

A patient with cardiac device-related Infective endocarditis



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DE MARSEILLE



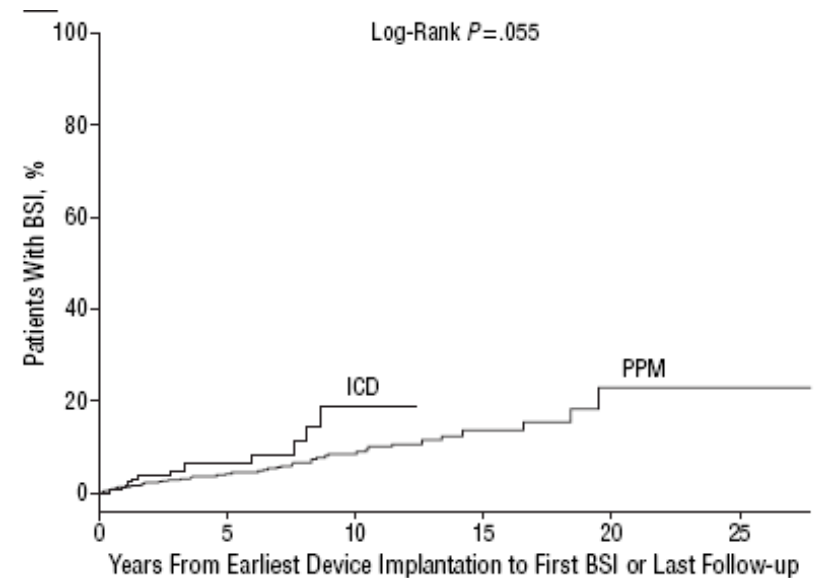
Pacemaker / defibrillator IE

- 1. increasing incidence**
- 2. difficult diagnosis**
- 3. high-risk population**
- 4. relatively bad prognosis**
- 5. management controversial**



CDRIE: incidence

- ✦ **0.13 to 10% of implanted devices**
- ✦ **1.9 / 1000 devices / year**
(Uslan DZ, Arch Int Med 2007)
- ✦ **higher probability of infection after ICD as compared with PPM**



