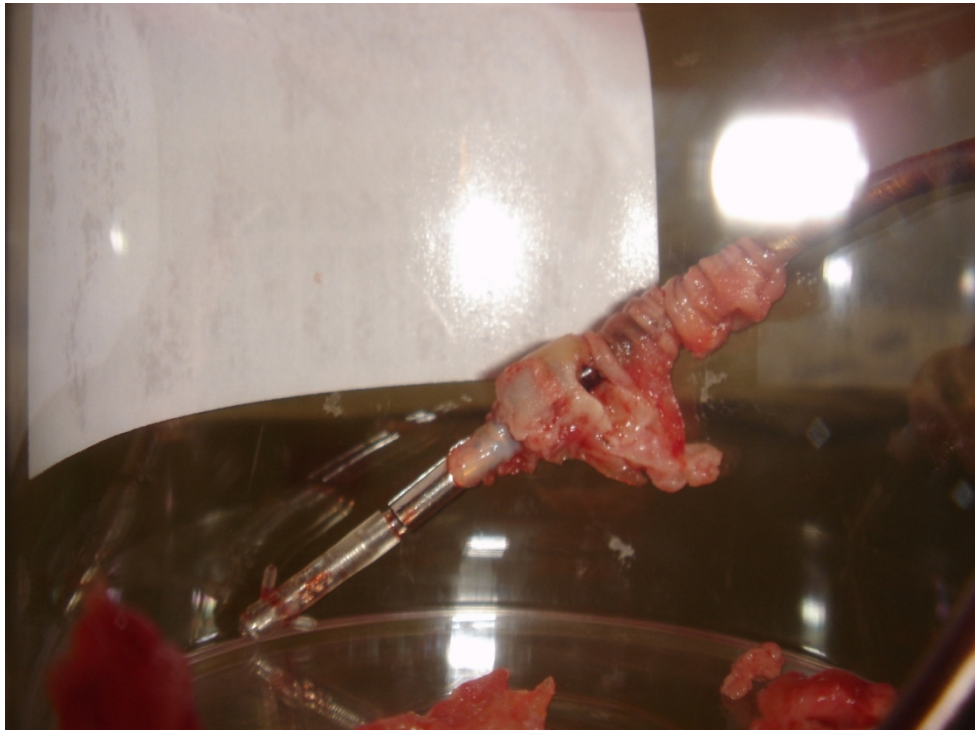
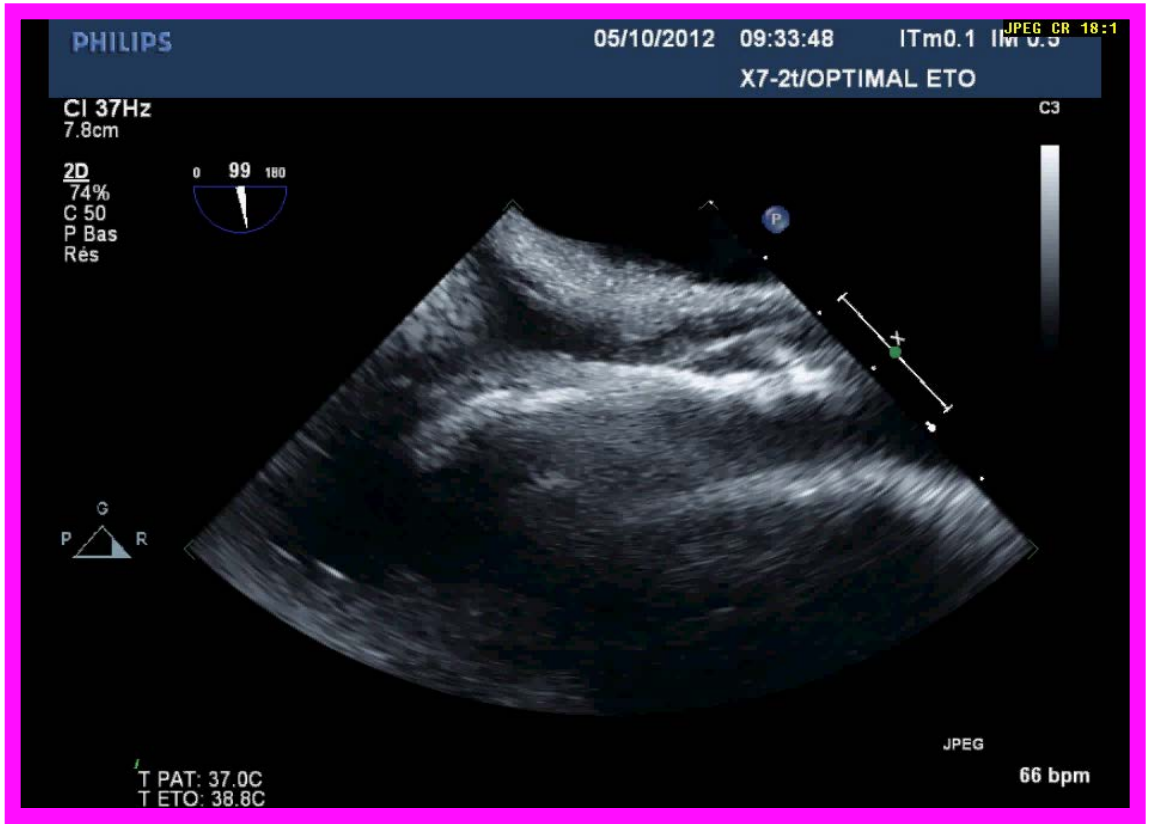
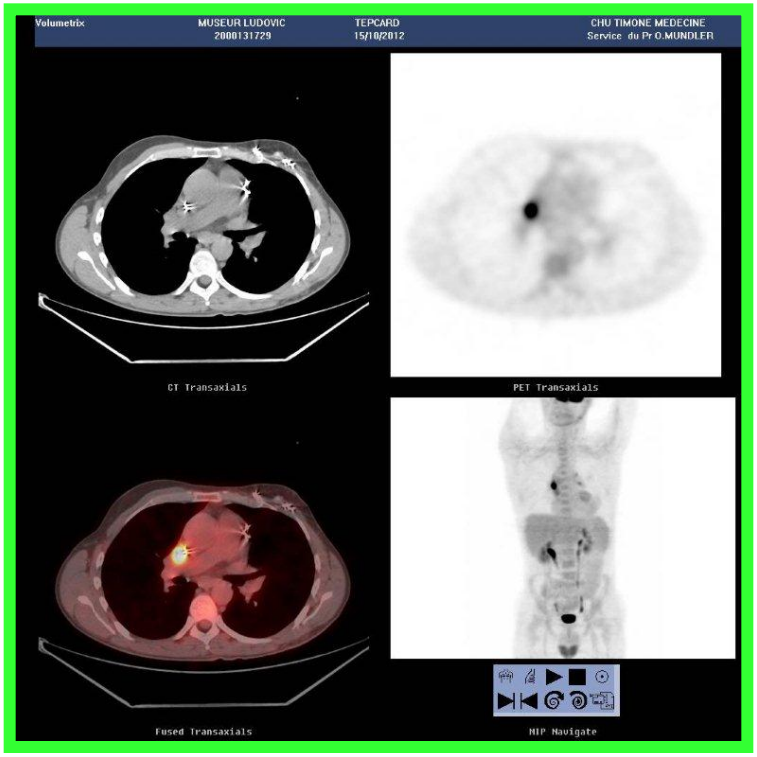
CRDIE: TOE



PMLIE: PET / CT





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CDRIE: ESC guidelines 2009

Recommendations: IE on pacemakers and implantable defibrillators	Class[a]	Level[b]
A - PRINCIPLES OF TREATMENT:		
Prolonged antibiotic therapy and device removal are recommended in definite CDRIE	I	B
Device removal should be considered when CDRIE is suspected on the basis of occult infection without other apparent source of infection	IIa	C

CDRIE: ESC guidelines 2009

Recommendations: IE on pacemakers and implantable defibrillators	Class[a]	Level[b]
A - PRINCIPLES OF TREATMENT:		
Prolonged antibiotic therapy and device removal are recommended in definite CDRIE	I	B
Device removal should be considered when CDRIE is suspected on the basis of occult infection without other apparent source of infection	IIa	C
B - MODE OF DEVICE REMOVAL:		
Percutaneous extraction is recommended in most patients with CDRIE, even those with large (> 10 mm) vegetations	I	B
Surgical extraction should be considered if percutaneous extraction is incomplete or impossible or when there is associated severe destructive tricuspid IE	IIa	C
Surgical extraction may be considered in patients with very large (> 25 mm) vegetations	IIb	C

Conclusion: IE today

1. **multimodality imaging**
2. **early diagnosis**
3. **urgent surgery**

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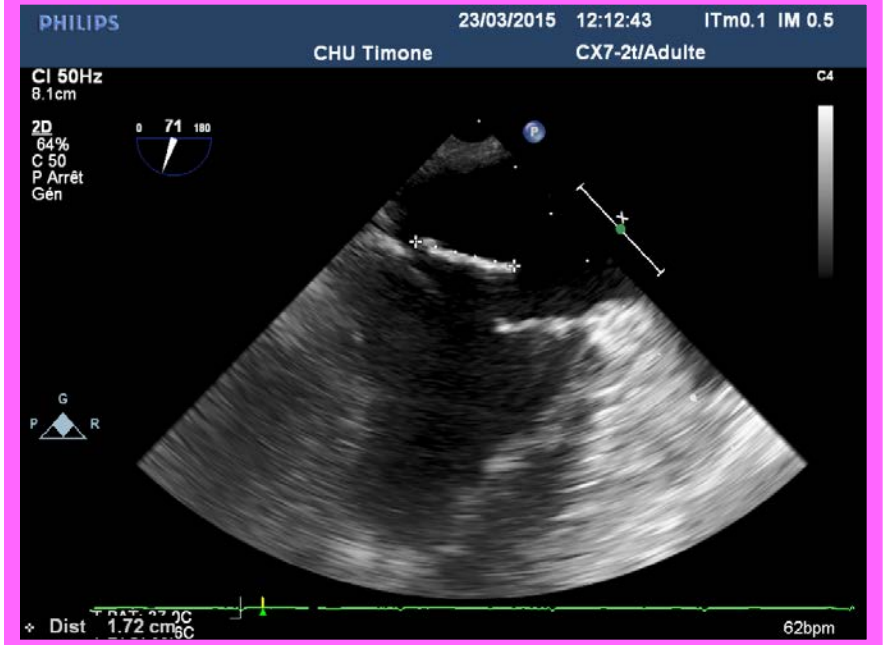
Imaging in Infective Endocarditis

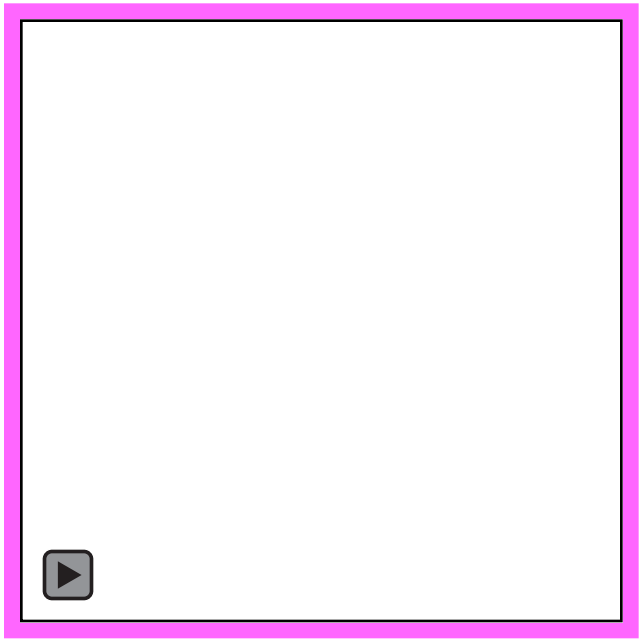
1. **case 1: prosthetic valve endocarditis**
2. **case 2: nuclear imaging**
3. **case 3: PVE, abscess**
4. **case 4: mitral perforation**
5. **case 5: TAVI endocarditis**
6. **case 6: right-sided IE**
7. ***case 7: suspected NVE, coronary embolism***
8. **case 8: bicuspid aortic valve IE - abscess**

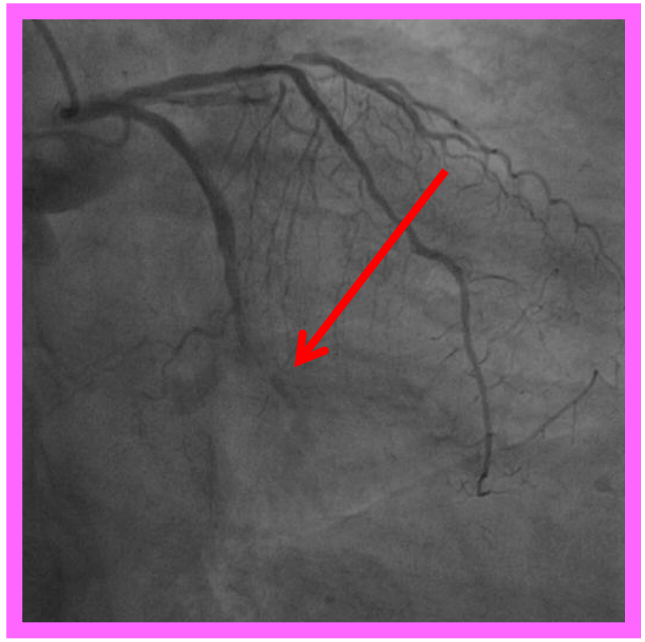
Case 7: coronary embolism

- 75 year-olf woman
- chest pain
- elevated troponin
- fever = 38°
- negative BC



Case 7: coronary embolism





Case 7: coronary embolism

Imaging in Infective Endocarditis

1. case 1: prosthetic valve endocarditis
2. case 2: nuclear imaging
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4. case 4: mitral perforation
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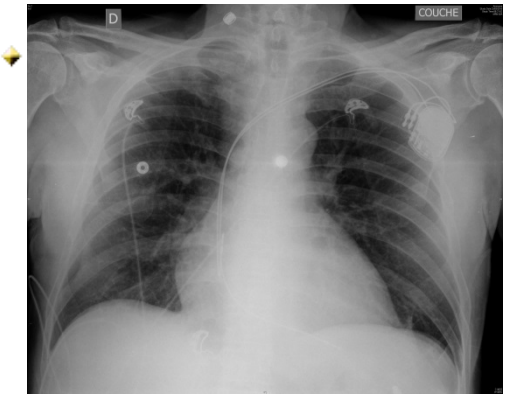
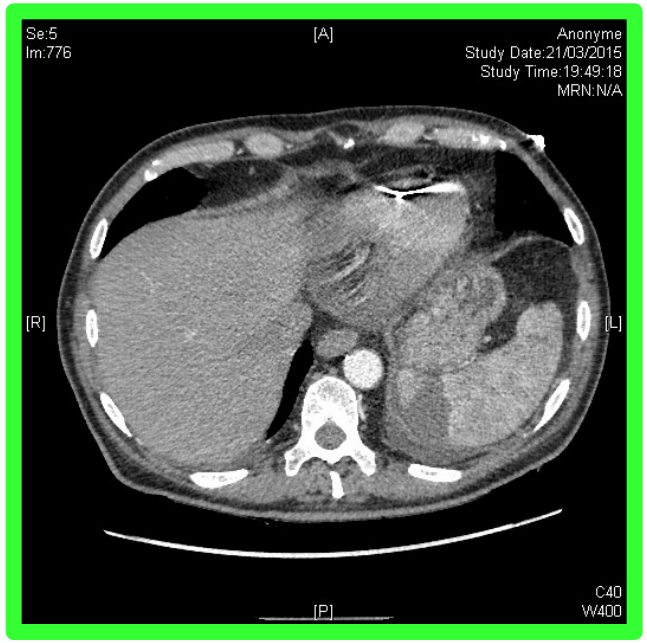
6. case 6: right-sided IE
7. case 7: suspected NVE, coronary embolism
8. *case 8: bicuspid aortic valve IE - abscess*

Case 8: BAV IE + abscess

- PM implanted 2 weeks ago
- peripherial embolism 1 week ago
- dyspnea
- fever = 39°
- negative BC





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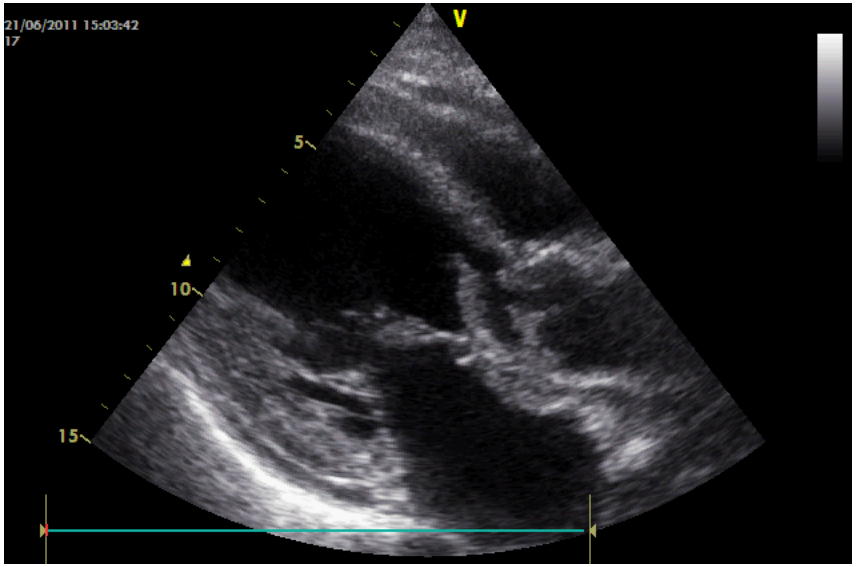
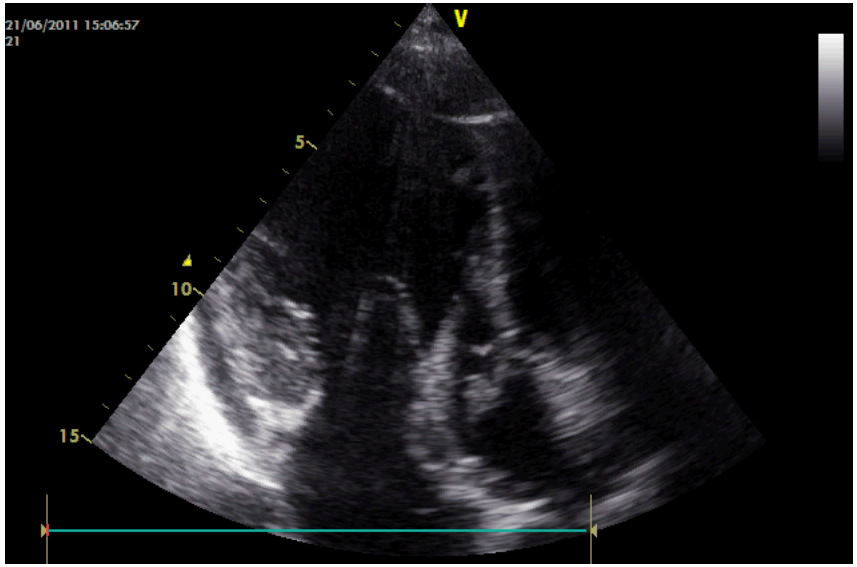
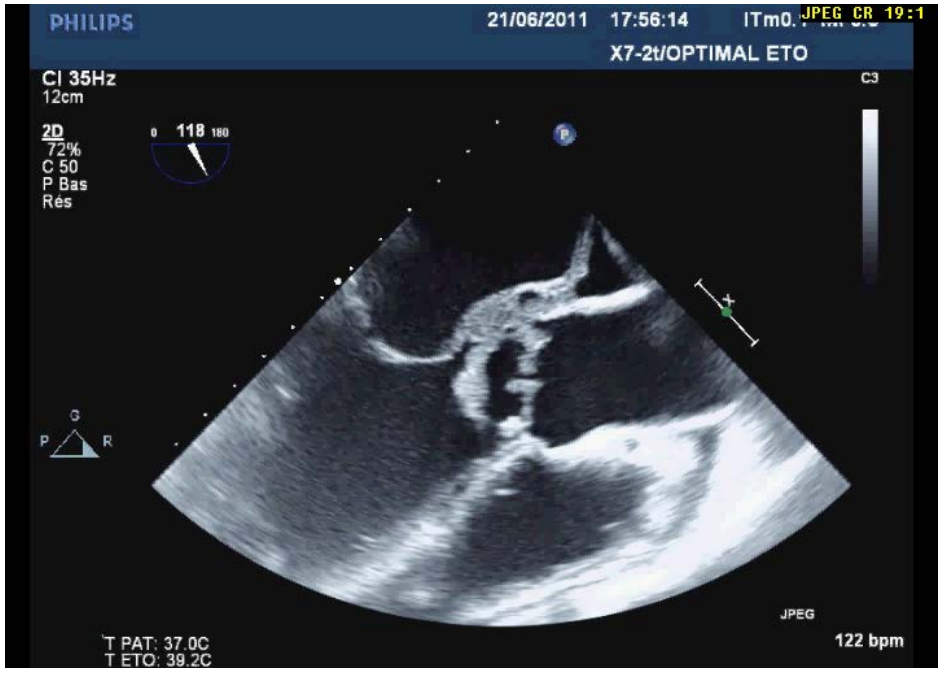
TTE





TEE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C 50
P Bas
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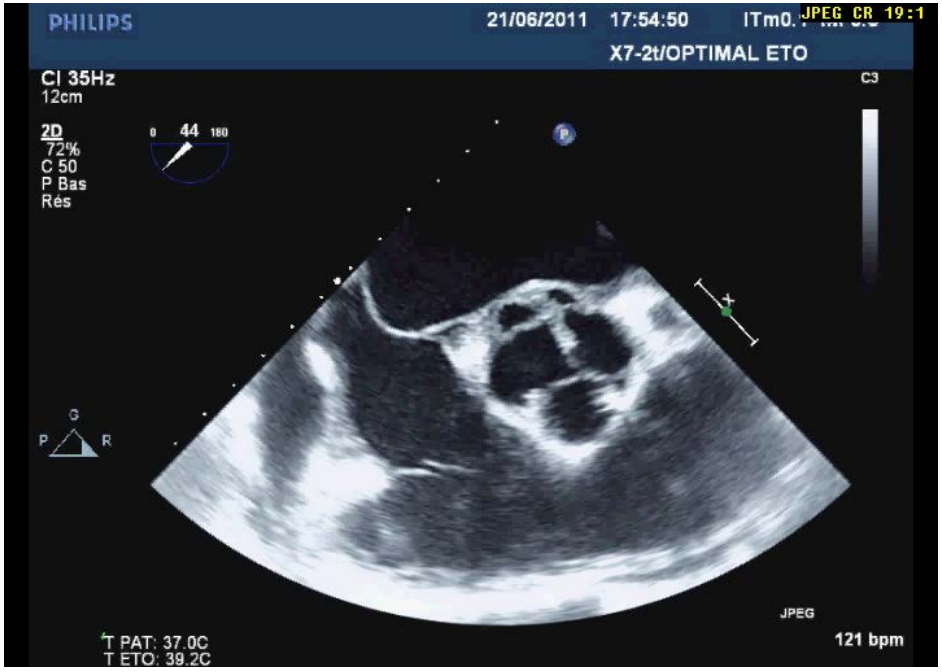
JPEG
T PAT: 37.0C
T ETO: 39.2C
122 bpm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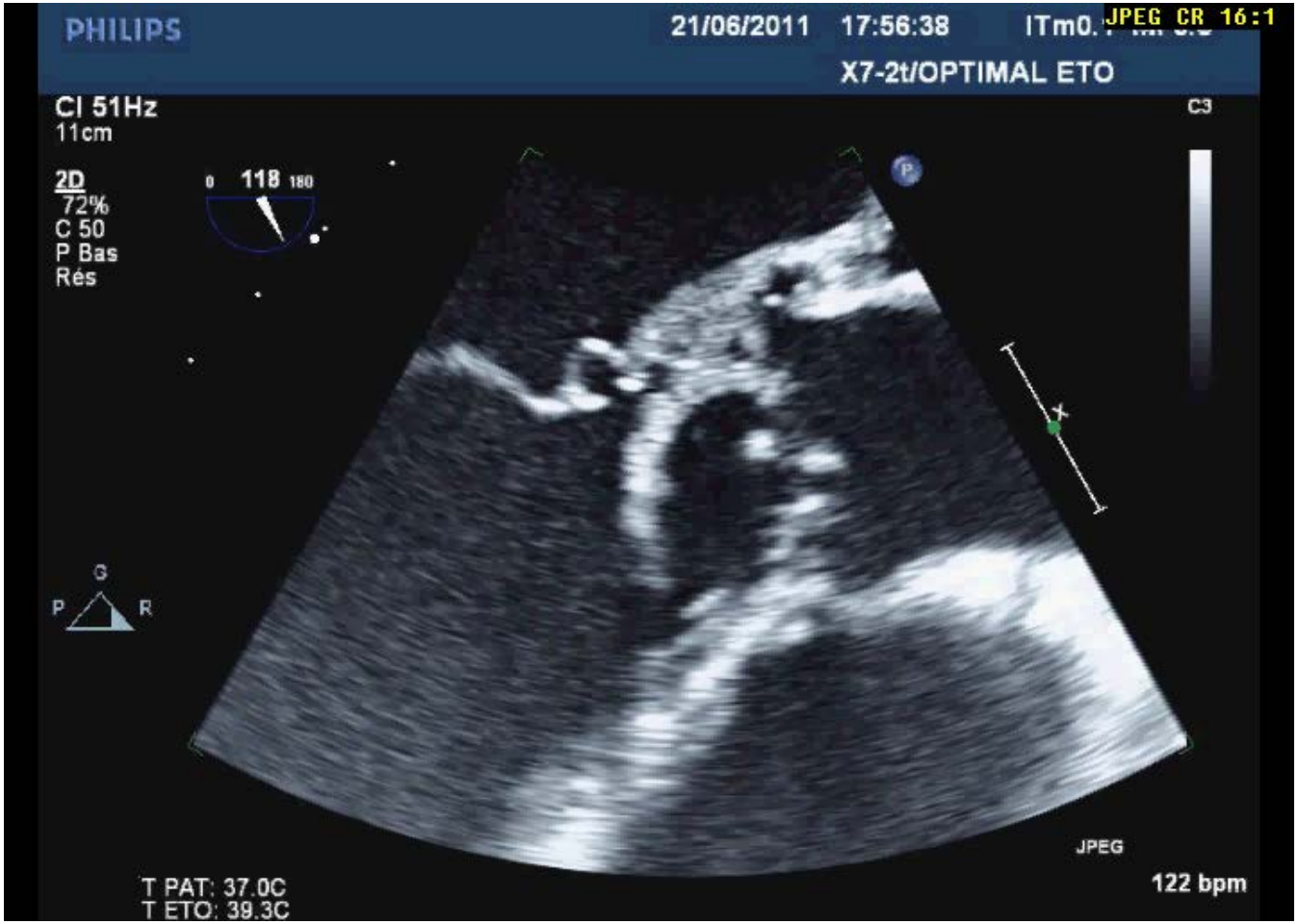
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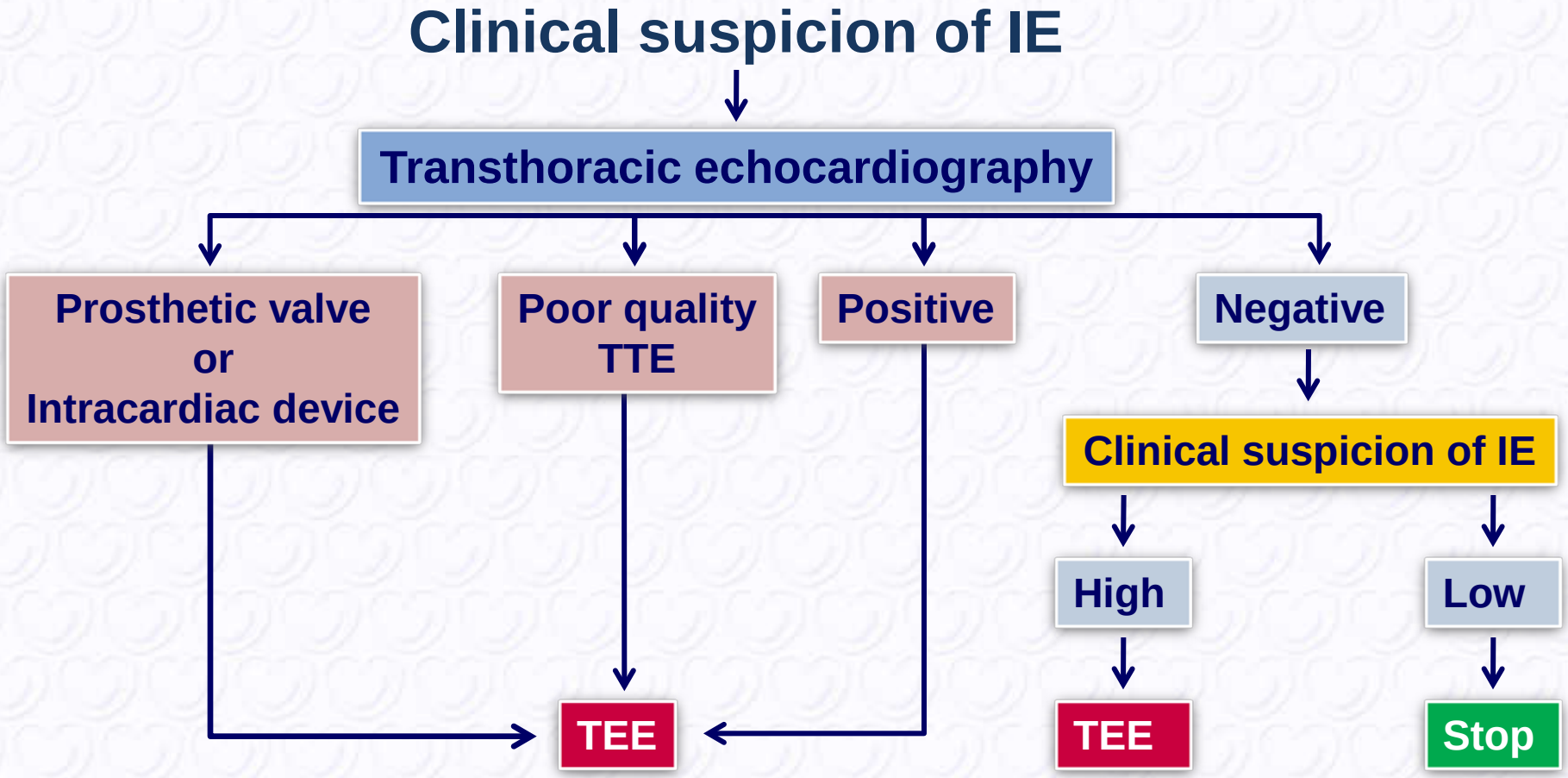
Indications for echocardiography



If initial TEE is negative but persistent suspicion of IE: repeat TEE within 7-10 days

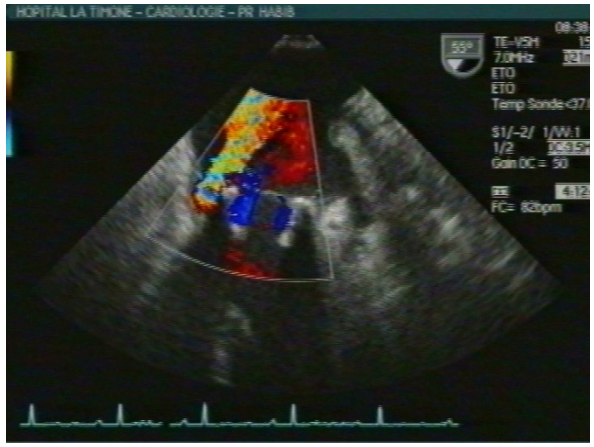
European Heart Journal (2009) 30:2369–2413