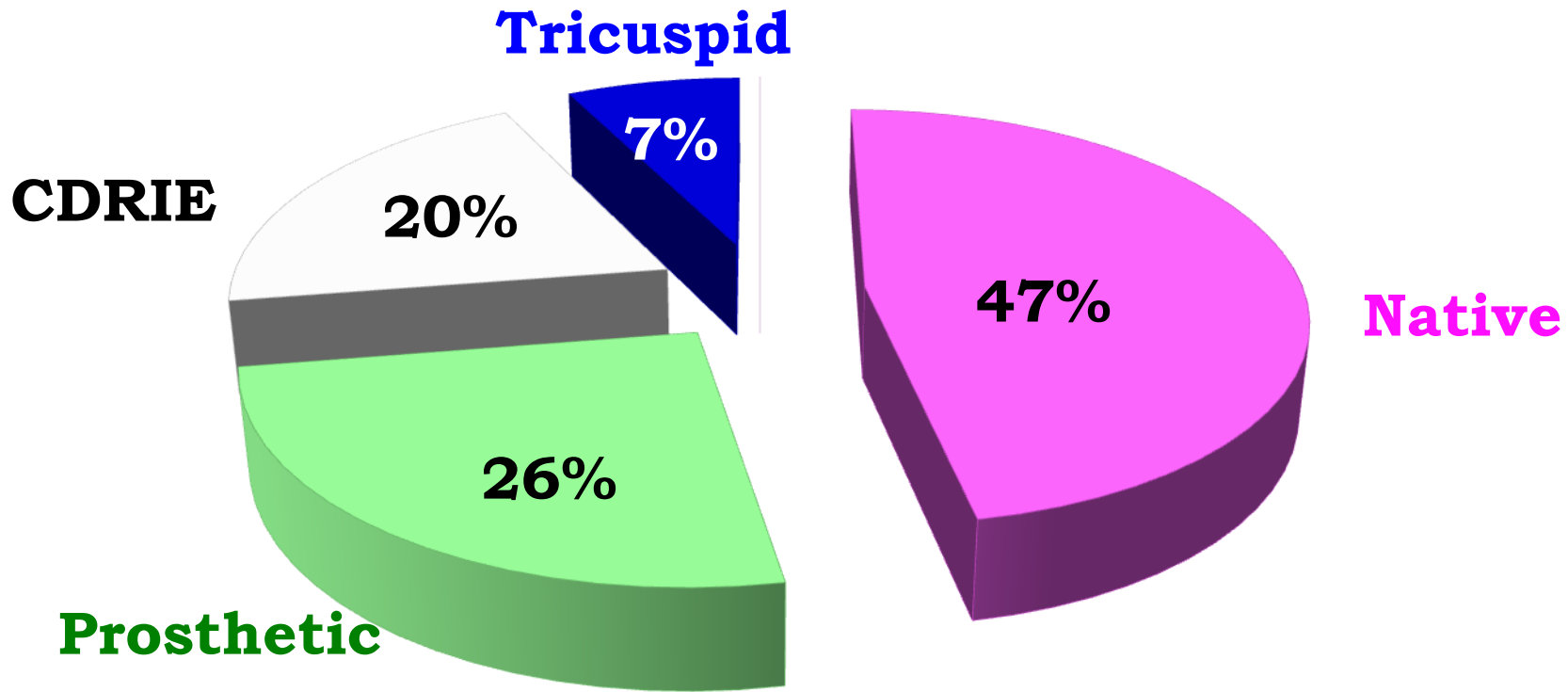
PPM: permanent pacemaker

ICD: implantable cardioverter-defibrillator



604 endocarditis Marseille 1994-2007

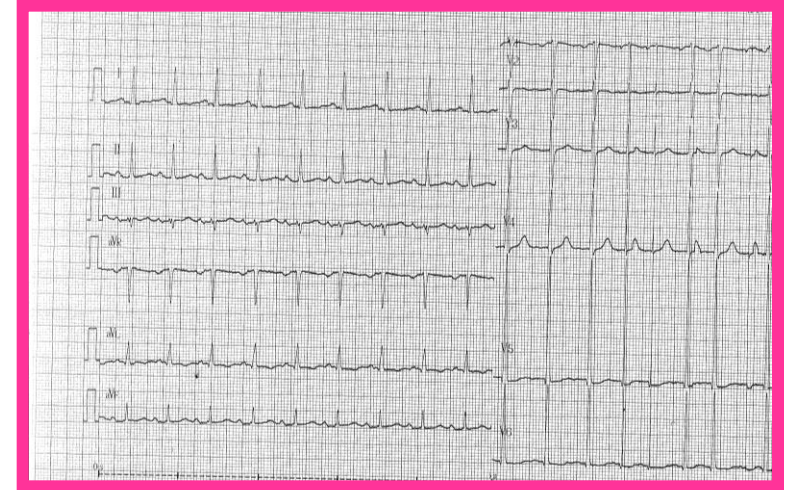
121 endocarditis affecting pacemaker / defibrillator



Case report

History of the disease

- 50 year-old man,
- severe dilated cardiomyopathy
- January 2010: ICD implanted