The Duke echographic criteria

Durack DT Am J Med 1994 ; 96 : 200-9

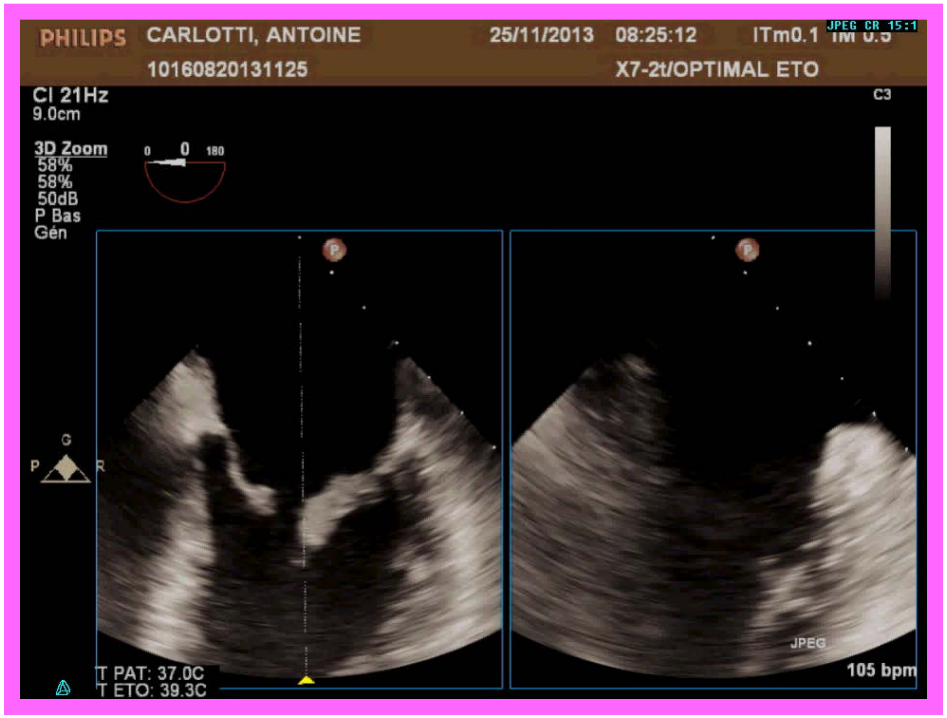
vegetation

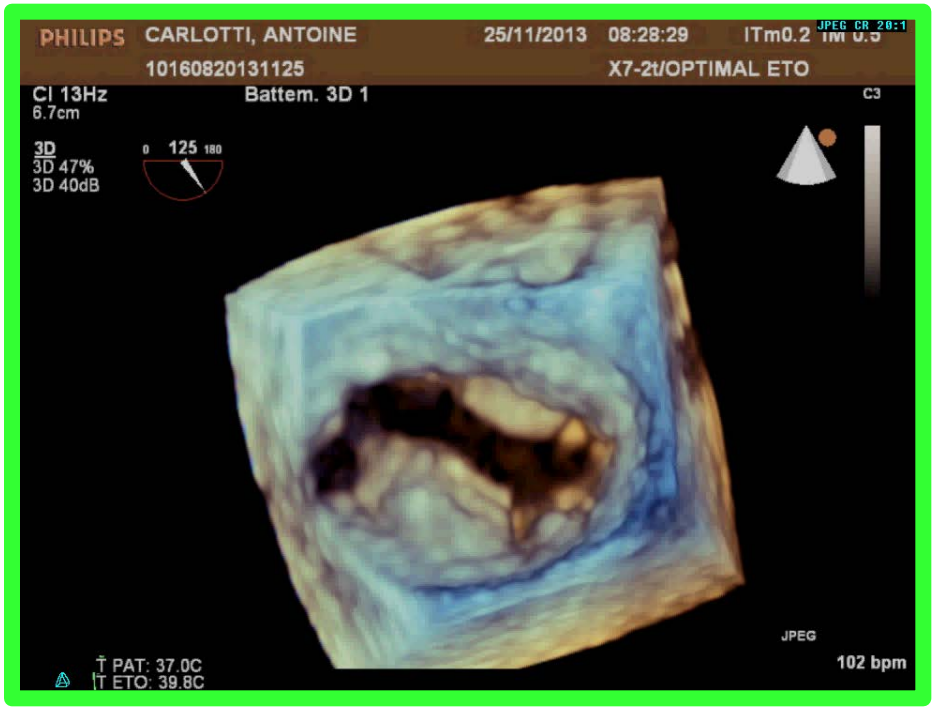
abscess



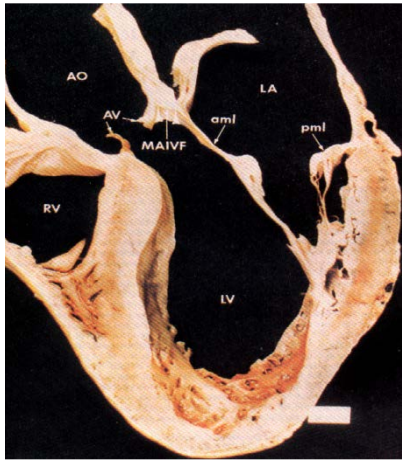
new dehiscence of prosthetic valve

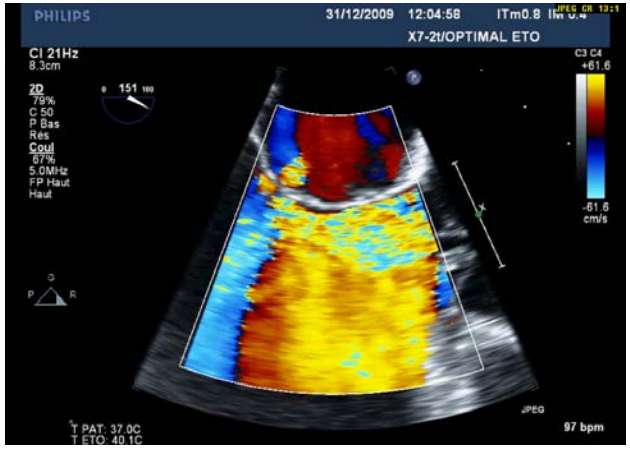
3D echocardiography

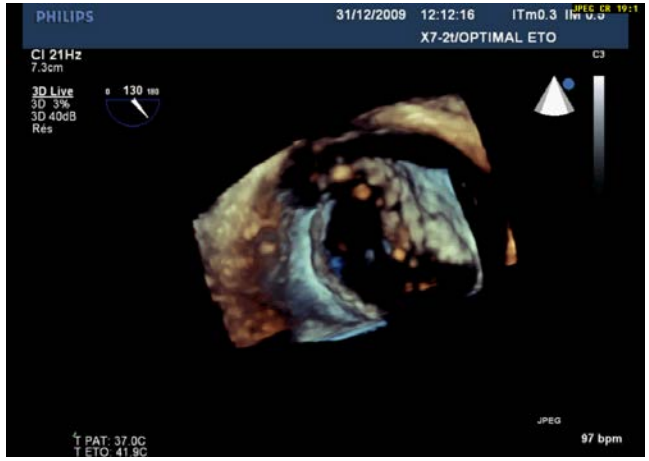




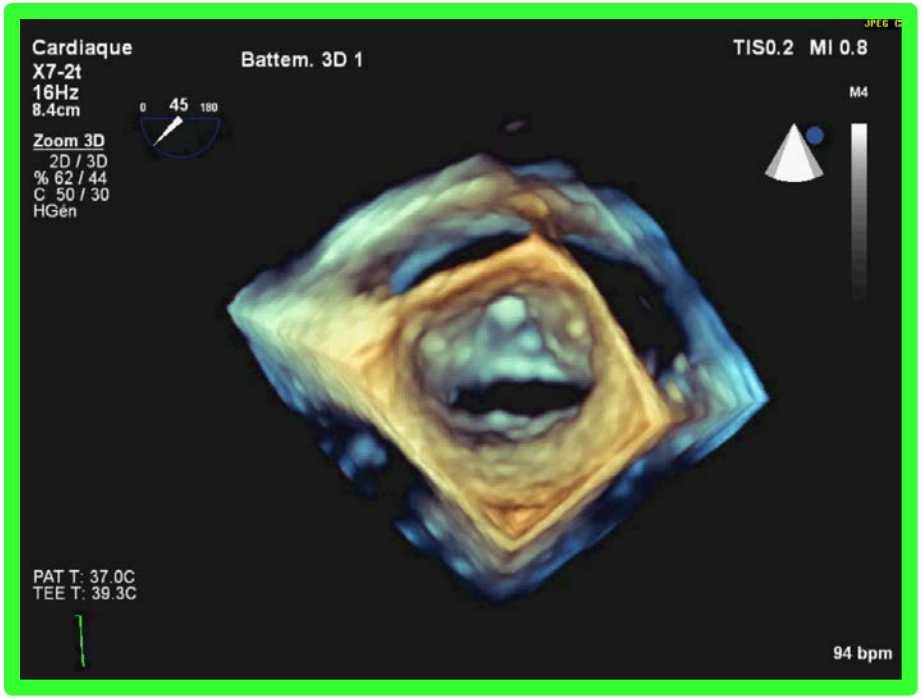
Aortic IE - Mitral perforation



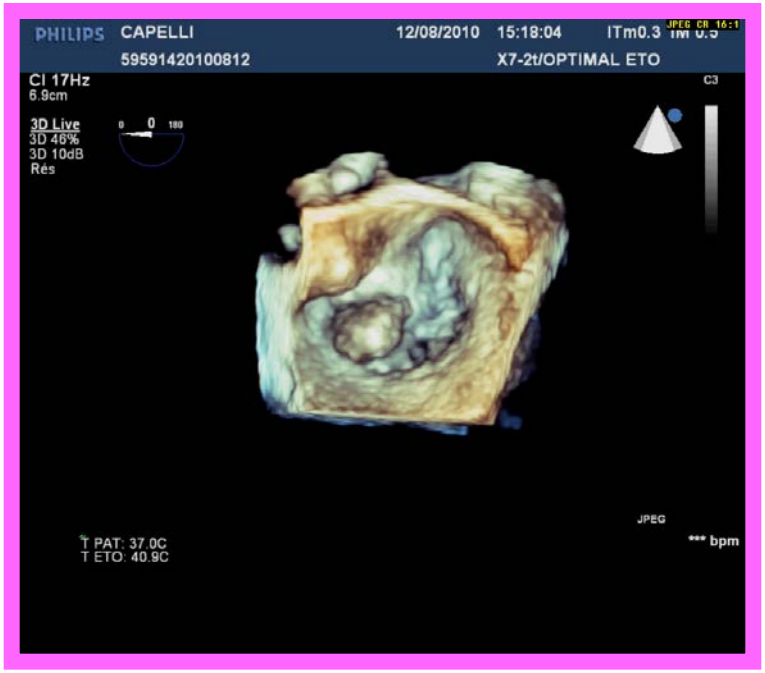




3D TEE – mitral endocarditis



Mitral perforation

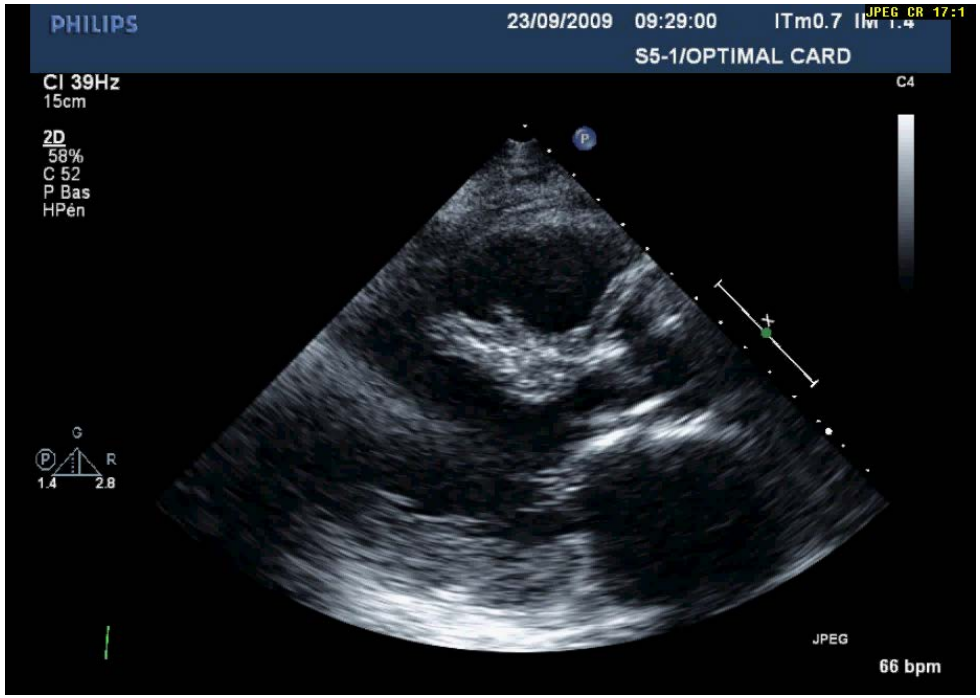


Mitral abscess

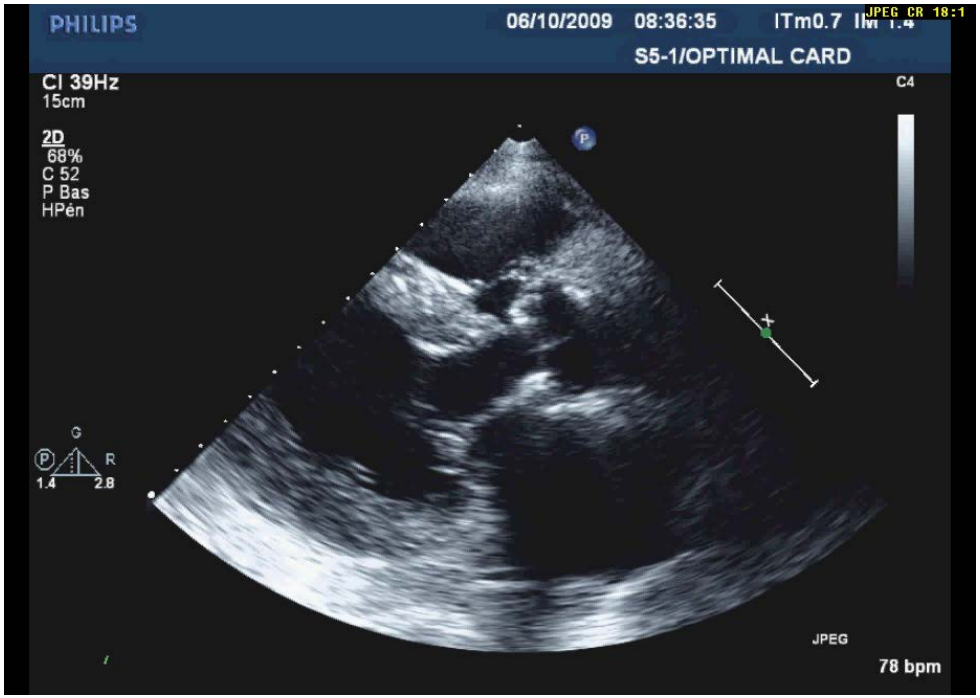
Echo is not 100% sensitive

1. very small (< 2 mm) vegetation
2. non vegetant endocarditis
3. prosthetic and pacemaker endocarditis
4. mitral valve prolapse with thickened valves
5. vegetation not yet present or already embolized

Aortic bioprosthetic abscess



September 23, 2009



October 6, 2009

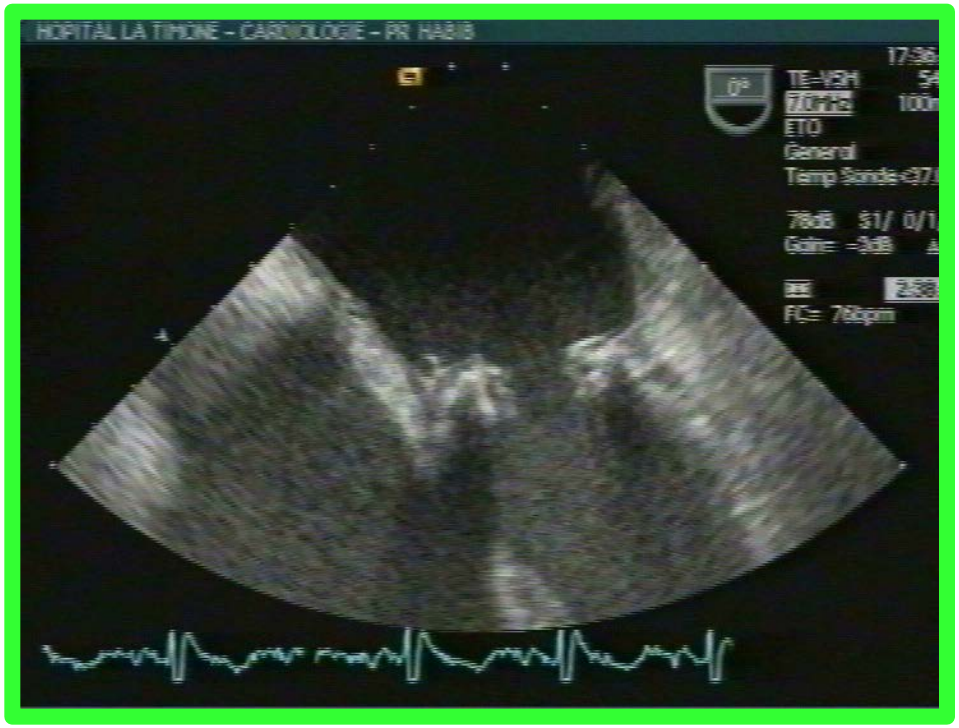
Role of echocardiography in IE (1)

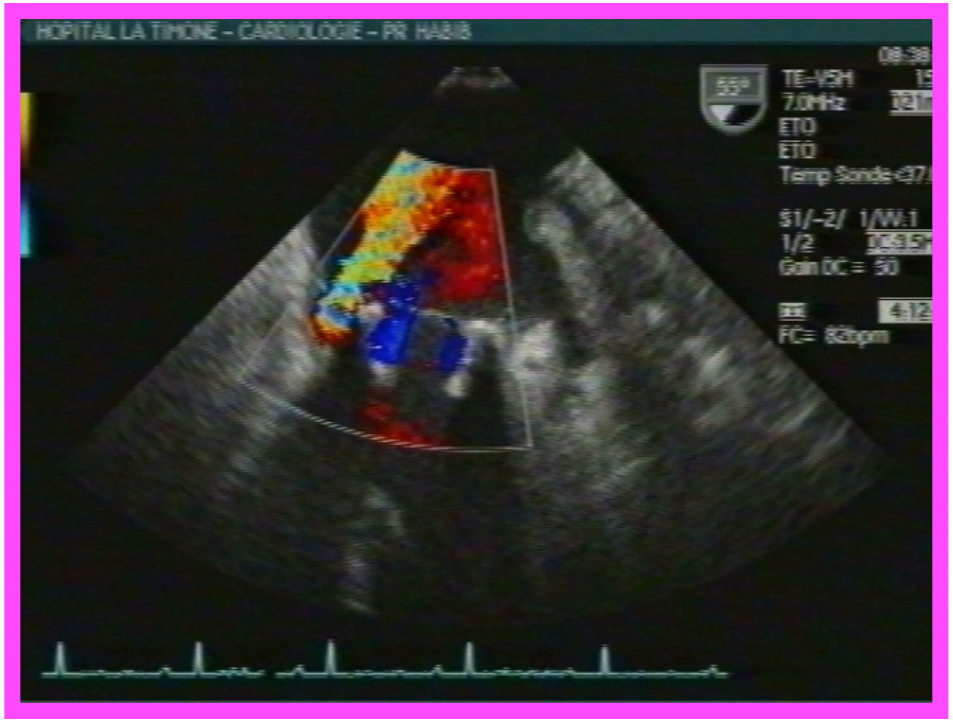
A. Diagnosis

Recommendations	Class	Level
1. TTE is recommended as the first-line imaging in suspected IE.	I	B
2. TEE is recommended in patients with high clinical suspicion of IE and normal TTE.	I	B
3. Repeat TTE/TEE within 7-10 days in case of negative initial examination and if clinical suspicion of IE persists.	I	B
4. TEE should be considered in most of adult patients with suspected IE, even in case of positive TTE.	IIa	C
5. TEE is not indicated in patients with a good quality negative TTE and low suspicion of IE.	III	C

European Heart Journal (2009) 30:2369–2413

First TEE may be normal





October 27th

November 13th

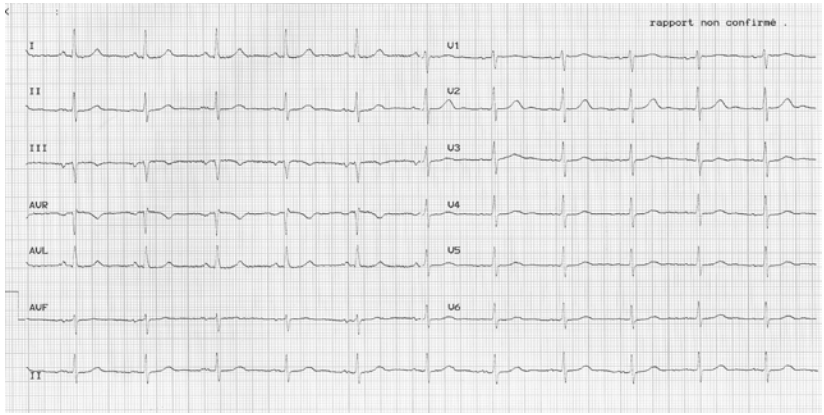
Imaging in Infective Endocarditis

1. case 1: echocardiography
2. *case 2: nuclear imaging*
3. case 3: imaging embolic risk
4. case 4: right-sided IE

Case 2: imaging

History of the disease

- 75 year-old woman,
- 2008: aortic bioprosthesis for aortic stenosis
- atrial flutter 2010
- december 2010: unexplained fever



Clinical examination

- no sign of CHF
- fever = 38° 5
- aortic systolic murmur 2/6
- arterial pressure: 140 / 70 mmHg
- normal neurological examination

Blood cultures negative

TEE

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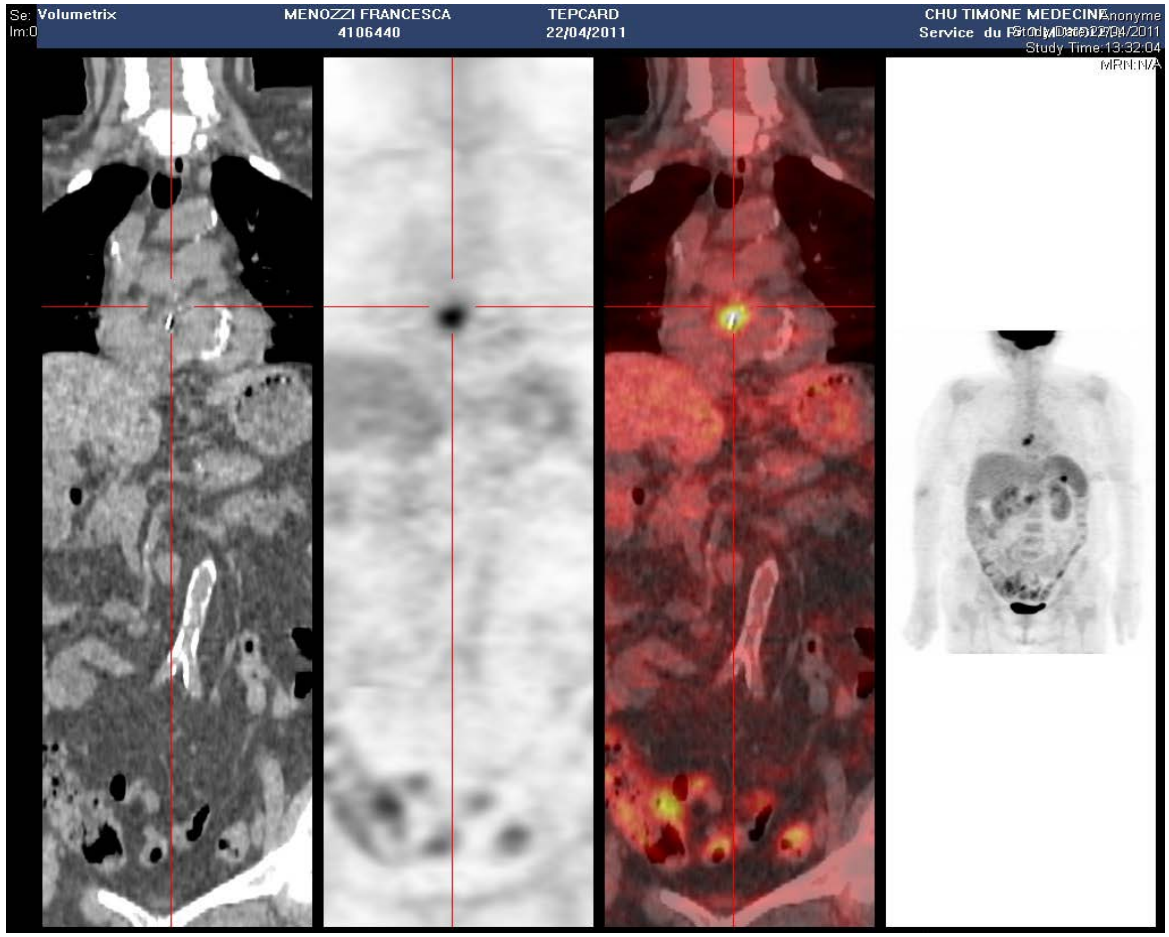
^{18}FDG-PET-CT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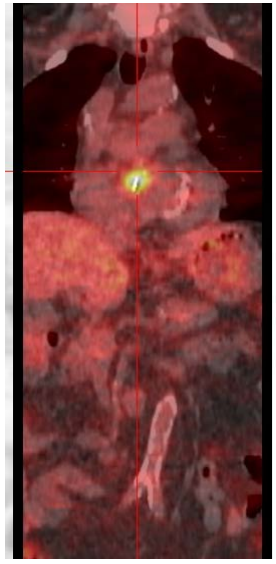

First TEE **^{18}FDG-PET-CT** **Follow-up TEE**

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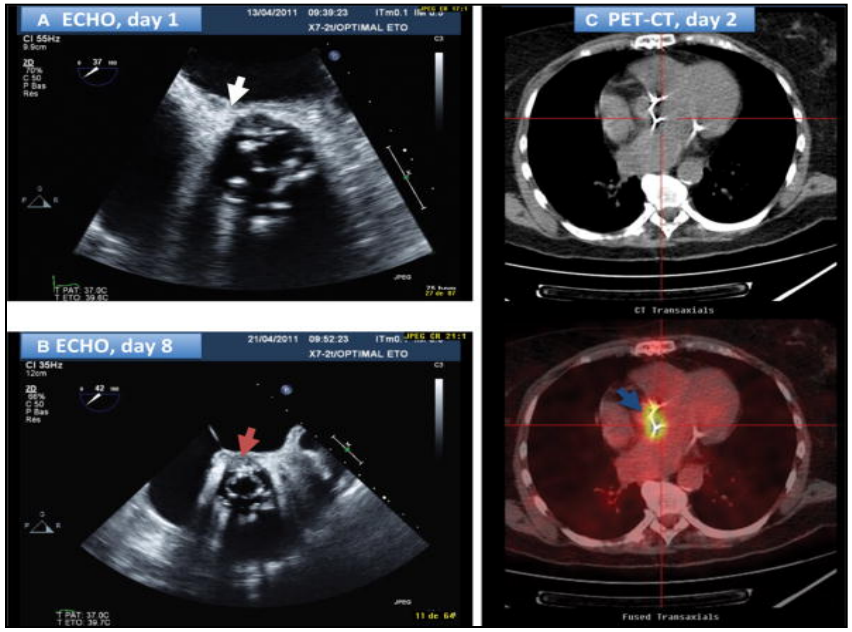
Images in Cardiovascular Medicine

Early Diagnosis of Abscess in Aortic Bioprosthetic Valve by 18F-Fluorodeoxyglucose Positron Emission Tomography-Computed Tomography

Ludivine Saby, MD; Yvan Le Dolley, MD; Olivia Laas, MD; Laetitia Tessonnier, MD; Serge Cammilleri, MD; Jean-Paul Casalta, MD; Didier Raoult, MD, PhD; Gilbert Habib, MD; Franck Thuny, MD, PhD



Results of echocardiographic studies and 18F-FDG PET-CT

The first transesophageal echocardiography (A) showed a small thickening around the aortic bioprosthetic annulus (white arrow).

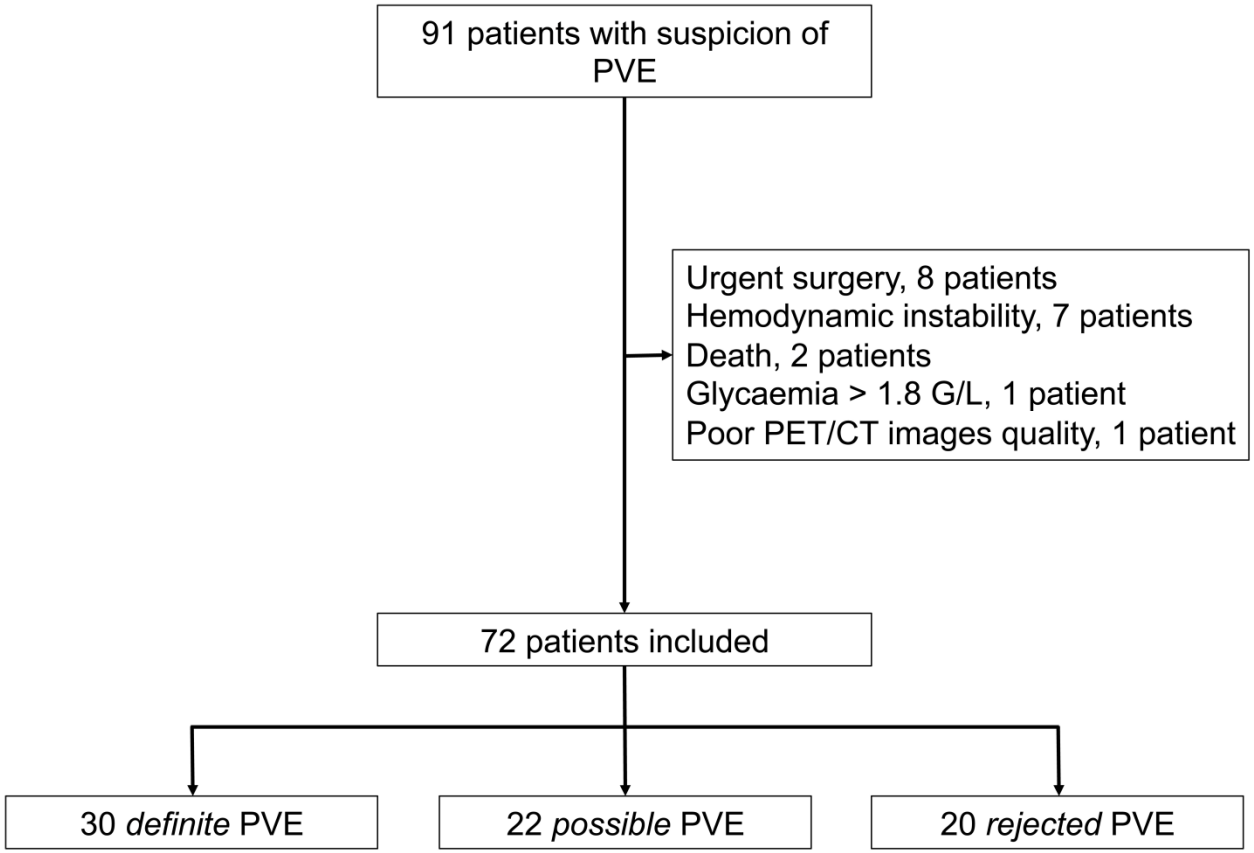
The second transesophageal echocardiography (B), performed 8 days after, showed a periprosthetic abscess (red arrow).

The 18F-FDG PET-CT performed the day after the first echocardiography showed a hyperfixation around the aortic prosthesis (C, blue arrow).

Circulation. 126(14):e217-e220, October 2, 2012.
DOI: 10.1161/CIRCULATIONAHA.112.102301

^{18}FDG-PET-CT in endocarditis

Saby L, Thuny F, Habib G - J Am Coll Cardiol. 2013; 11;61:2374-82



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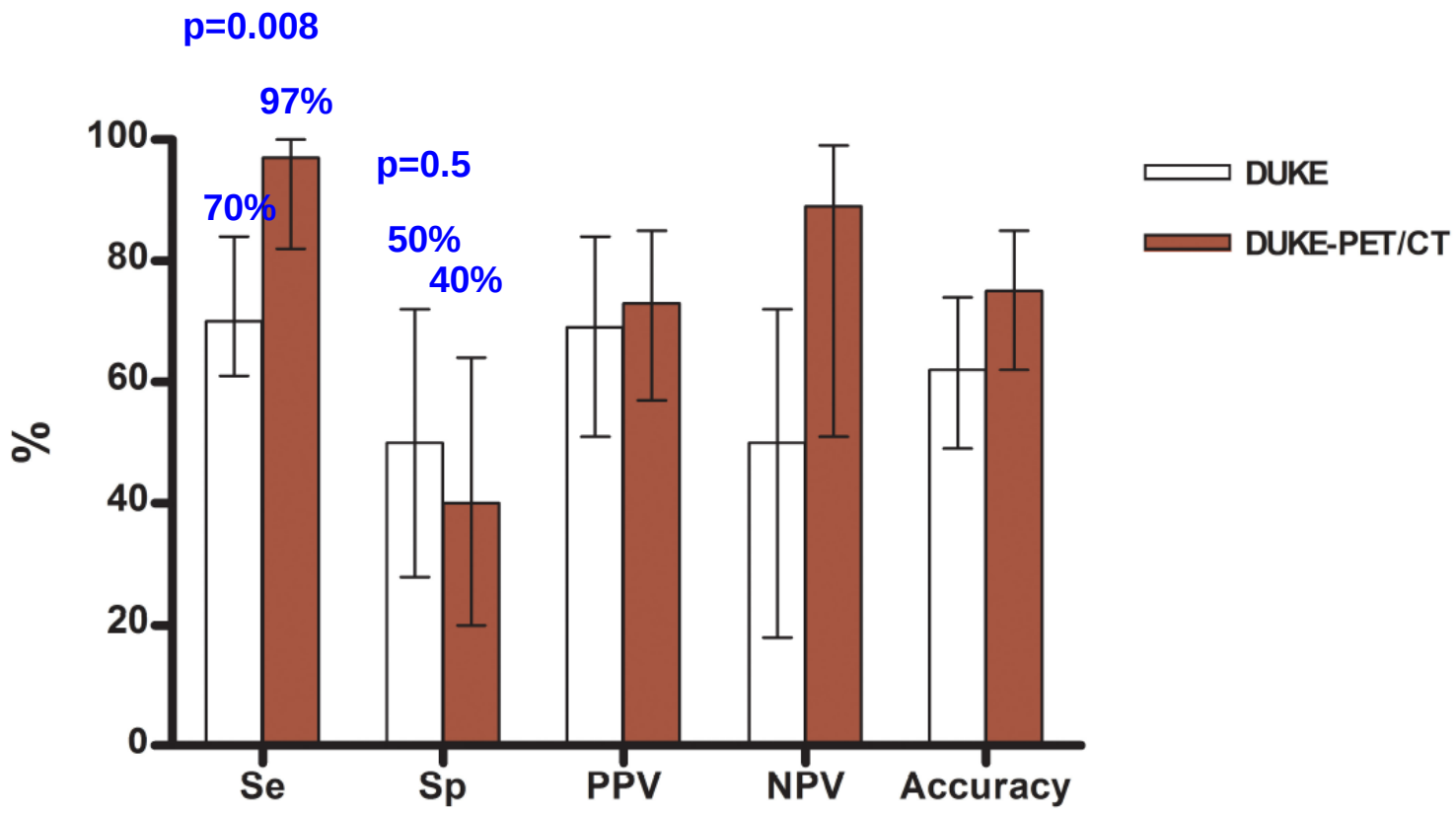

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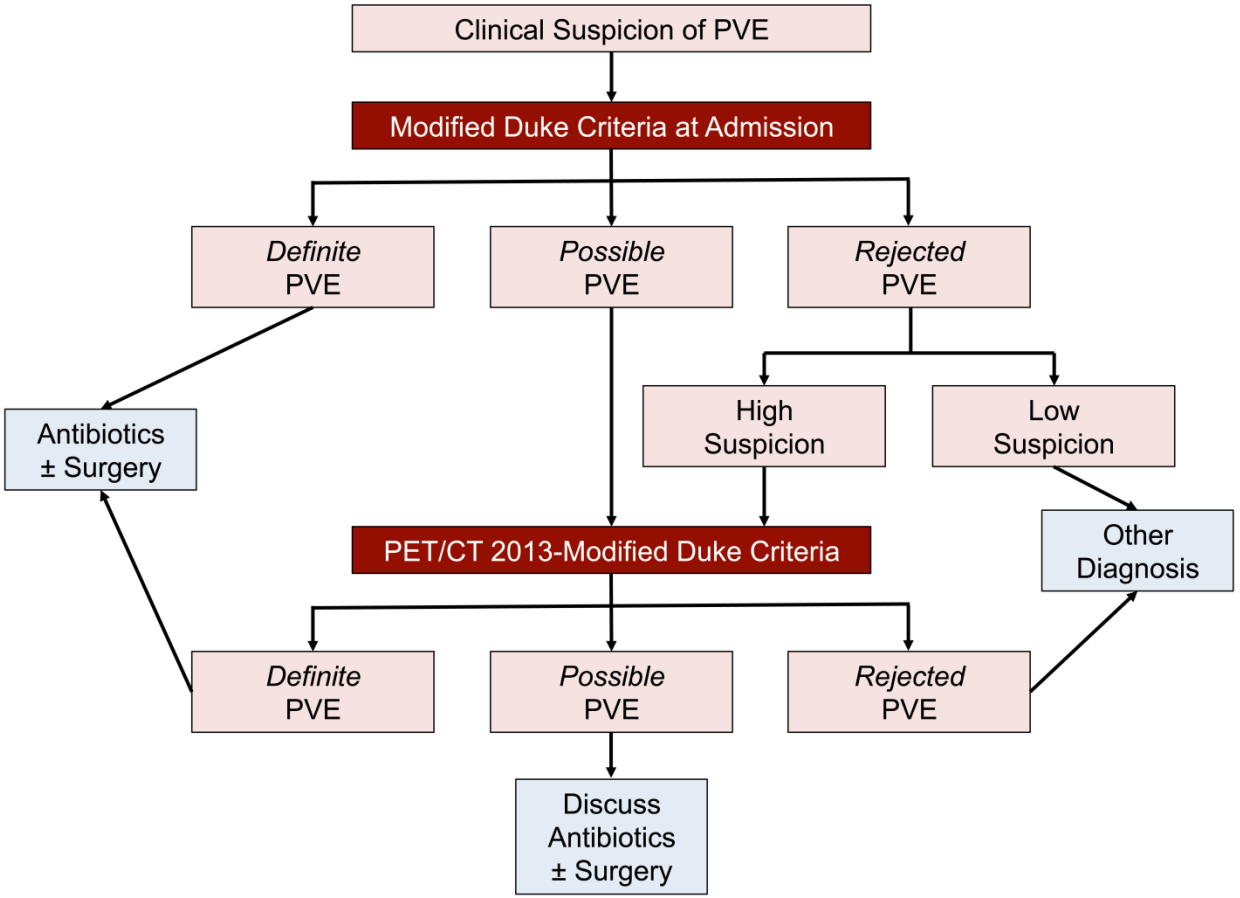

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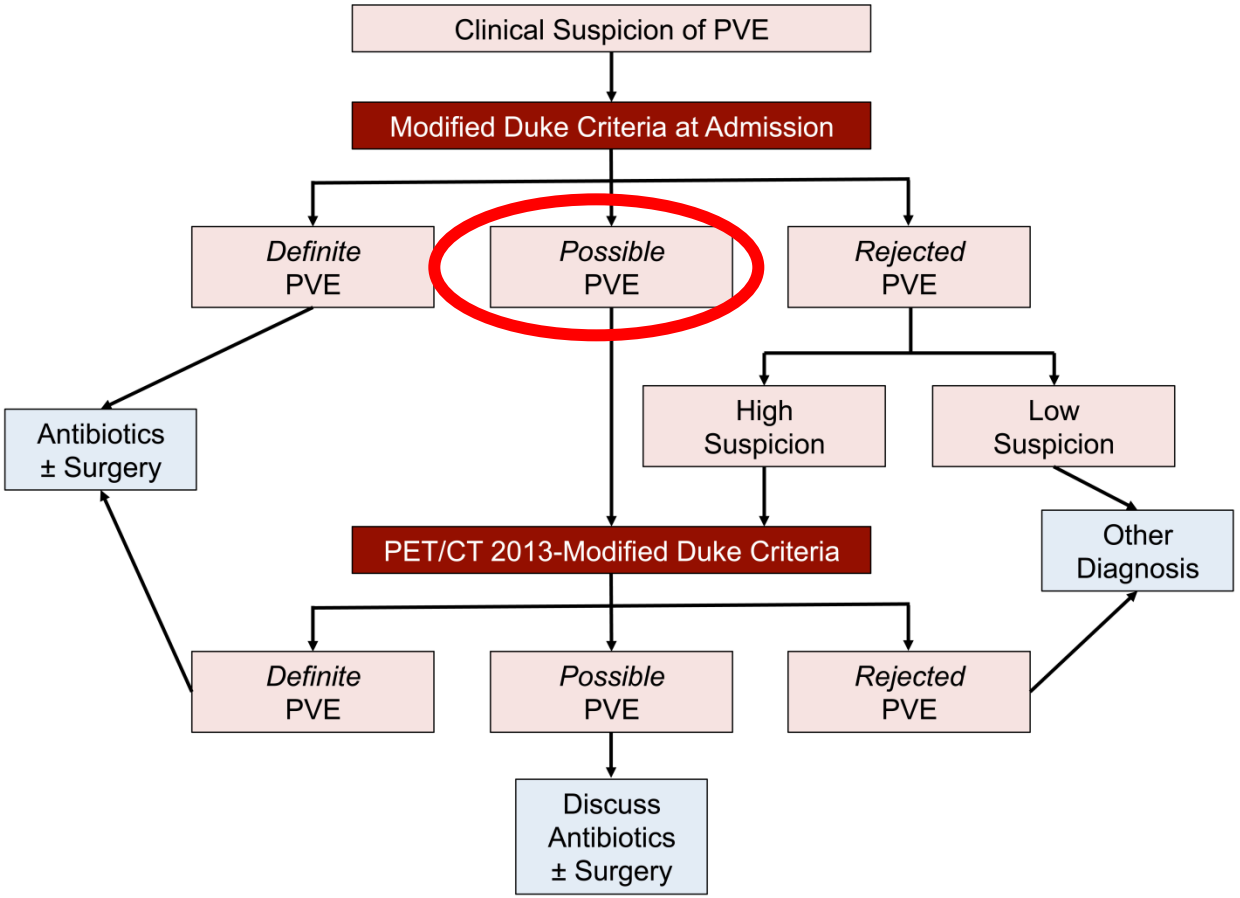

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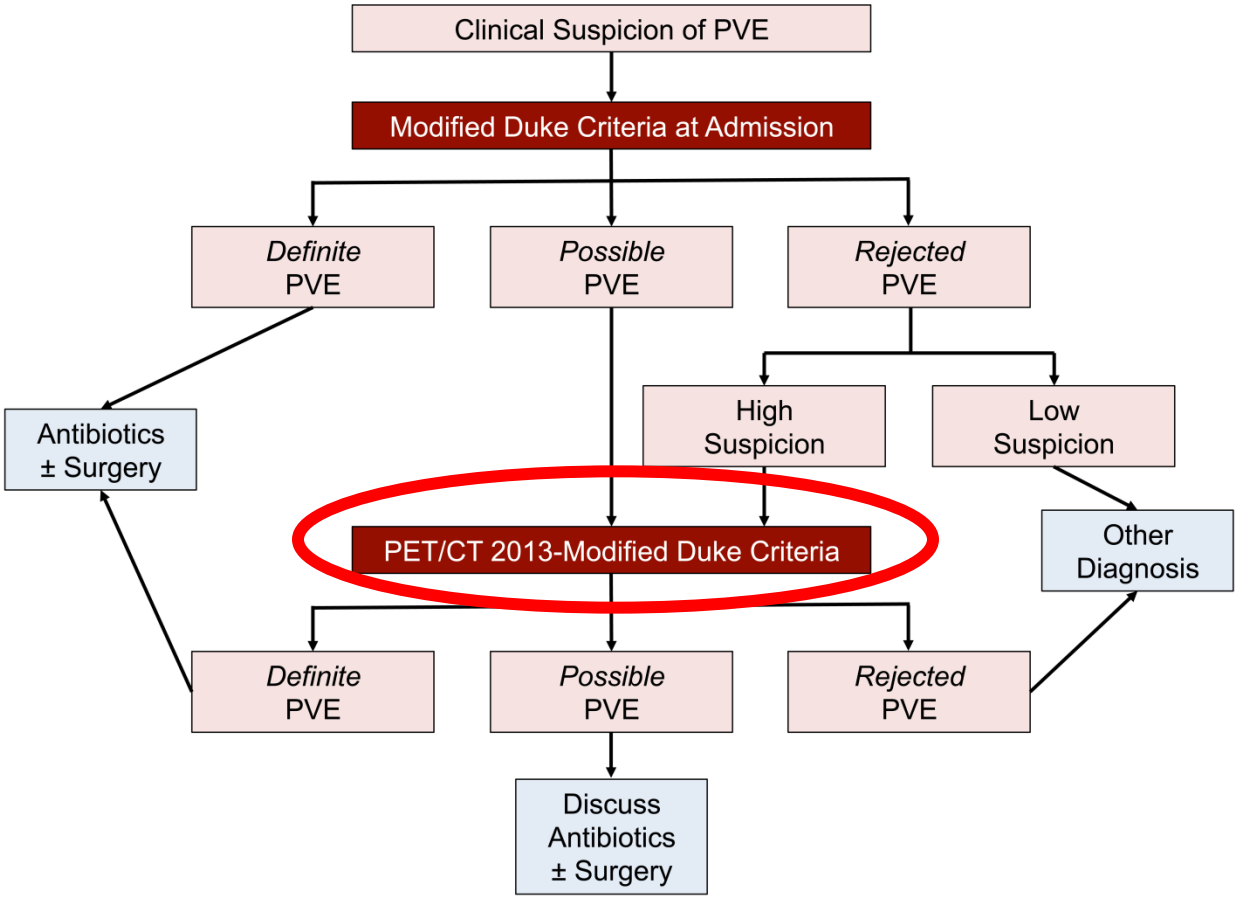

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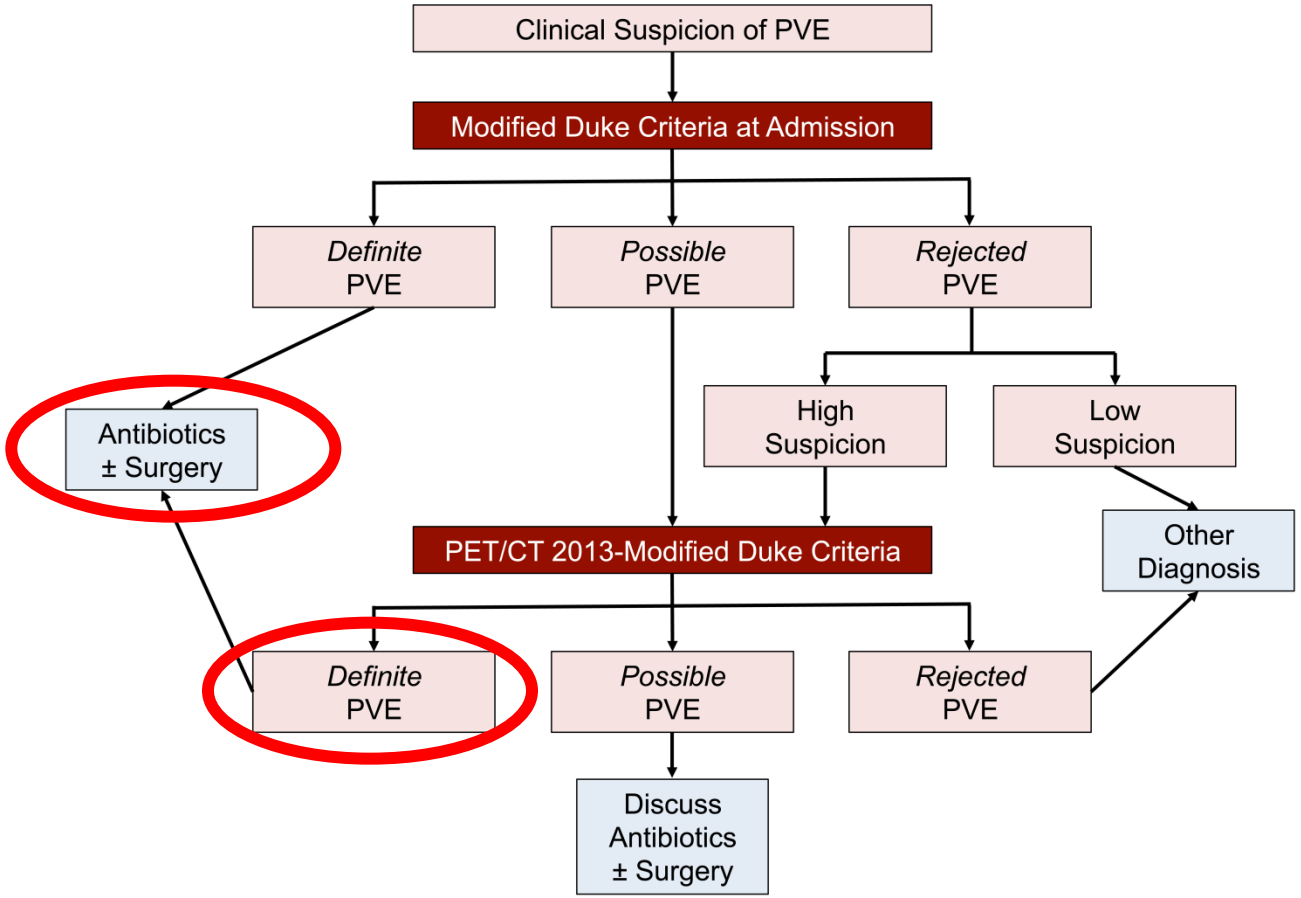
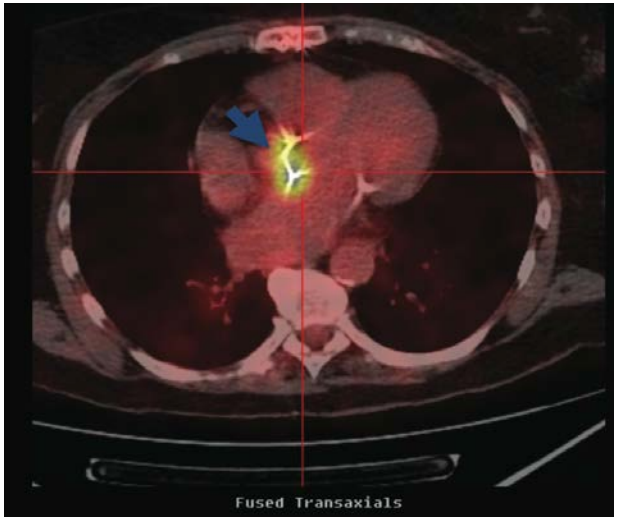


Advantages of PET – CT over echo

- **Echo provides morphological imaging without accurate information on the activity of IE = insensitive for very early diagnosis**

- **PET/CT provides a functional imaging of inflammation and has the potential to bring an earlier diagnosis of IE**