- March 2010: Cardiogenic shock
- ICU: dobutamine infusion



Clinical examination

- severe CHF
- fever = 38°5
- arterial pressure: 75 / 55 mmHg
- normal neurological examination



Case report

Laboratory data

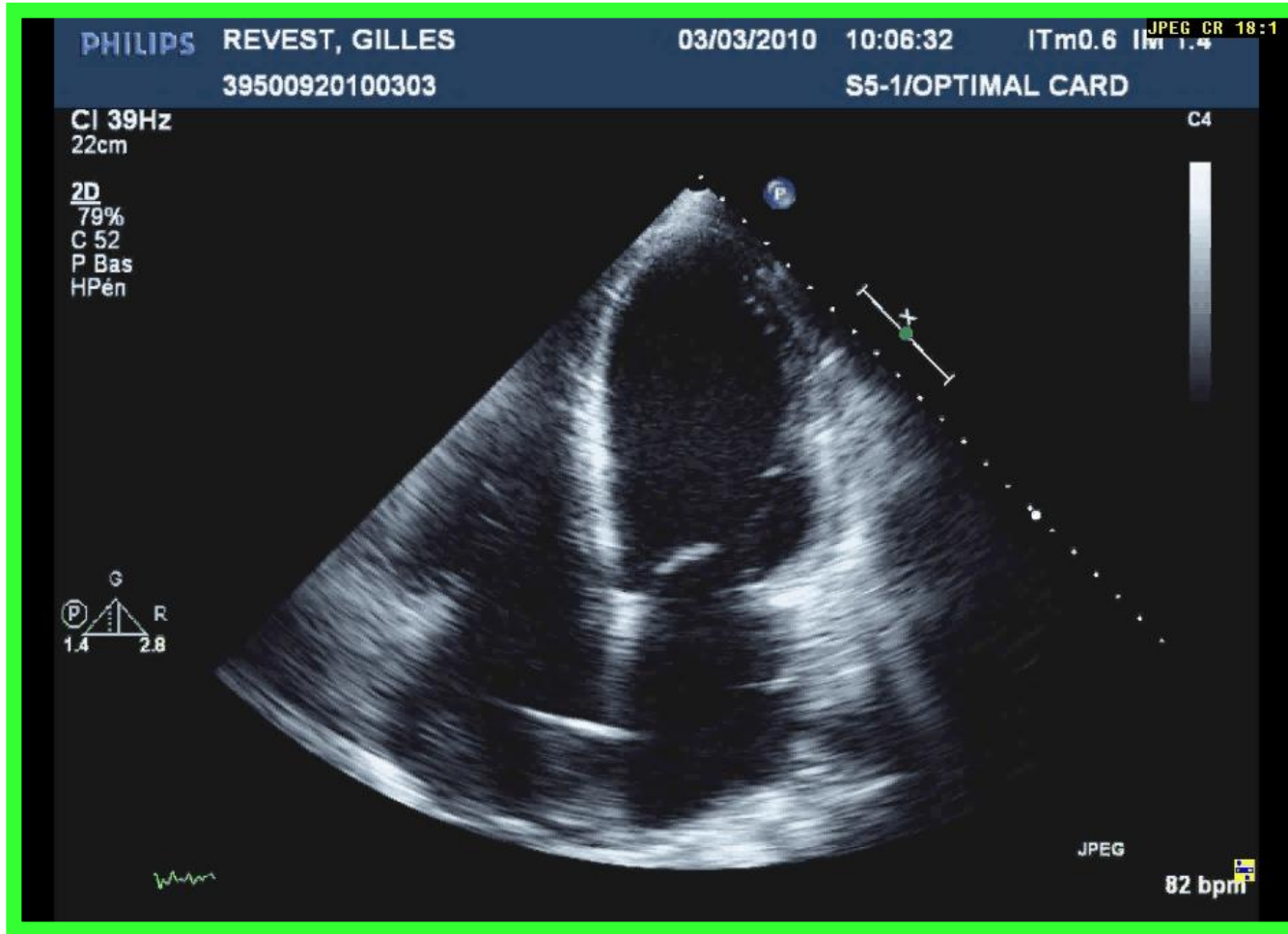
- ✦ haemoglobin: 8.5 g / dl
- ✦ white blood cell count: 13,000 / mm³
- ✦ sedimentation rate: 60 mm
- ✦ CRP = 136 mg/l
- ✦ creatinin = 160 mg