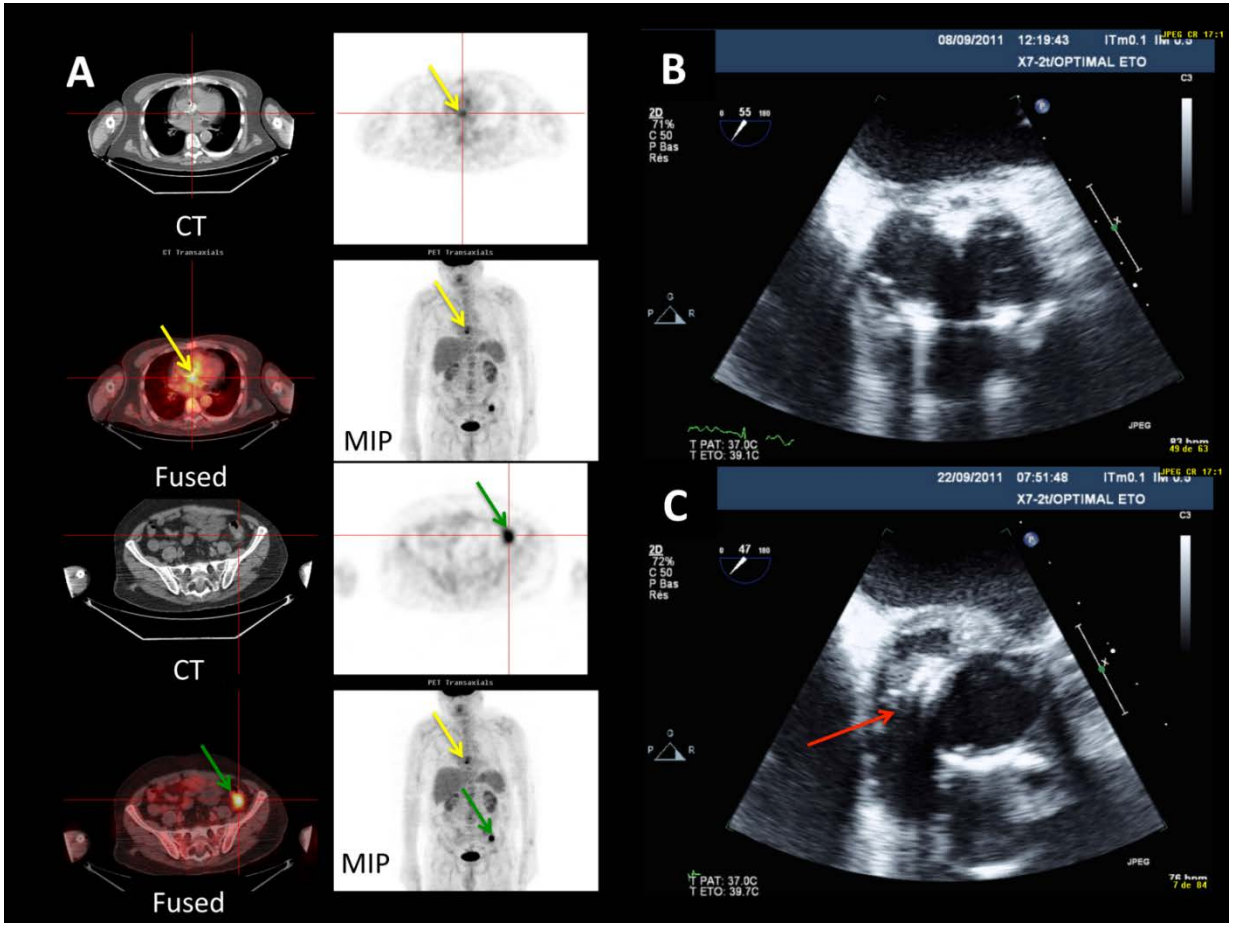


Bensimhon L, et al. Clin Microbiol Infect 2011;17:836-44
Ploux S, et al. Heart Rhythm 2011;8:1478-81
Sarrazin JF, et al. J Am Coll Cardiol 2012;59:1616-25
Saby L, et al. Circulation 2013;126:e217-220

^{18}FDG-PET-CT in endocarditis

1. **Early diagnosis of perivalvular lesions**

2. **Detection of secondary lesions**



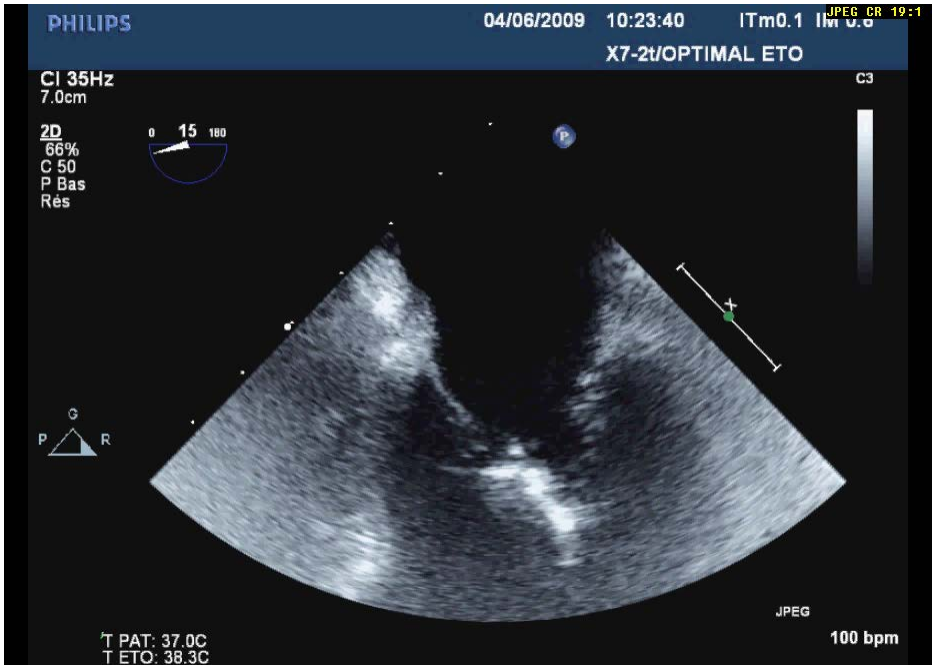
Imaging in Infective Endocarditis

1. case 1: echocardiography
2. case 2: nuclear imaging
3. *case 3: imaging embolic risk*
4. case 4: right-sided IE

Case 3: embolic risk

History of the disease

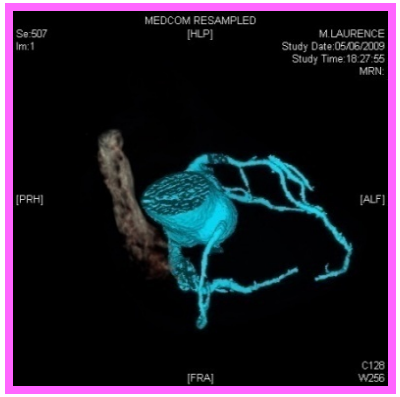
- 52 year-old woman,
- march 2009 : fever and lombalgia
- diagnosis of spondylitis
- no previous known cardiac disease

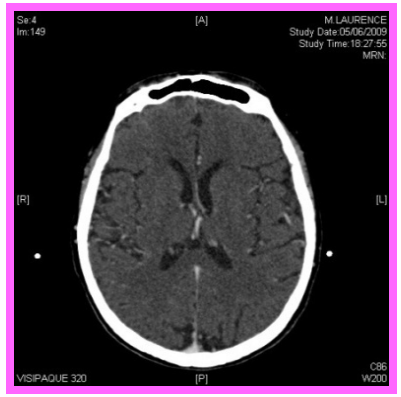


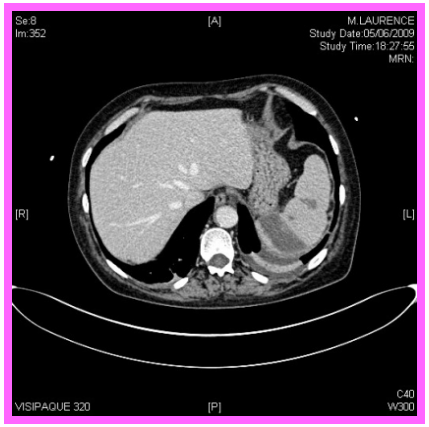
Clinical examination

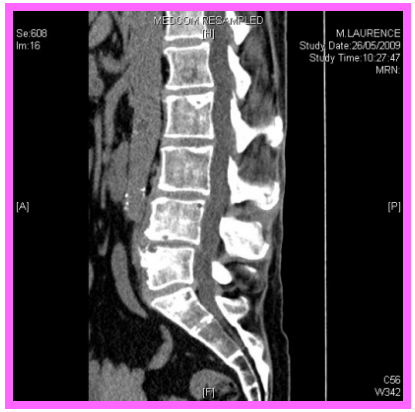
- no sign of CHF
- fever = 38°5
- mitral systolic murmur 2/6
- arterial pressure: 120 / 70 mmHg
- normal neurological examination

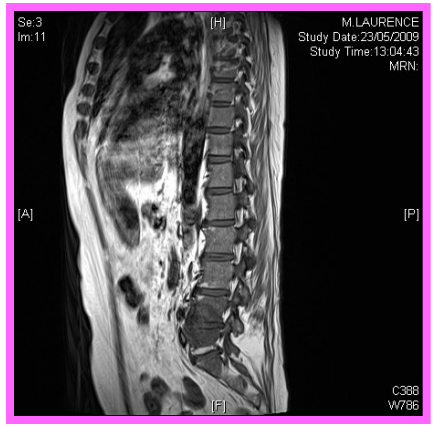
« Endocarditis CT-scan »

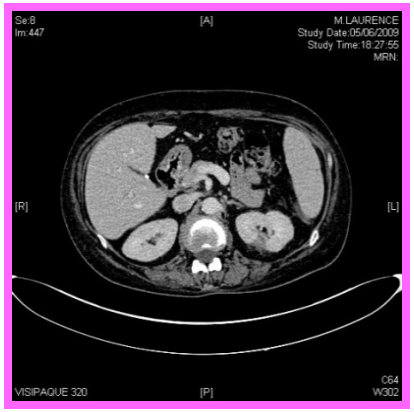










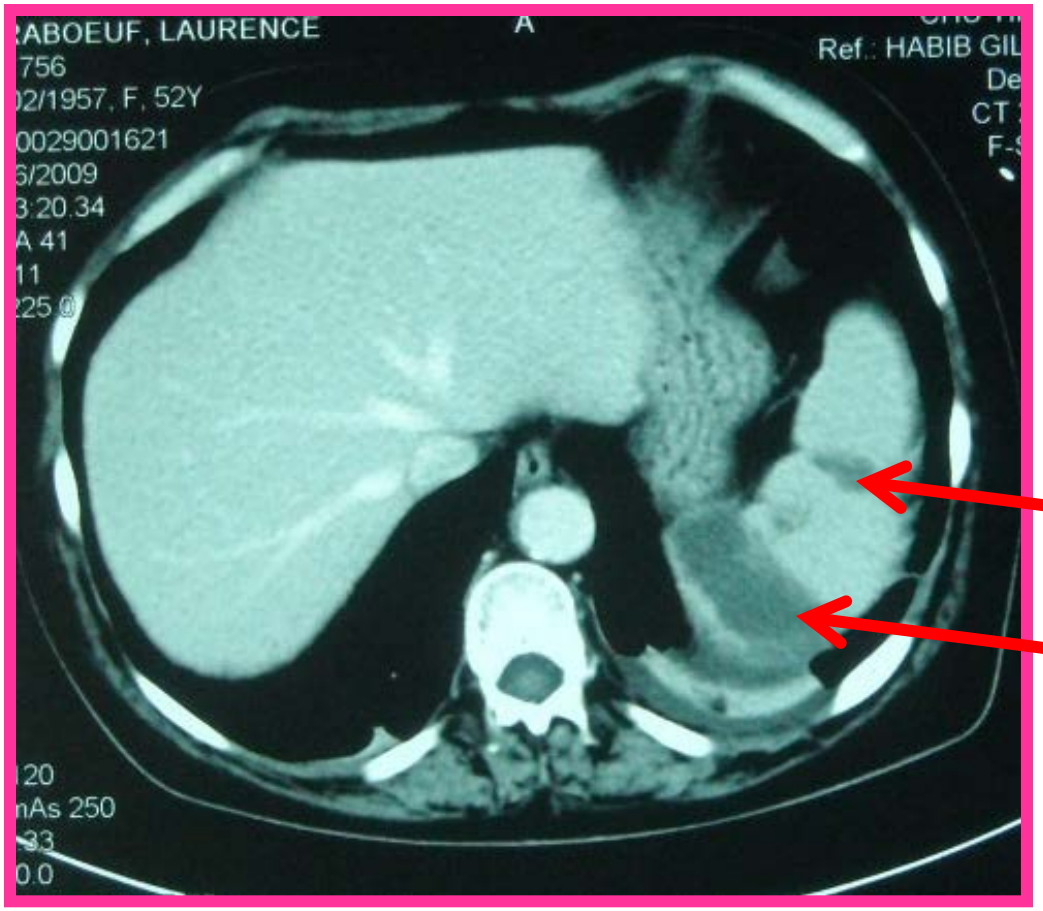


EACVI EUROPEAN ASSOCIATION OF CARDIOVASCULAR IMAGING

EUROPEAN SOCIETY OF CARDIOLOGY®

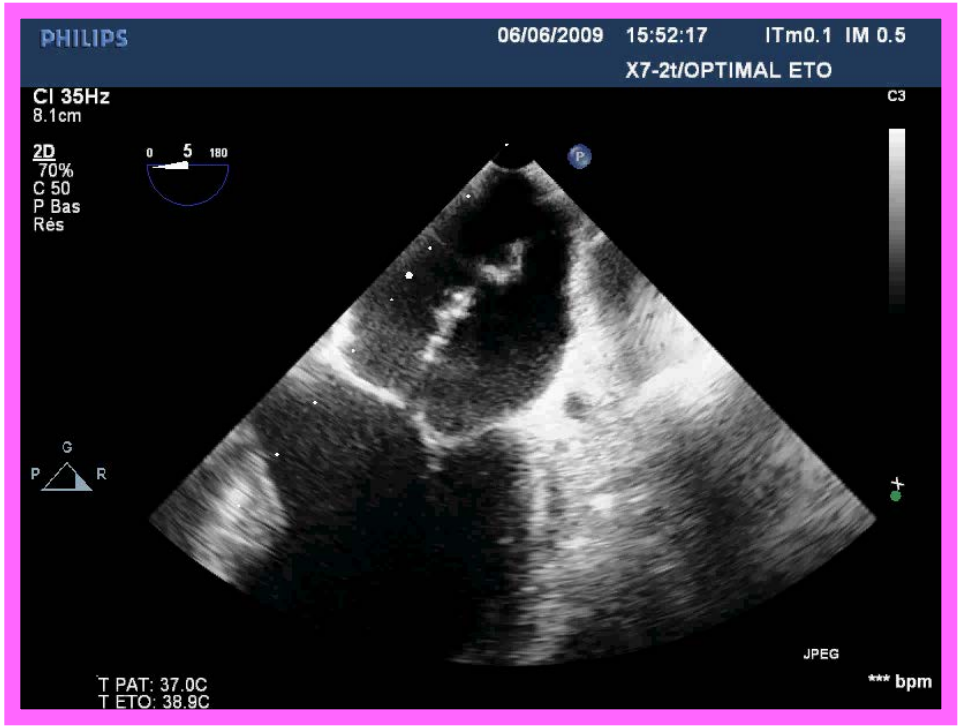
FACULTÉ DE MÉDECINE DE MARSEILLE

CT-scan imaging



Embolic events in IE

1. are frequent and severe
2. are related to the vegetation size
3. occur early in the course of IE