Blood cultures:

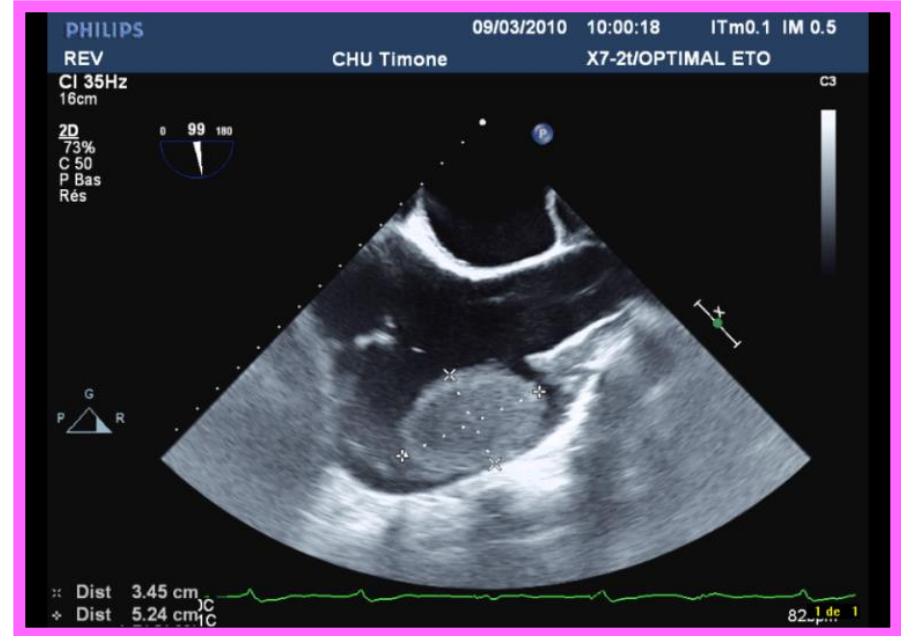
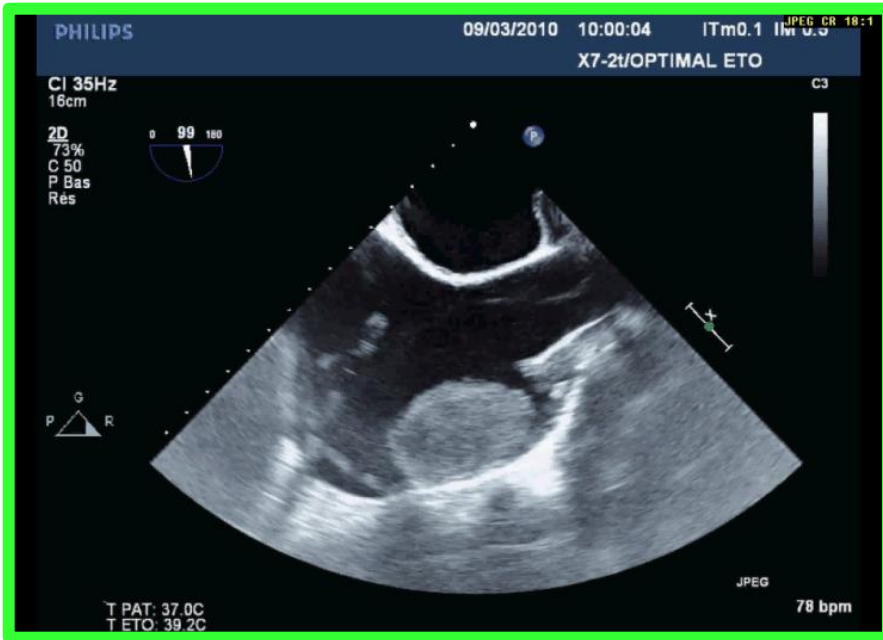
negative



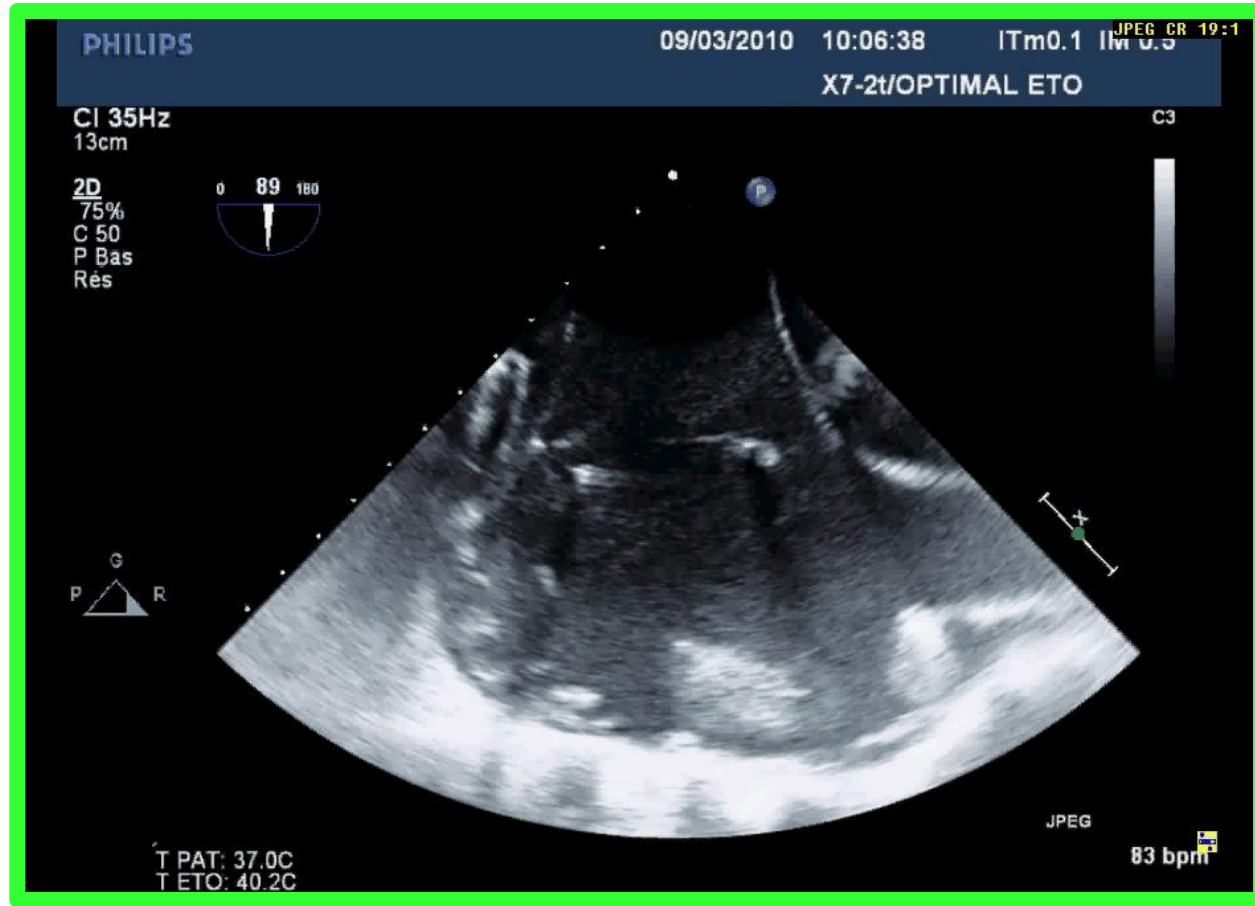
TTE



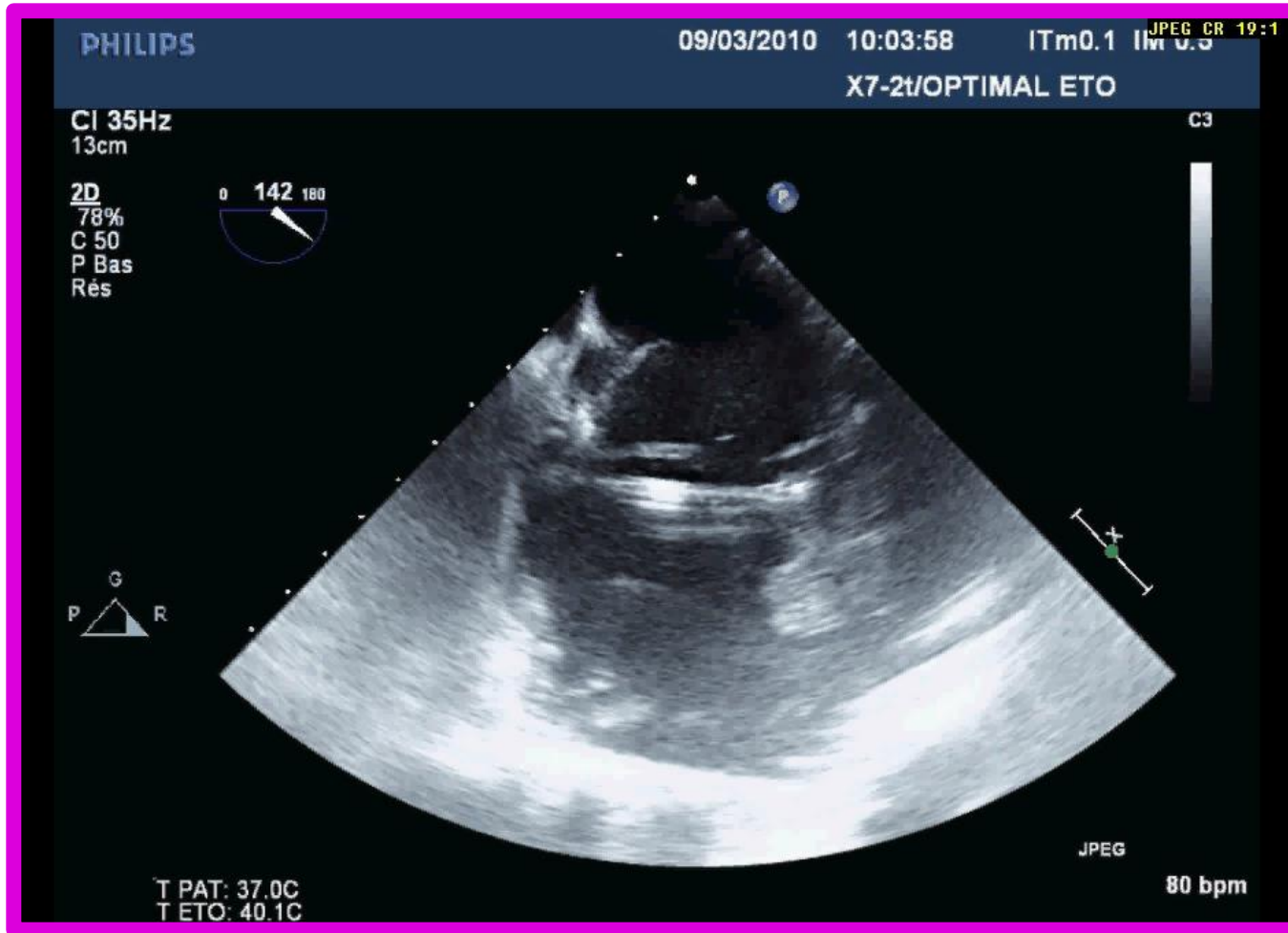
TEE



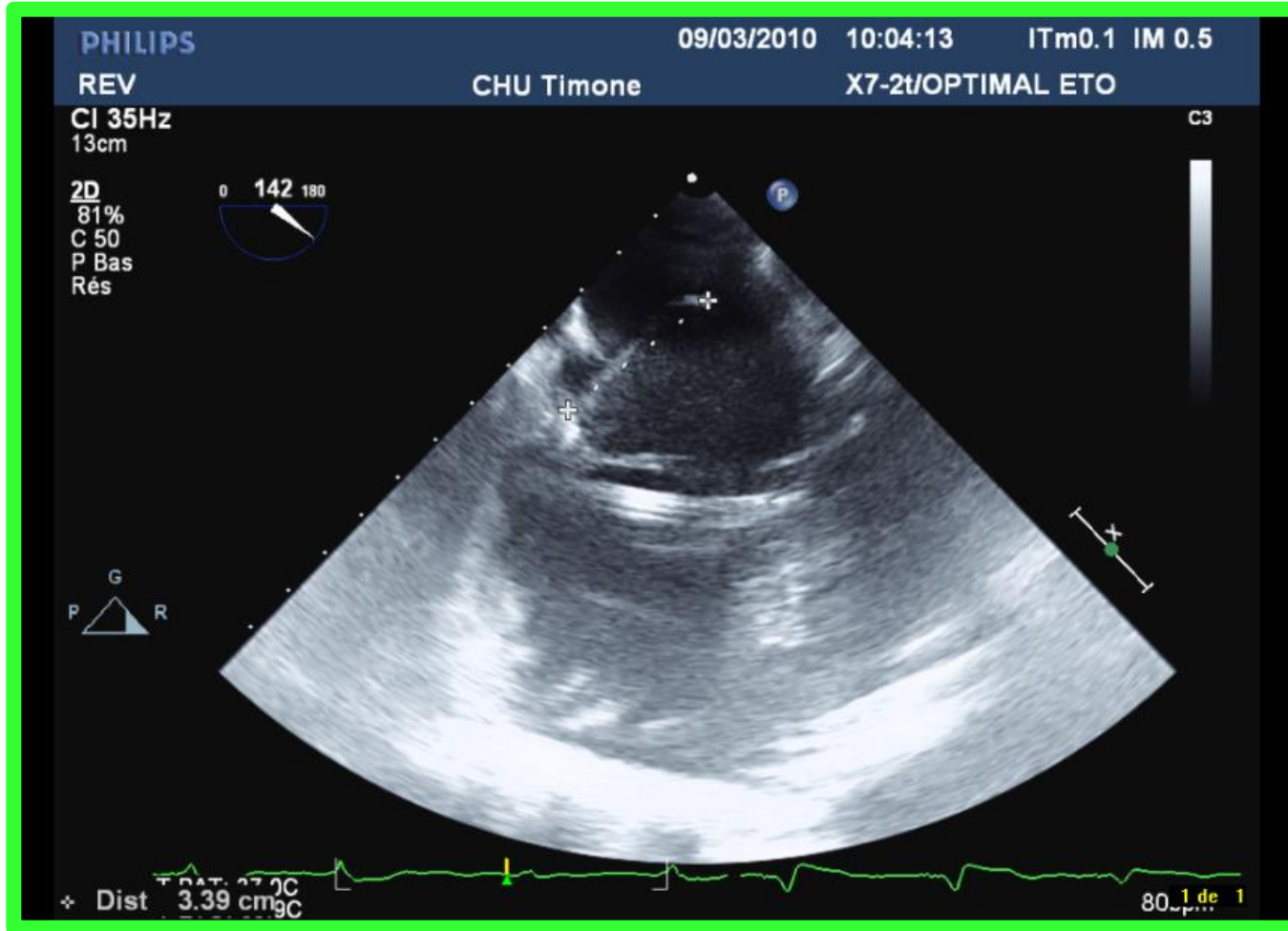
TEE



TEE



TEE



CDRIE

- 1. Diagnosis**
- 2. Treatment**
- 3. Follow-up**



CDRIE

1. Diagnosis

2. Treatment

3. Follow-up



Q1: is the diagnosis of IE ?

1. definite ?
2. possible ?
3. rejected ?
4. other investigations are needed ?



Modified Duke criteria

Li JS , CID 2000 ; 30 : 633-8

MAJOR CRITERIA

Blood cultures positive for IE:

- Typical microorganisms consistent with IE from 2 separate blood cultures:
Viridans streptococci, *Streptococcus bovis*, HACEK group, *Staphylococcus aureus*; or
Community-acquired enterococci, in the absence of a primary focus;
- or
- Microorganisms consistent with IE from persistently positive blood cultures:
At least 2 positive blood cultures of blood samples drawn > 12 h apart; or
All of 3 or a majority of ≥ 4 separate cultures of blood (with first and last sample drawn at least 1 h apart)
- or
- Single positive blood culture for *Coxiella burnetii* or phase I IgG antibody titer > 1 : 800