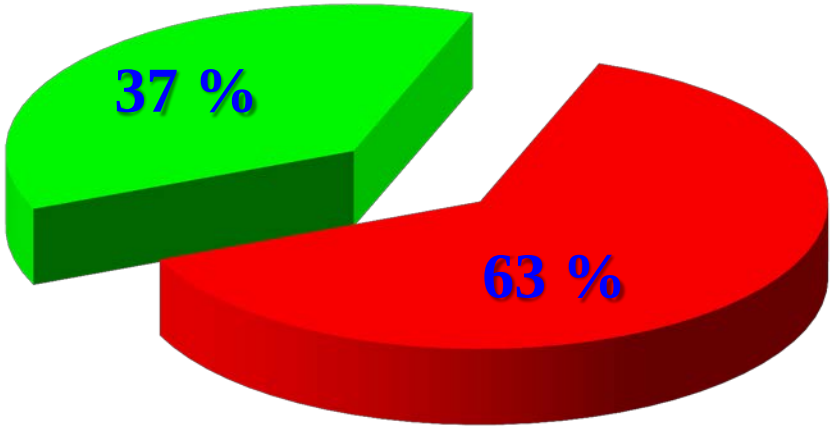


TEE and embolic risk

178 patients, definite IE

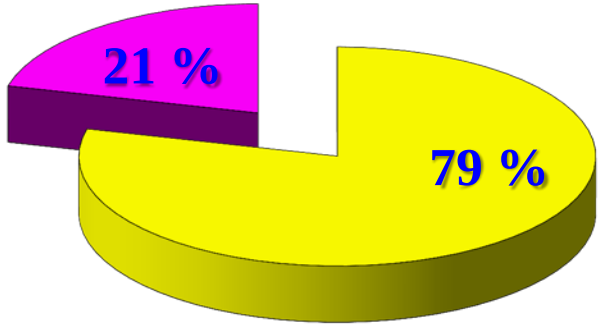
Di Salvo - JACC – 2001; 37 : 1069-76

With embolism



Without embolism

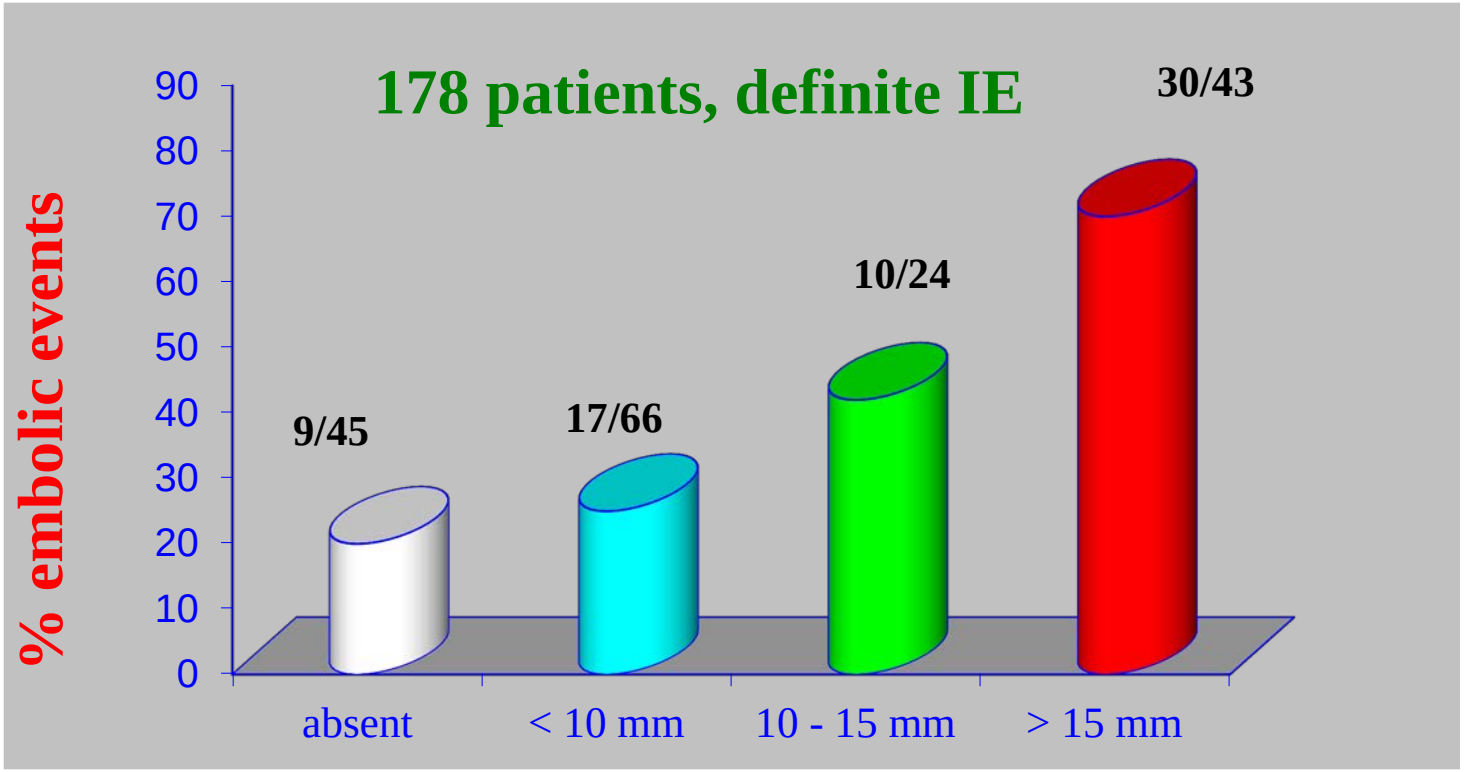
silent embolism



clinical embolism

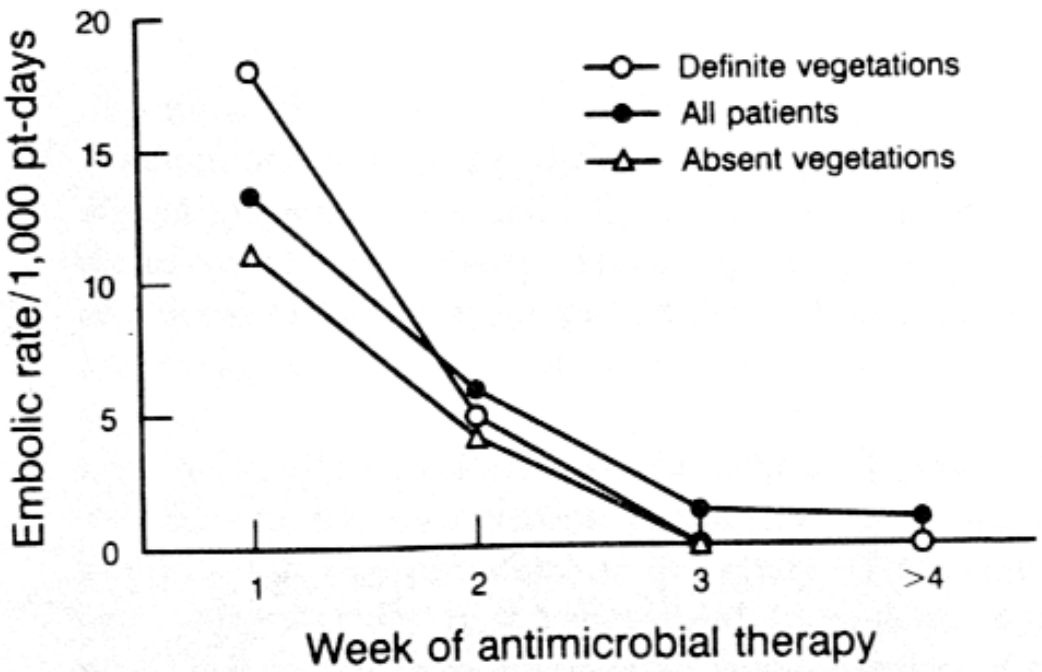
TEE and embolic risk

Di Salvo - JACC – 2001; 37 : 1069-76



Embolic risk under therapy

Steckelberg - Ann Int Med 1991

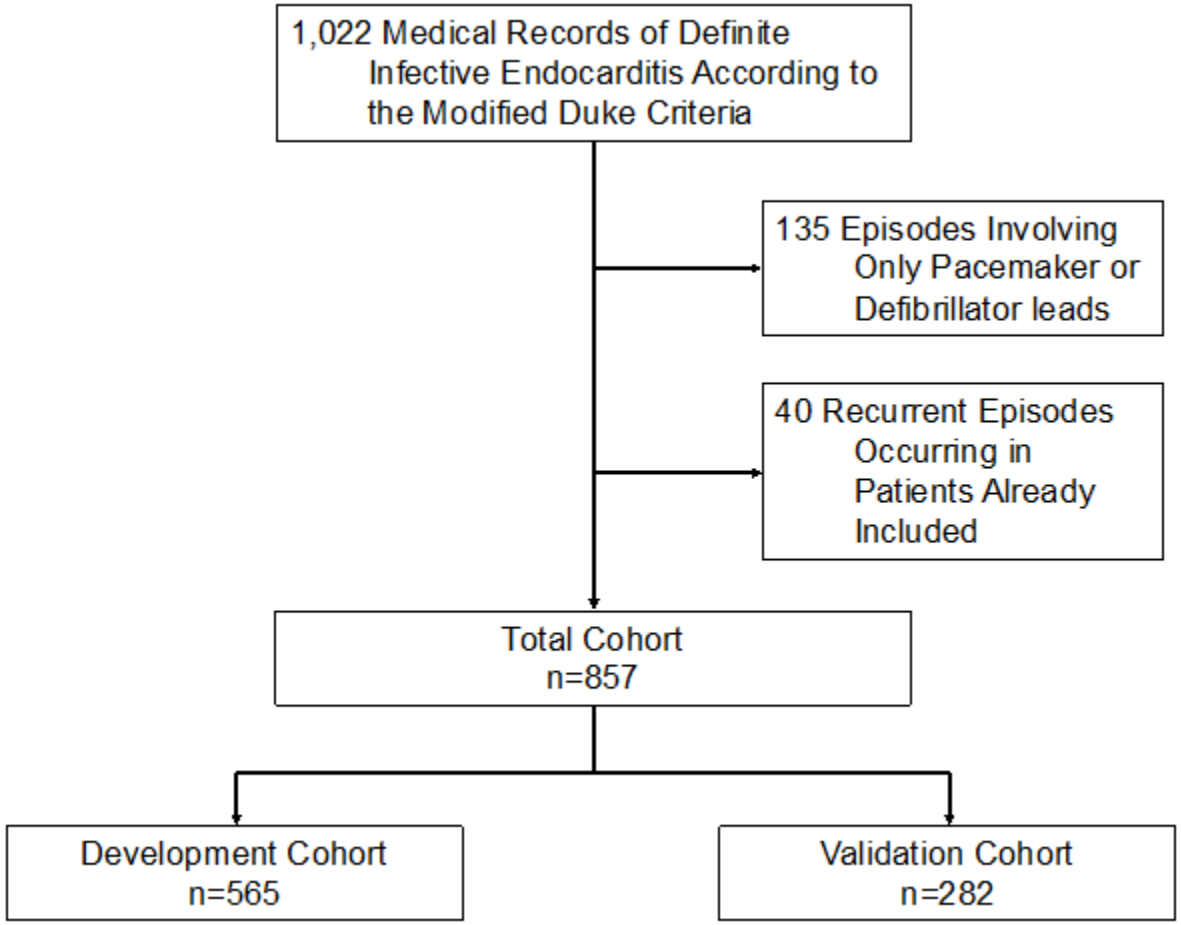


- 207 IE
- 13 % embolic events

- 13/1000 pt/d during the 1st week
- 1.2/1000 pt/d after the 2nd week

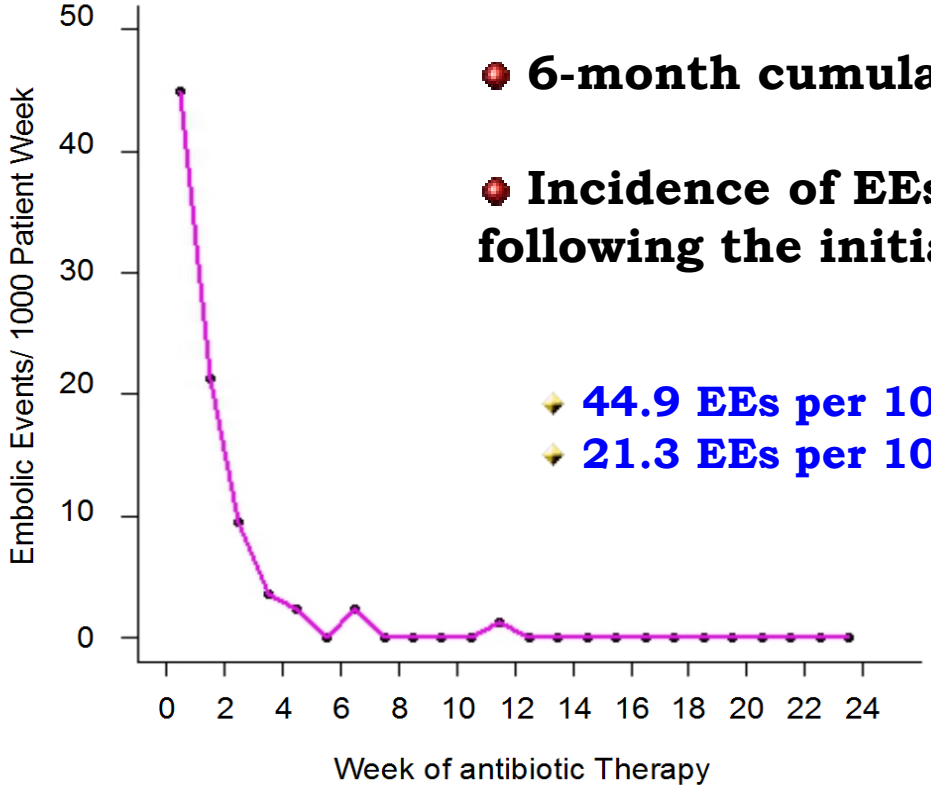
Embolic risk under therapy

Hubert S- J Am Coll Cardiol 2013;62:1384–92



Embolic risk under therapy

Hubert S- J Am Coll Cardiol 2013;62:1384–92



- **6-month cumulative incidence of new EEs: 8.5%**
- **Incidence of EEs highest during the first two weeks following the initiation of antibiotic therapy**
  - **44.9 EEs per 1000 patient-weeks the first week**
  - **21.3 EEs per 1000 patient-weeks the second week**

Can we predict the embolic risk ?

Hubert S- J Am Coll Cardiol 2013;62:1384–92

	Univariate Analysis *P* Value	*Multivariate Analysis* Hazard Ratio 95% CI
Age	0.15	1.01 (0.99–1.03)
Diabetes	0.05	1.29 (0.60–2.77)
Previous EE	0.04	1.39 (0.73–2.64)
Atrial fibrillation	0.07	1.66 (0.81–3.39)
Mitral localization	0.18	1.09 (0.59–2.01)
Vegetation*		
≤10 mm	0.35	1.27 (0.24–6.73)
> 10 mm	0.02	4.50 (1.06–19.07)
Oral streptococci	0.20	0.64 (0.25–1.63)
Staphylococcus aureus	0.07	1.64 (0.77–3.50)

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Hubert S- J Am Coll Cardiol 2013;62:1384–92

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Can we *calculate* the embolic risk ?

Hubert S- J Am Coll Cardiol 2013;62:1384–92

The embolic risk calculator

PREDICTED EMBOLIC RISK CALCULATION	
Time (Days)	Predicted Embolic Risk
1	4%
2	6%
3	9%
4	12%
5	13%
6	14%
7	14%
10	16%
11	17%
12	18%
13	21%
14	22%
18	22%
19	23%
23	24%
28	25%
35	25%
47	26%
48	26%
180	27%

PREDICTED EMBOLIC RISK CALCULATION	
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23	24%
28	25%
35	25%
47	26%
48	26%
180	27%

Embolic risk under therapy

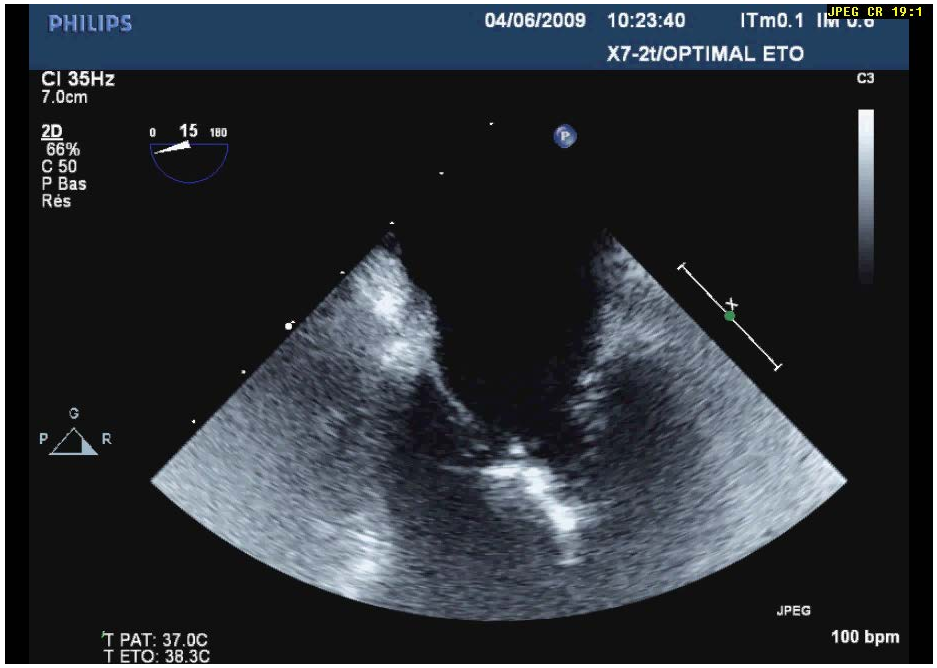
The risk of new embolism

1. Is very high in IE (1/3 patients overall)
2. Dramatically decreases after initiation of ATB
3. Is still high during the first 2 weeks of ATB
4. Is related to the size and mobility of the vegetation
5. Needs an early (surgical) decision by a multidisciplinary team

Decision: urgent surgery

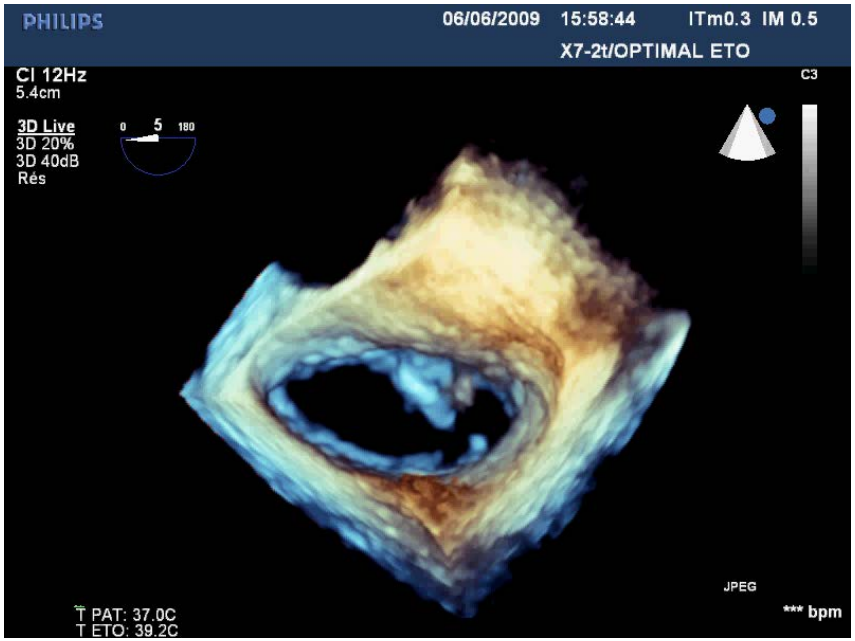
ATB (amoxicillin 12g IV / day + gentamycin 3 mg/kg/day)

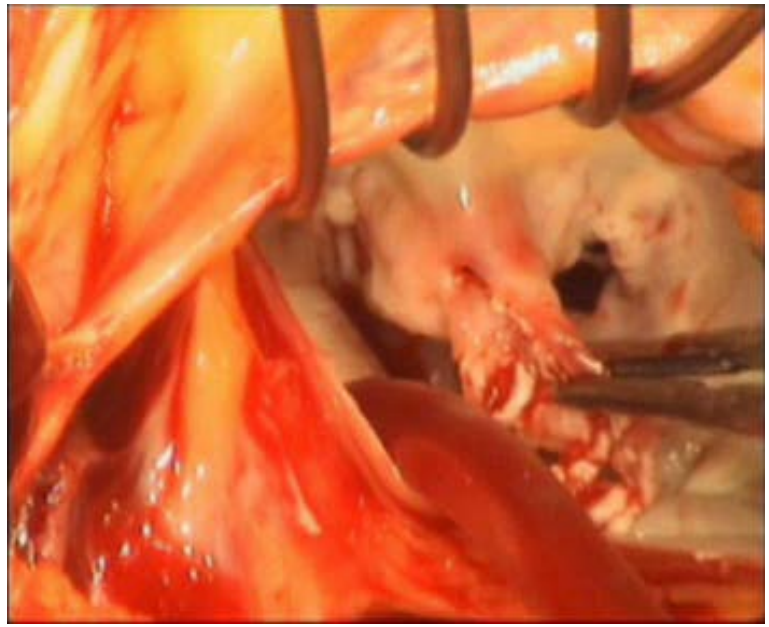
- previous embolism
- high embolic risk
- high probability of valve repair