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



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Modified Duke criteria

Li JS , CID 2000 ; 30 : 633-8

DEFINITE IE

- ▶ 2 major criteria
- ▶ 1 major, 3 minor criteria
- ▶ 5 minor criteria

POSSIBLE IE

- ▶ 1 major, 1 minor criteria
- ▶ 3 minor criteria



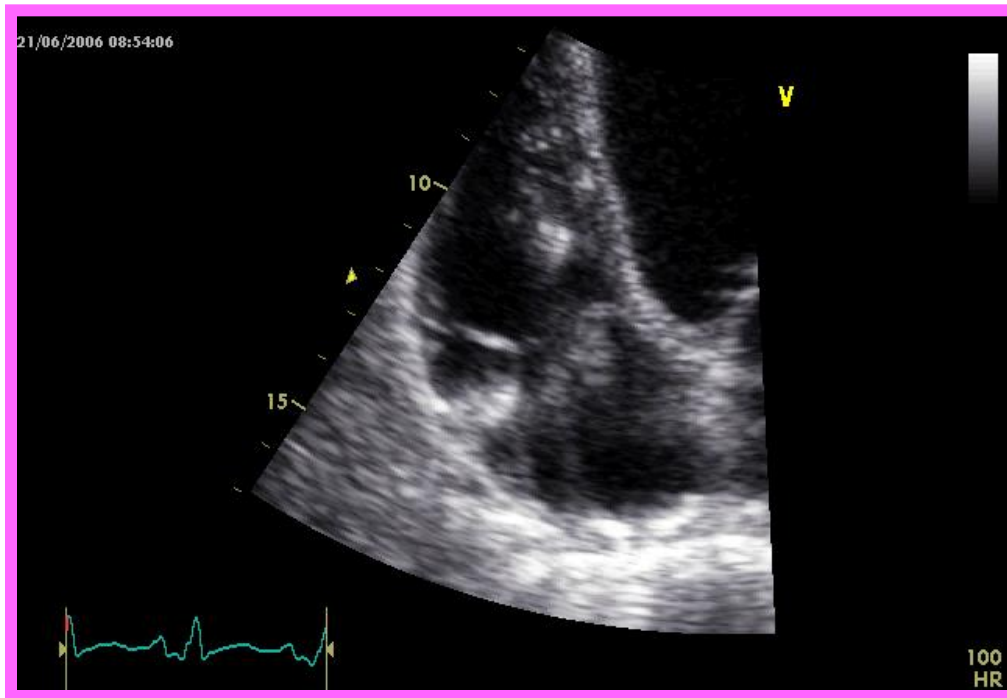
Echocardiography in CDRIE

- 1. major criterion: *vegetation***
 - on the lead
 - on the tricuspid valve
 - on the endocardial wall
- 2. minor criterion: *sleeve-like appearance***
- 3. others**
 - vegetation size
 - tricuspid regurgitation
 - right ventricular dilatation, PAP
 - follow-up after extraction
- 4. need for a complete lead study from the SVC to the apex of the right ventricle**



Pacemaker lead IE

Major role of echo, but



Pacemaker lead IE

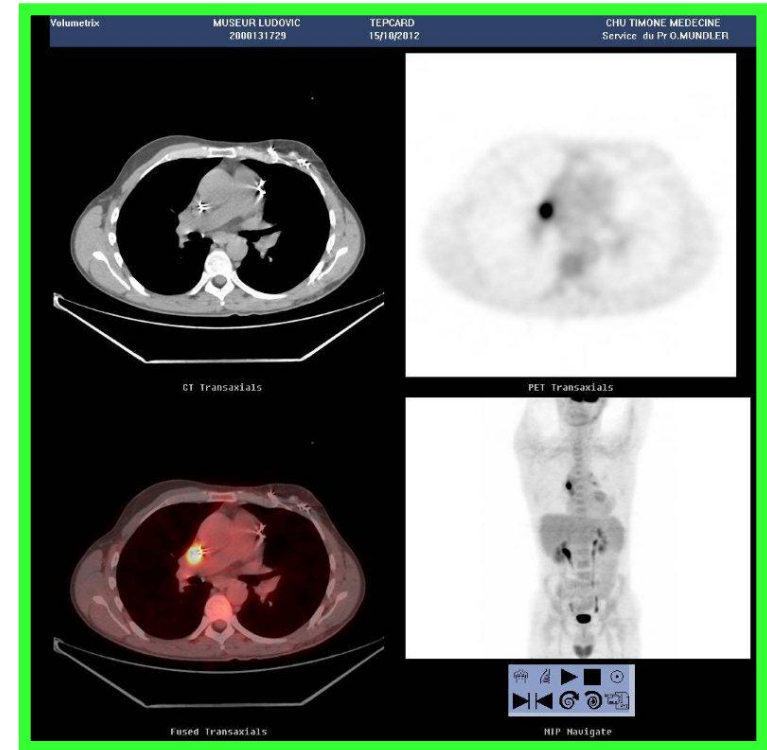
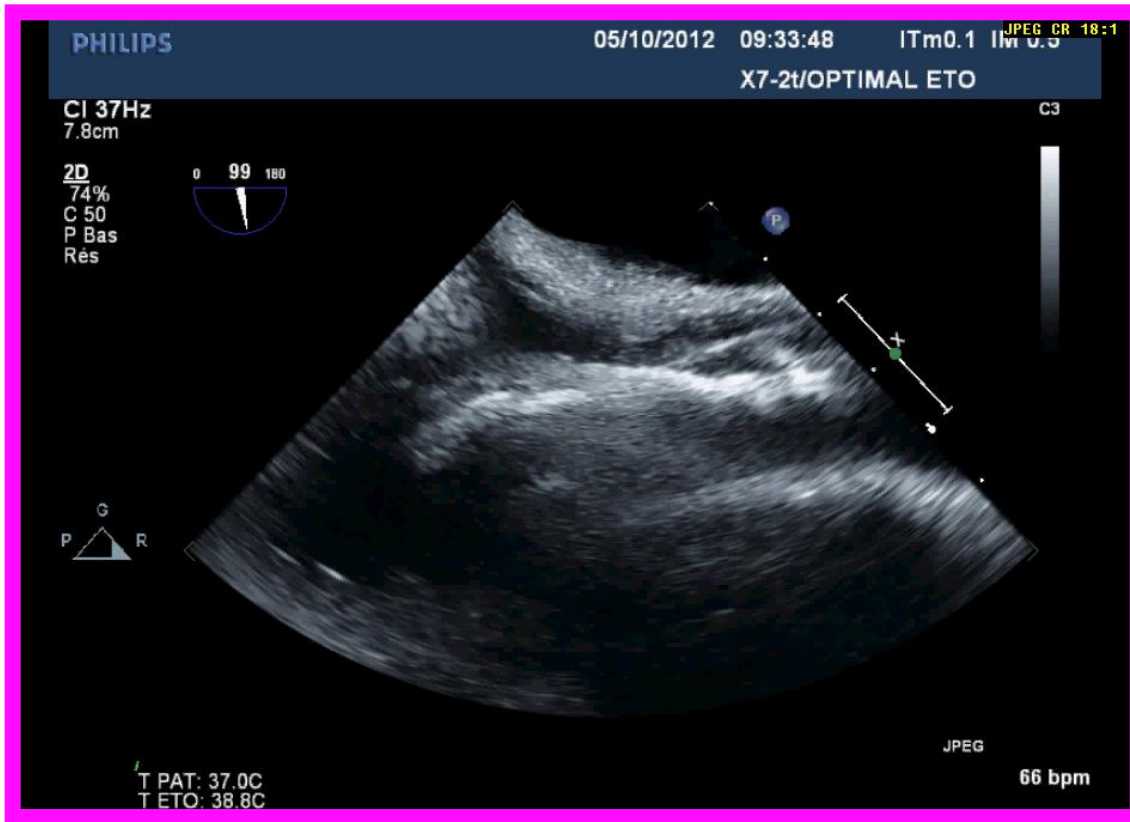
... both TTE and TEE may be normal