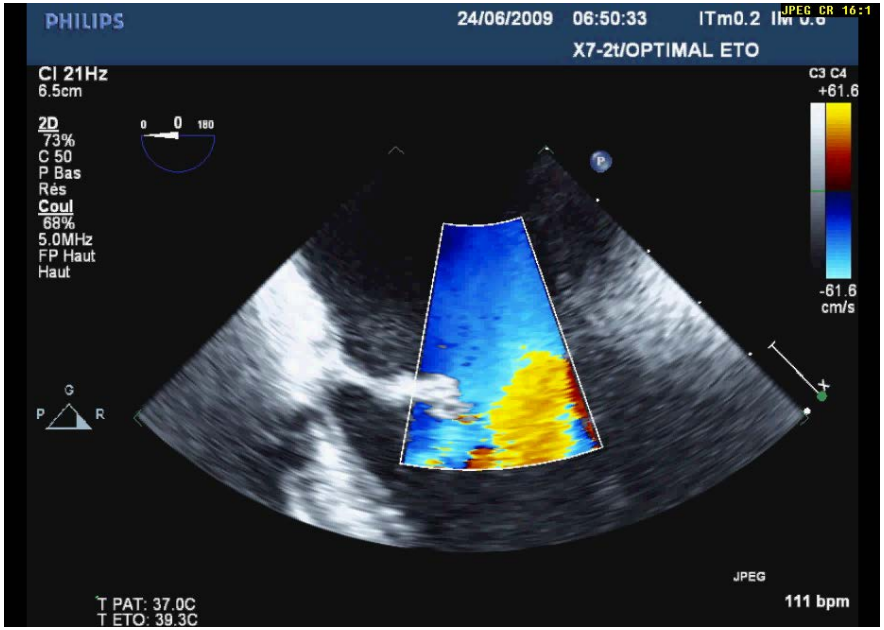
Urgent surgery planned

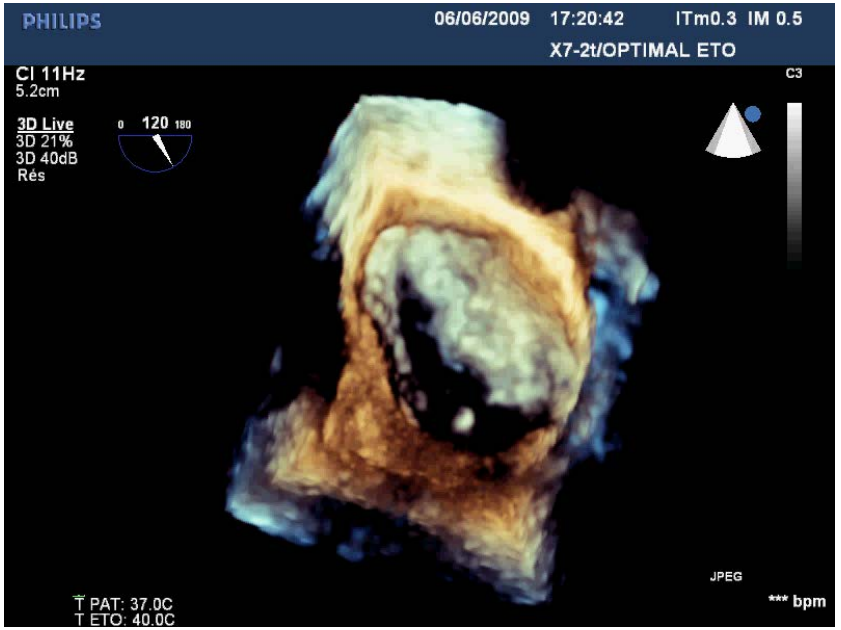
Peroperative TEE





Postoperative TEE

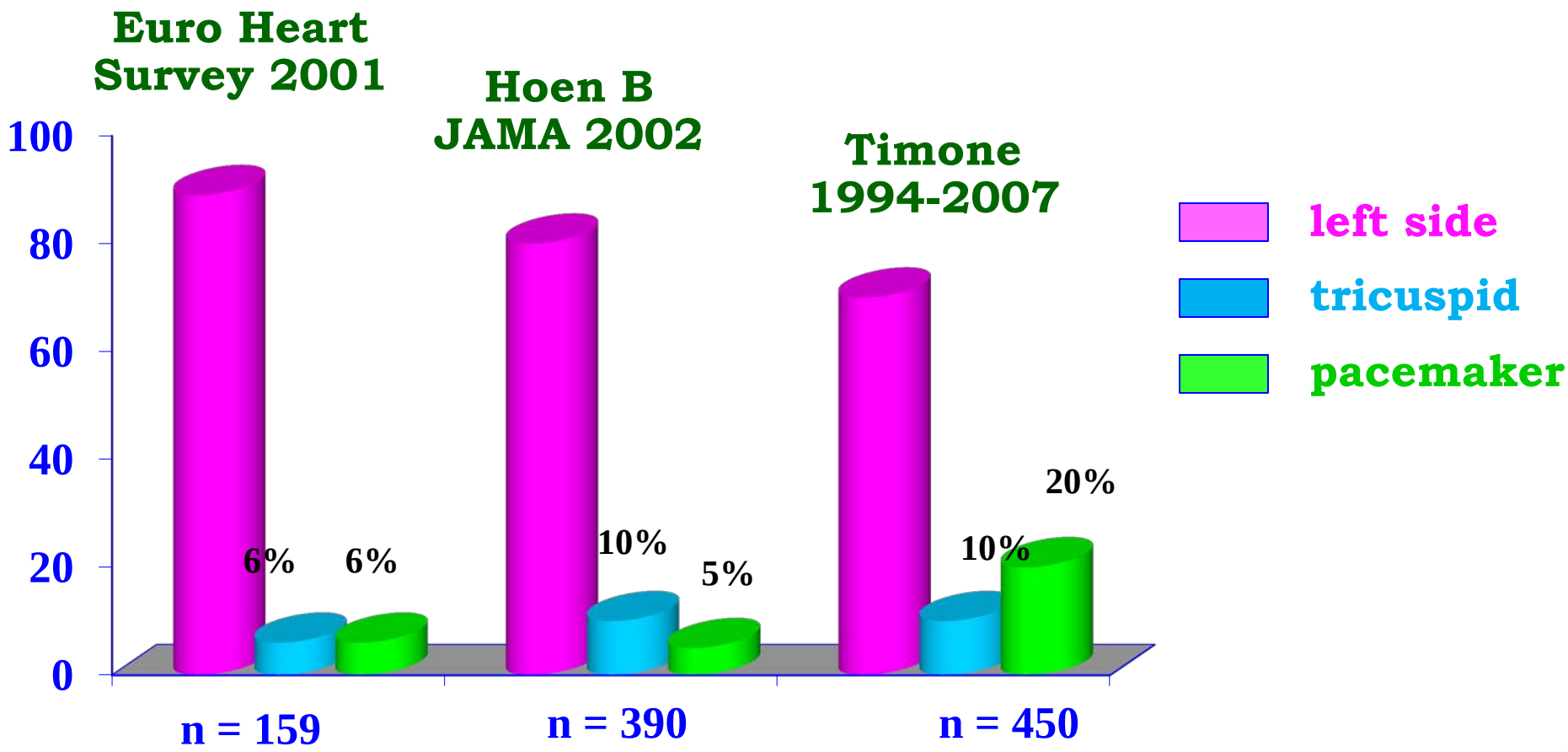




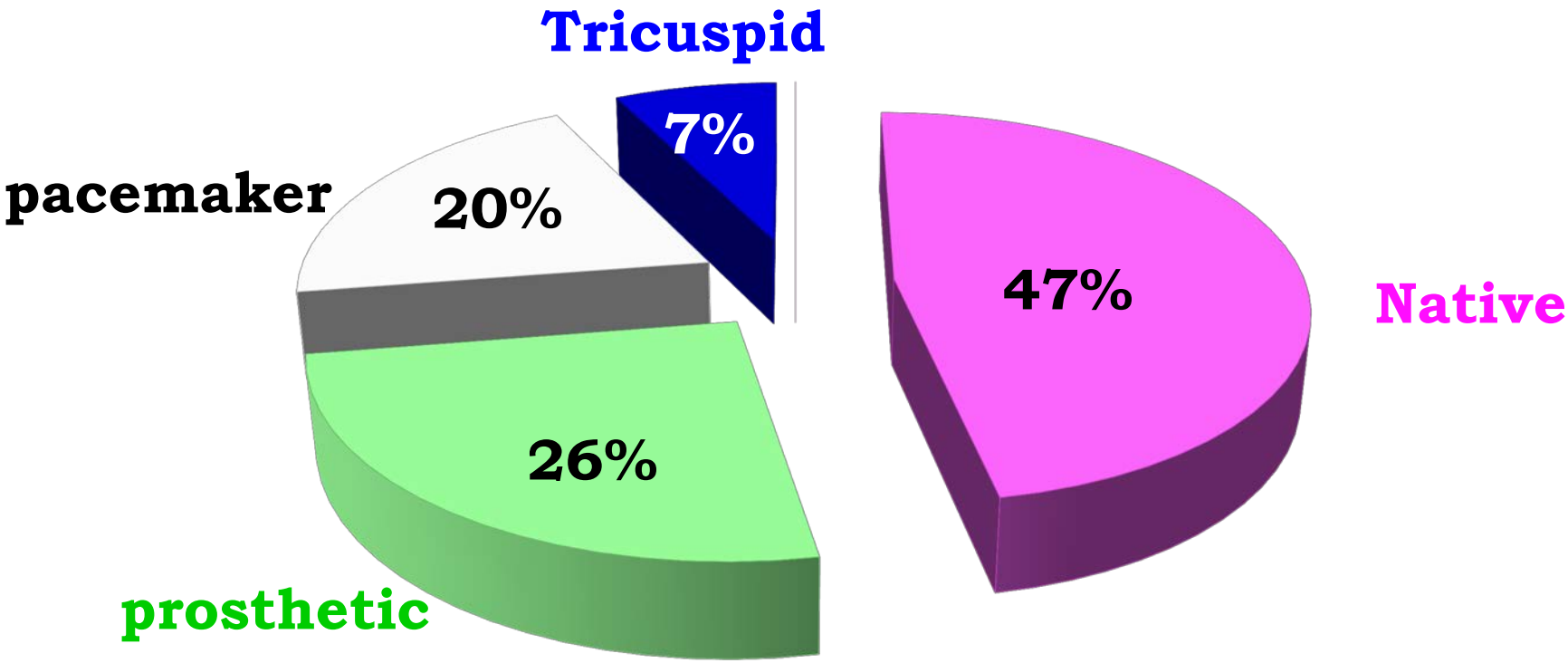
Imaging in Infective Endocarditis

1. case 1: echocardiography
2. case 2: nuclear imaging
3. case 3: imaging embolic risk
4. *case 4: right-sided IE*

Incidence of infective endocarditis



1020 endocarditis Marseille 2000-2014

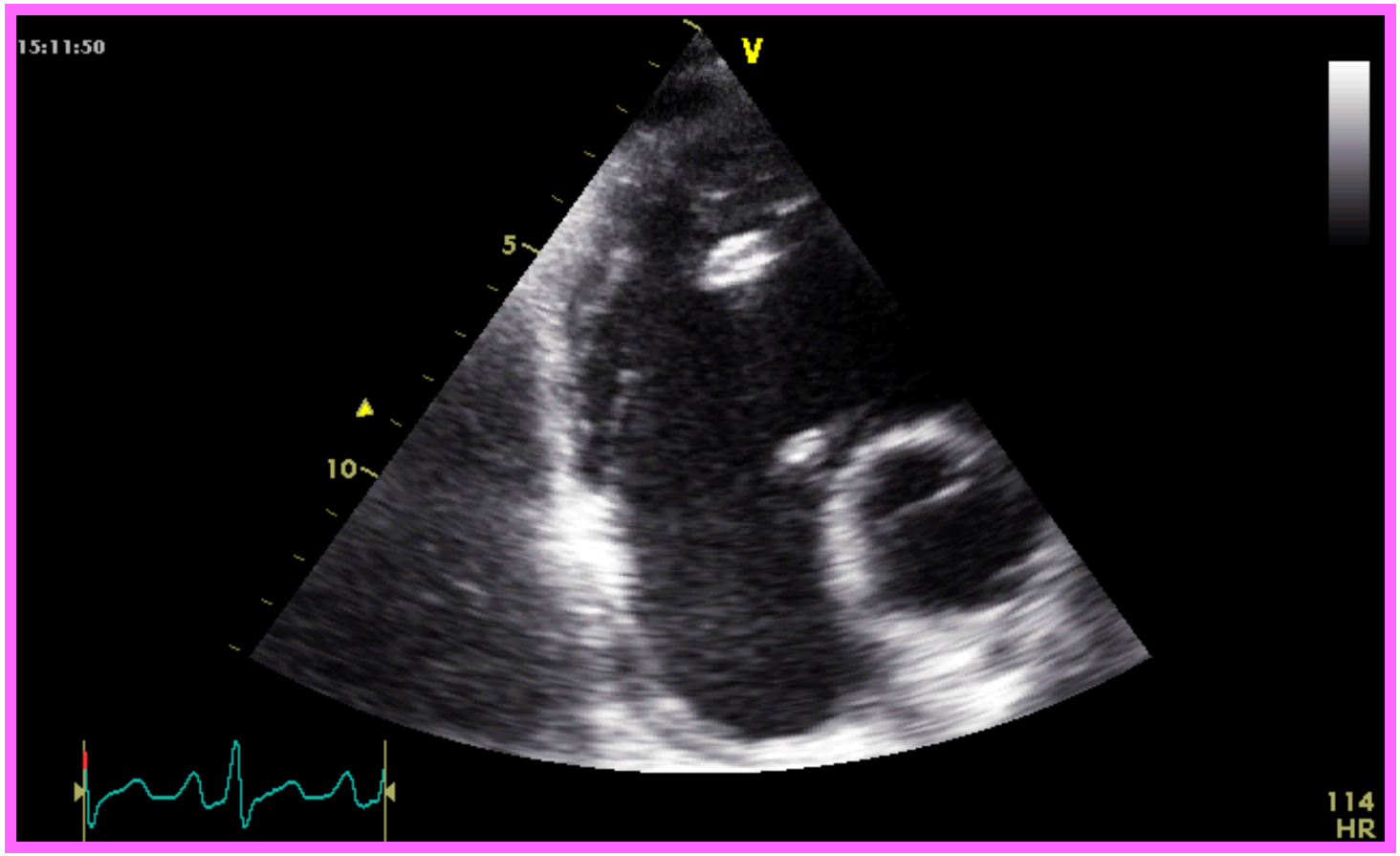


Right heart endocarditis

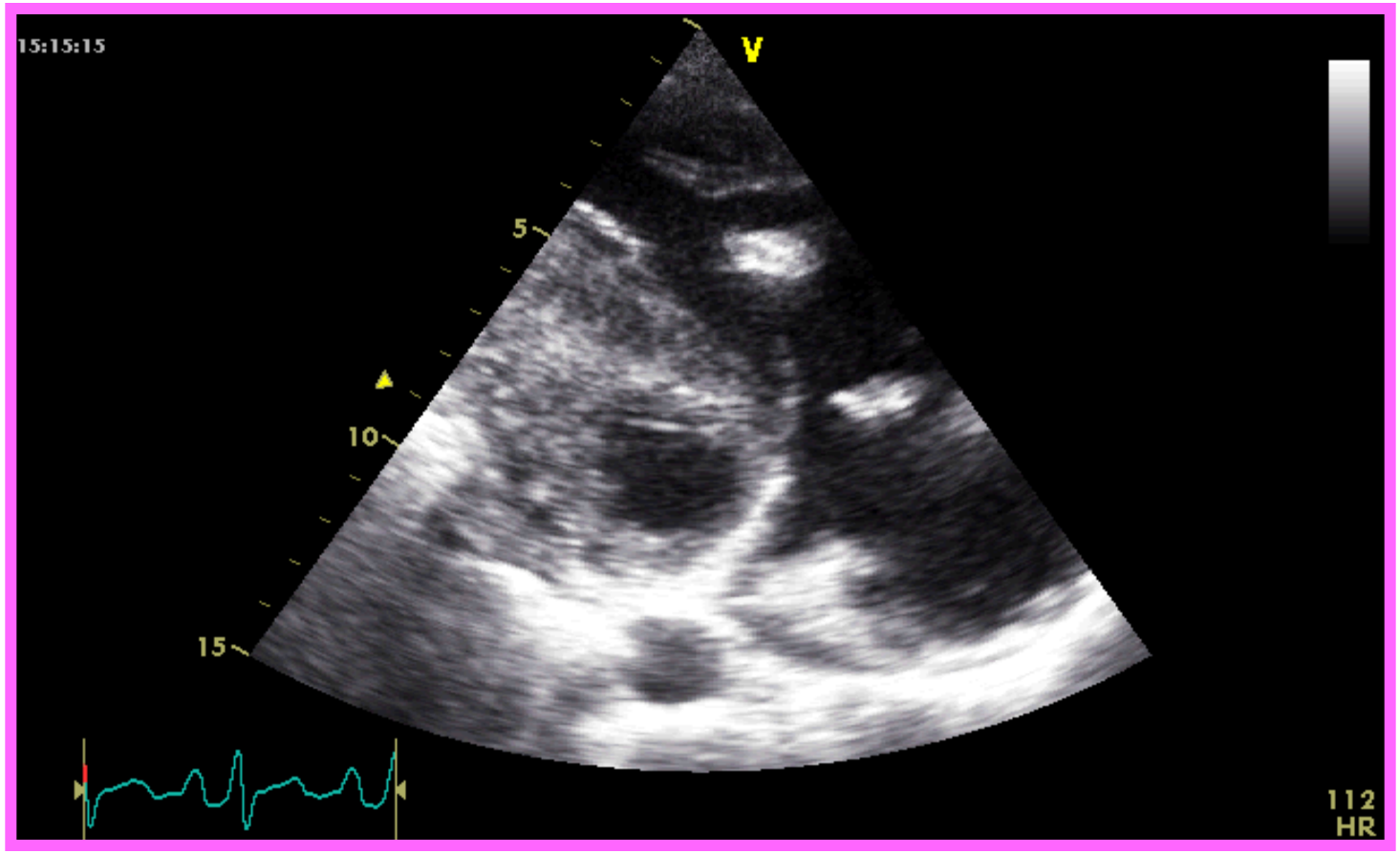
1. **isolated right heart endocarditis**
   - pure right heart endocarditis
   - associated left heart endocarditis

2. **cardiac device-related infective endocarditis (CDRIE)**

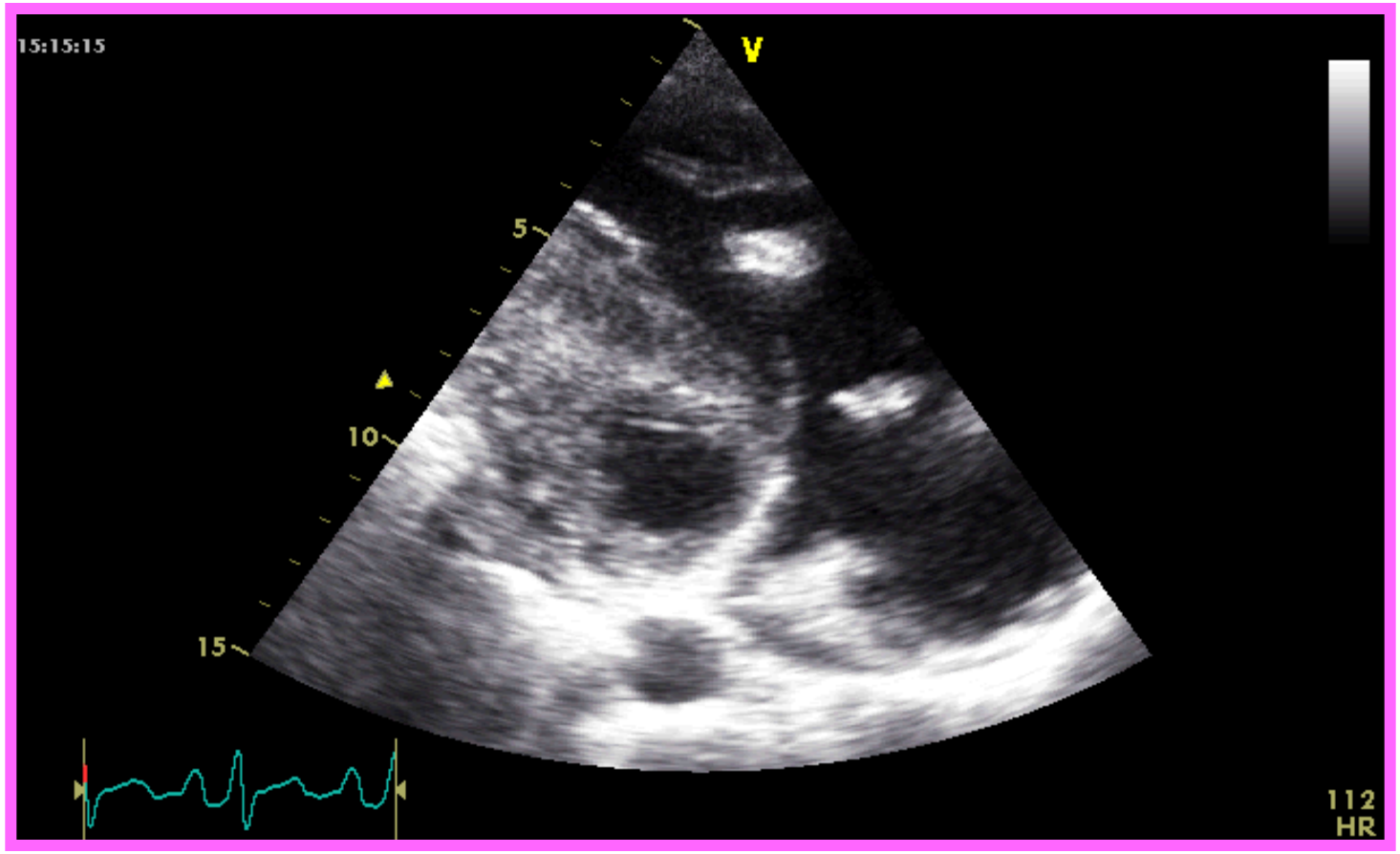
Tricuspid endocarditis: TTE



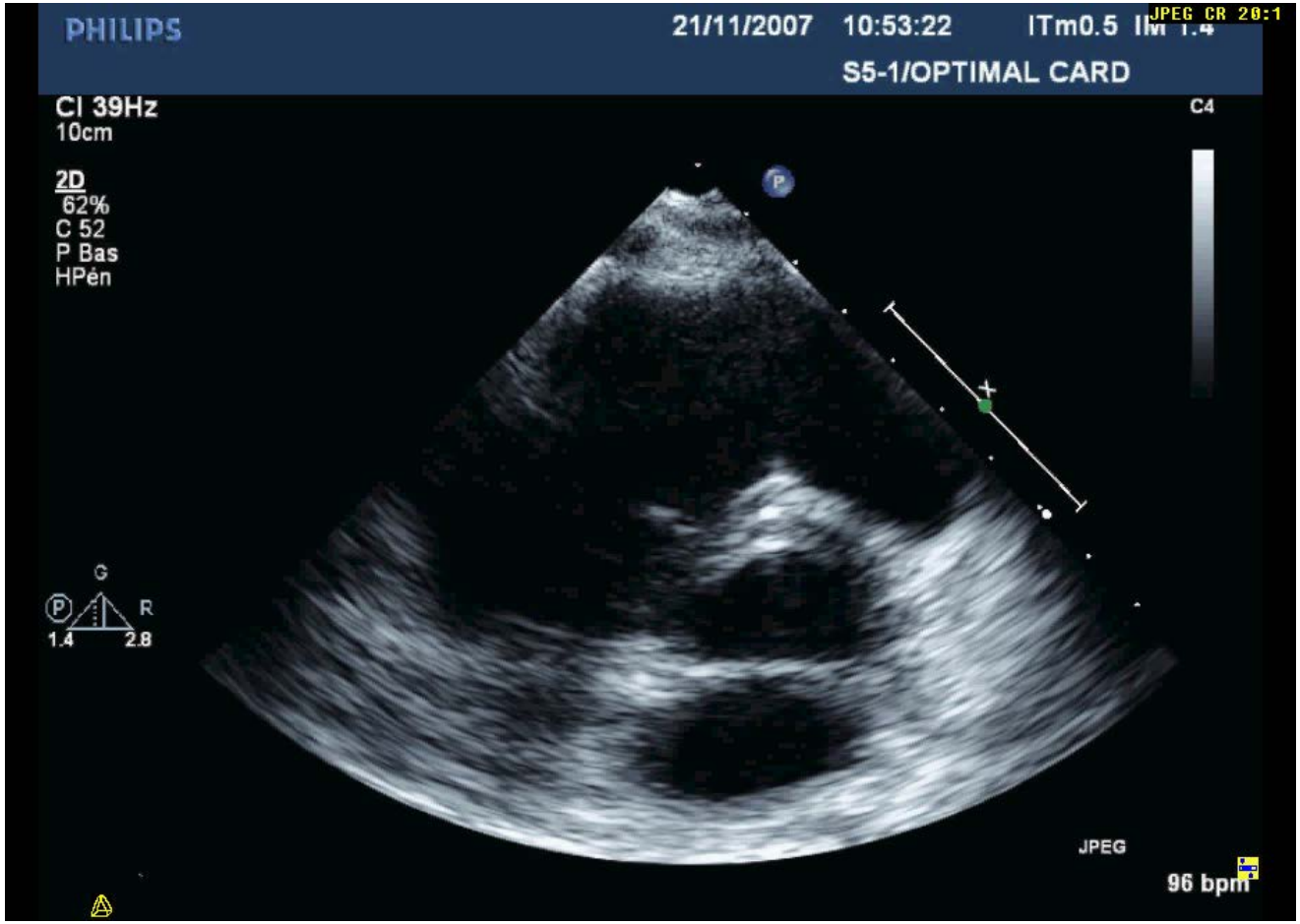
Tricuspid endocarditis: TTE



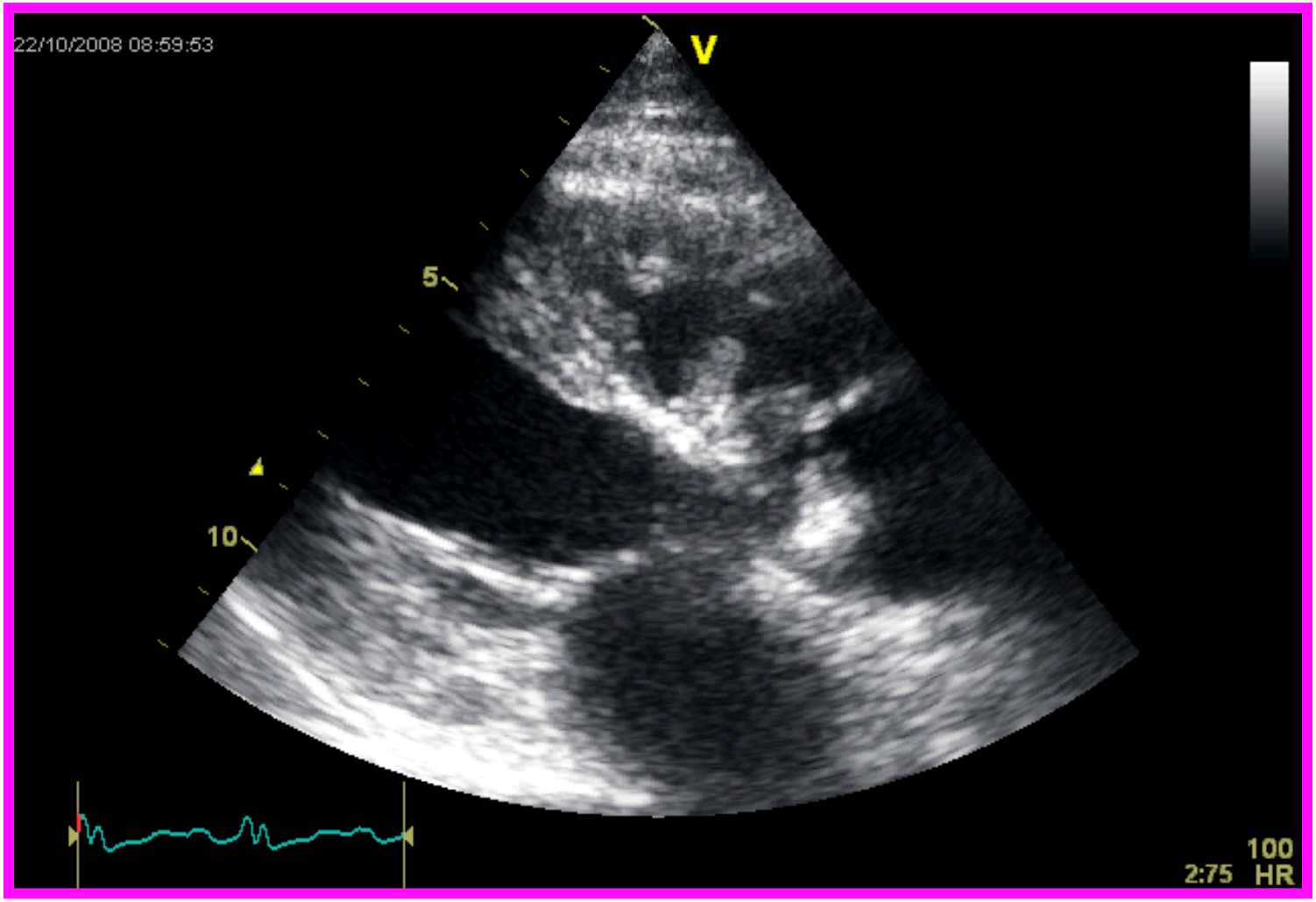
Tricuspid endocarditis: TTE



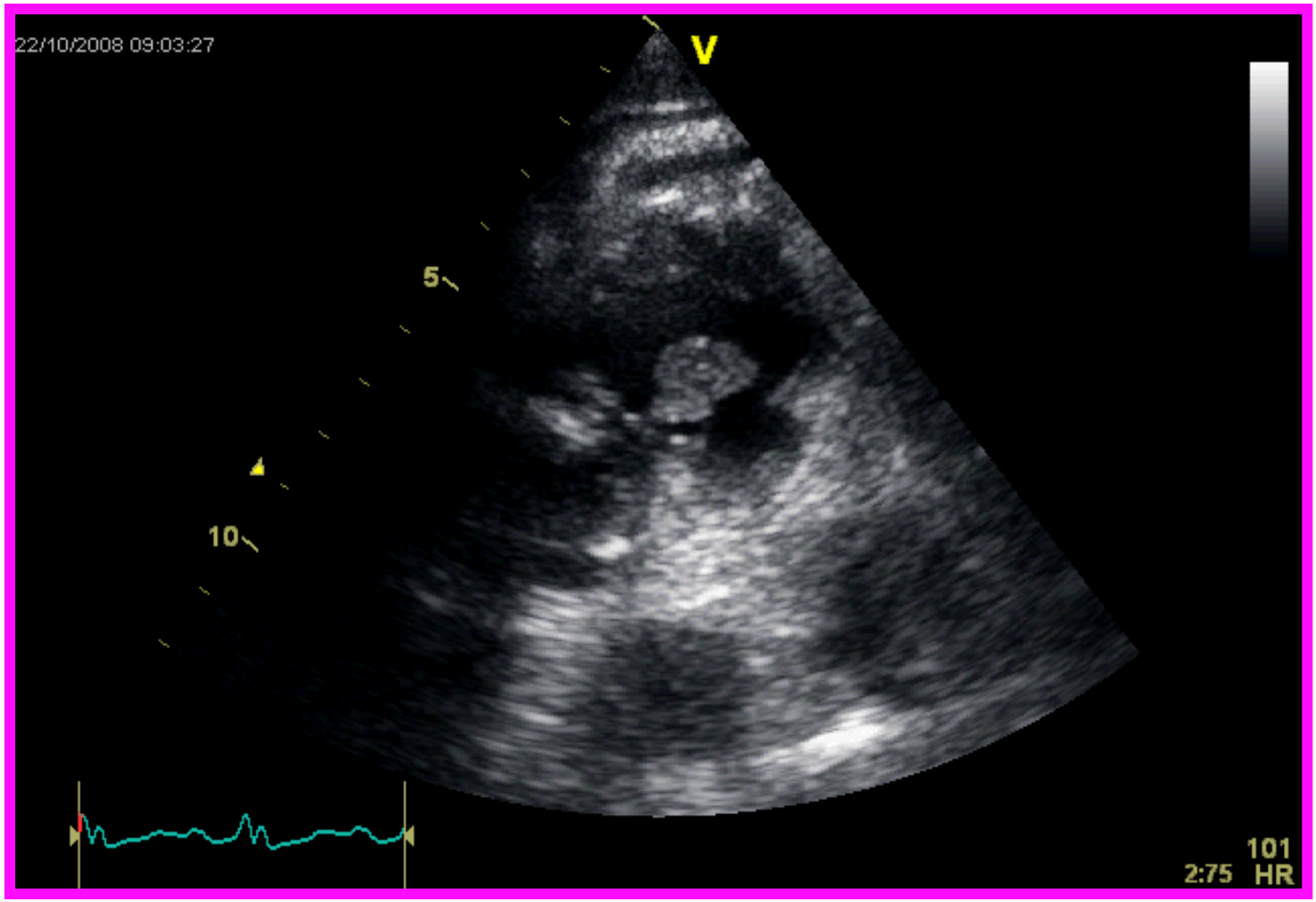
Tricuspid endocarditis: TTE



Aortic and pulmonary IE

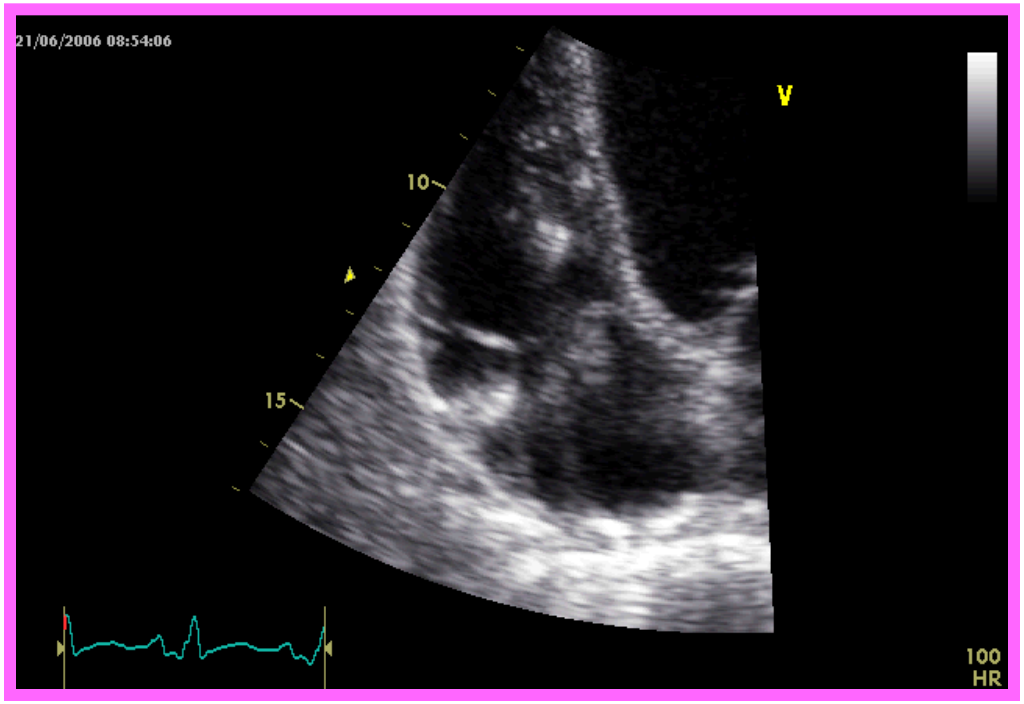


Aortic and pulmonary IE

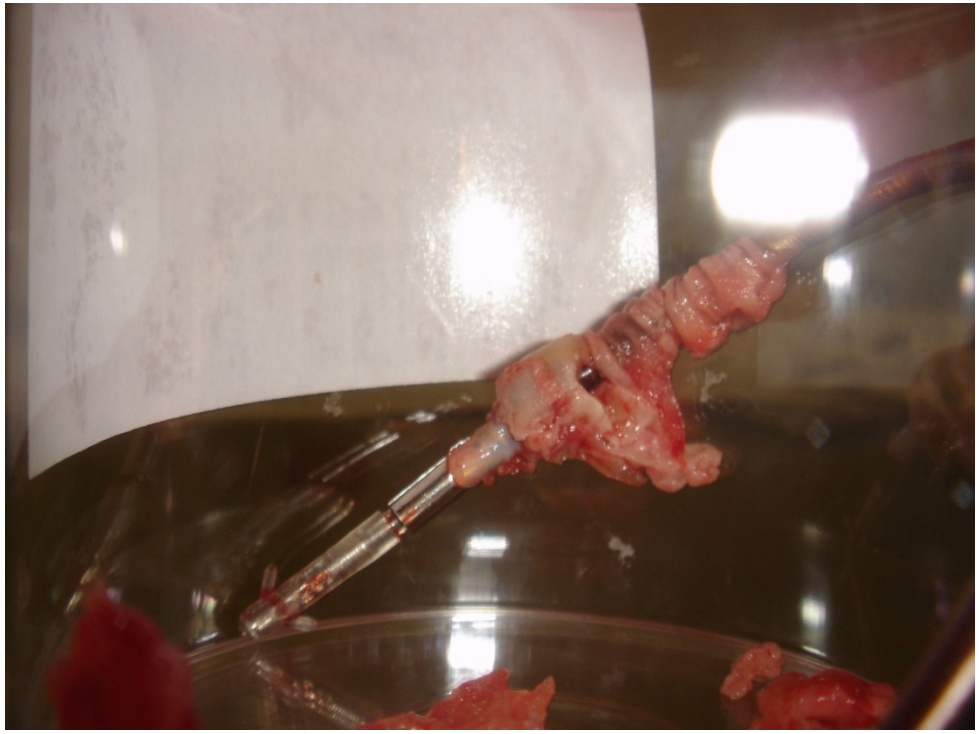


Pacemaker lead IE

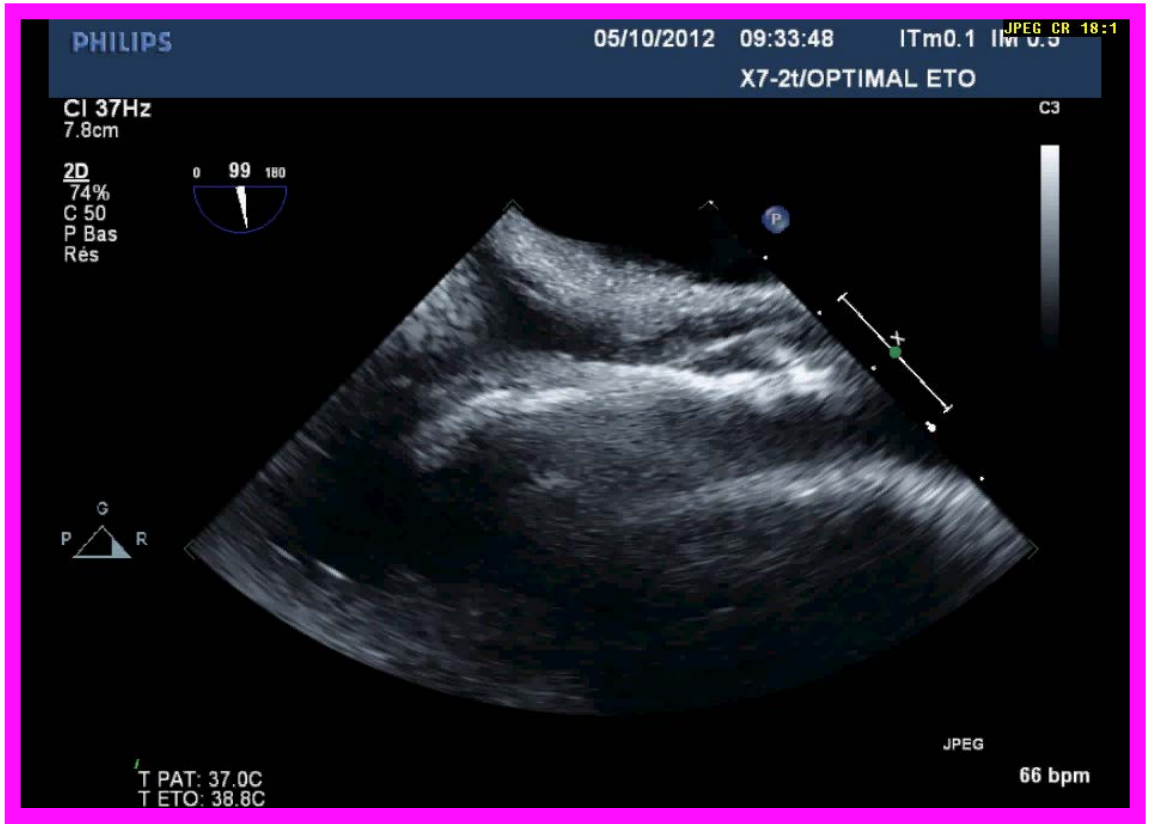
Major role of echo, but .....



CRDIE: TOE



PMLIE: PET / CT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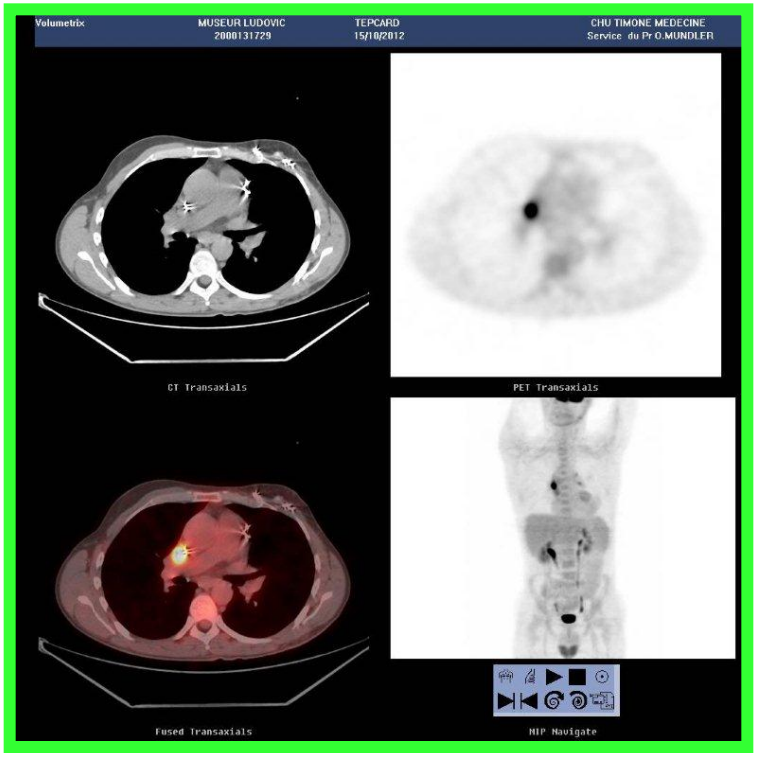
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Service du Pr O.MUNDLER
CT Transaxials
PET Transaxials
Fused Transaxials
MIP Navigate

CDRIE: ESC guidelines 2009

Recommendations: IE on pacemakers and implantable defibrillators	Class[a]	Level[b]
A - PRINCIPLES OF TREATMENT:		
Prolonged antibiotic therapy and device removal are recommended in definite CDRIE	I	B
Device removal should be considered when CDRIE is suspected on the basis of occult infection without other apparent source of infection	IIa	C

CDRIE: ESC guidelines 2009

Recommendations: IE on pacemakers and implantable defibrillators	Class[a]	Level[b]
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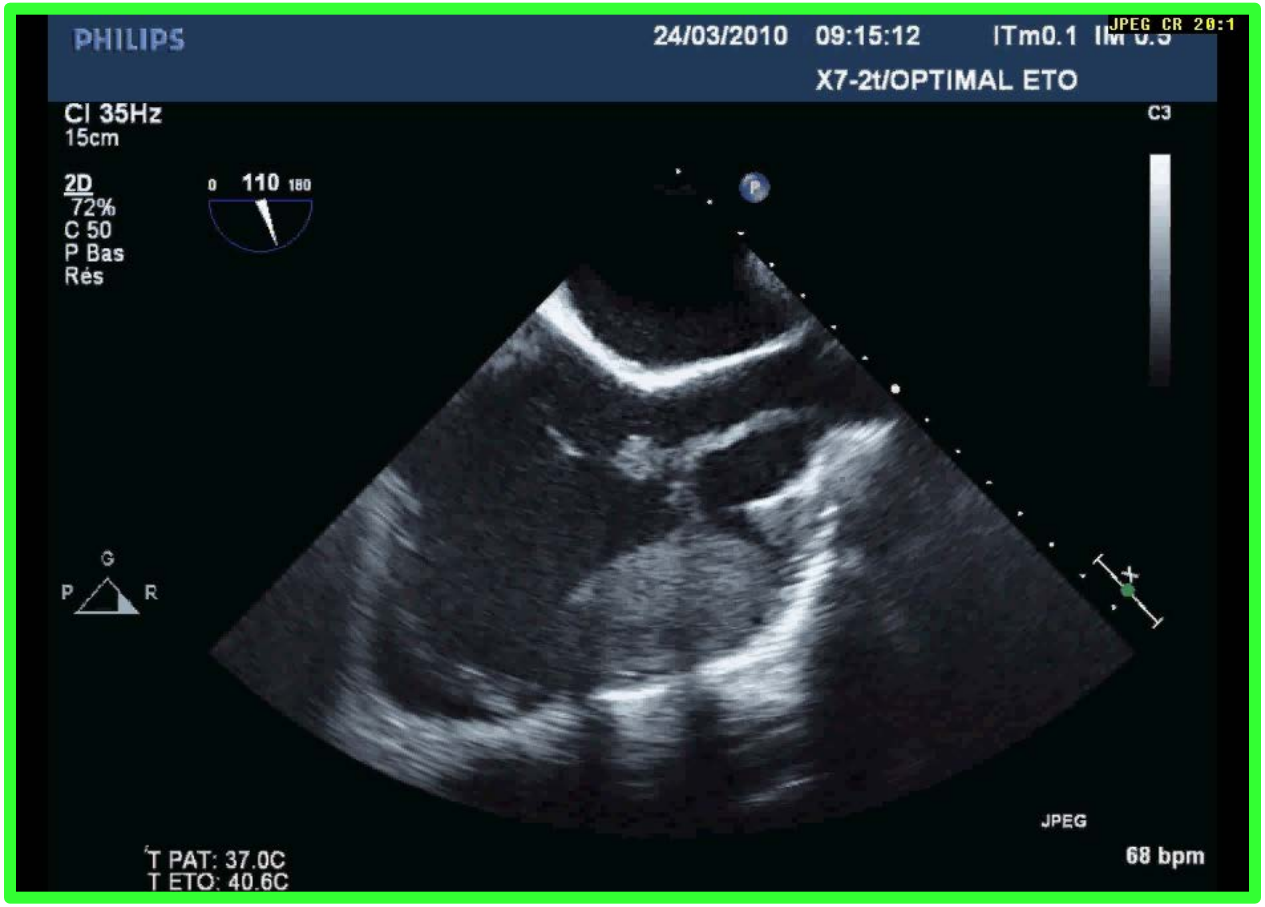
Prolonged antibiotic therapy and device removal are recommended in definite CDRIE	I	B
Device removal should be considered when CDRIE is suspected on the basis of occult infection without other apparent source of infection	IIa	C
B - MODE OF DEVICE REMOVAL:		
Percutaneous extraction is recommended in most patients with CDRIE, even those with large (> 10 mm) vegetations	I	B
Surgical extraction should be considered if percutaneous extraction is incomplete or impossible or when there is associated severe destructive tricuspid IE	IIa	C
Surgical extraction may be considered in patients with very large (> 25 mm) vegetations	IIb	C

TEE after extraction



Ghost of infected leads

Le Dolley Y – J Am Coll Cardiol Img 2010;3: 673– 81

- Ghosts of infected leads are associated

with CDRIE diagnosis (p<0.001, OR=7.63 (2.12-27.45)

- 16% (14pts/88) of all percutaneous removal for CDRIE

- Outcomes (one year follow up):
  - 3 deaths (2 sudden deaths, 1 heart failure)
  - 2 surgery
  - 1 symptomatic PE

Conclusion: imaging in IE

1. **key role of echocardiography, but diagnosis is still sometimes difficult**

2. **major role for prognostic assessment**
   - **hemodynamic risk**
   - **infectious risk**
   - **embolic risk**

3. **potential role of other imaging techniques**
   - **CT scan**
   - **MRI**
   - **Positron Emission Tomography**

EACVI / VHD WG

Infective Endocarditis European Registry (EURO-ENDO)

a prospective multicentre observational study

Project leader: Gilbert Habib (EACVI)

Project co-leader: Patrizio Lancellotti (WG VHD)

EACVI:, Erwan Donal, Bernard Cosyns, Bogdan Popescu

WG VHD : Patrizio Lancellotti, Bernard Iung, Pilar Tornos, Bernard Prendergast, Raphael Rosenhek

Infective Endocarditis European Registry (EURO-ENDO)

Main objectives

1 - To evaluate the prognosis of patients with Infective Endocarditis in Europe

2 – To describe the use of different imaging modalities in IE in Europe