CRDIE: TEE



PMILIE: PET / CT

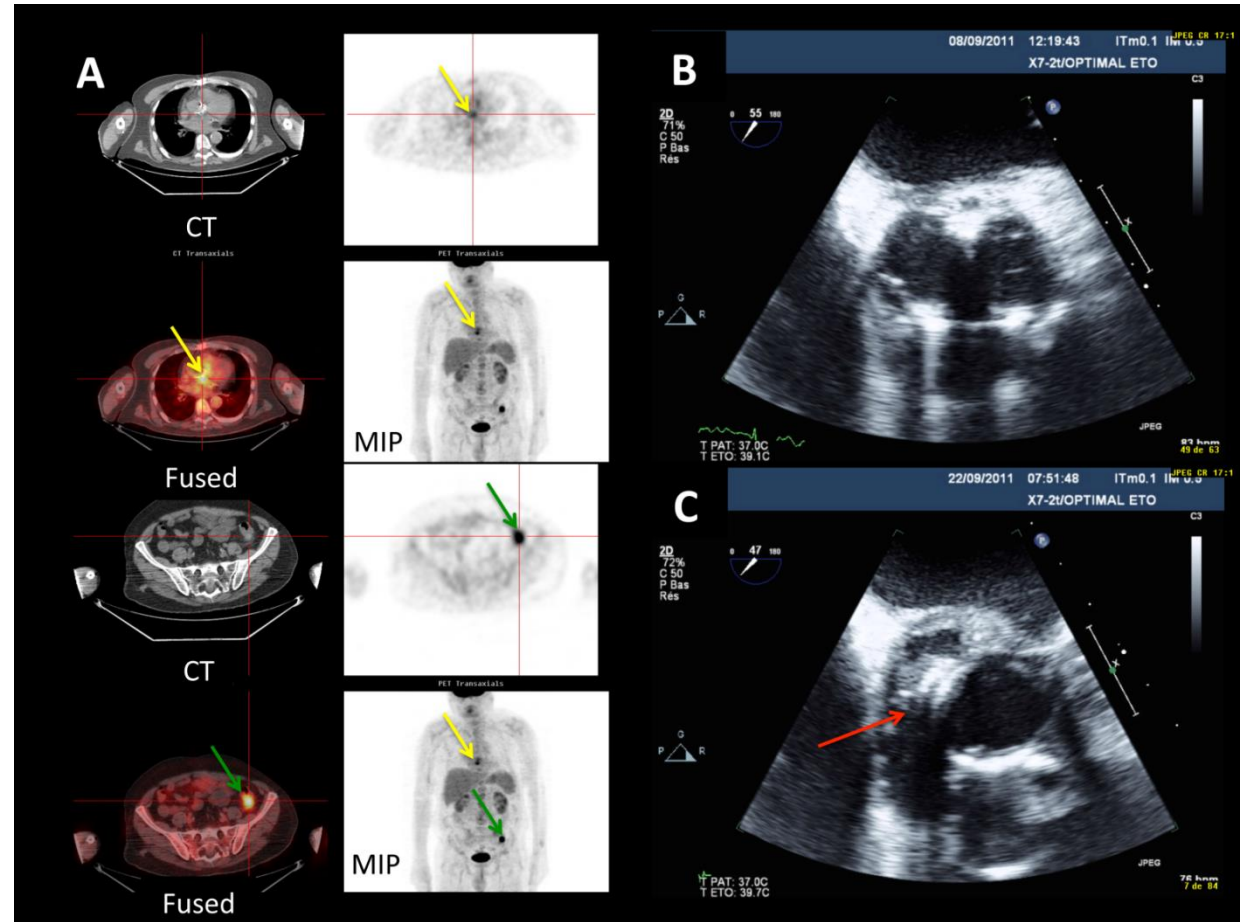


PET CT in endocarditis

Saby L - J Am Coll Cardiol. 2013; 11;61:2374-82

1. Early diagnosis of perivalvular lesions

2. Detection of secondary lesions



Q1: is the diagnosis of IE ?

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2. possible ?
3. rejected ?
4. other investigations are needed ?

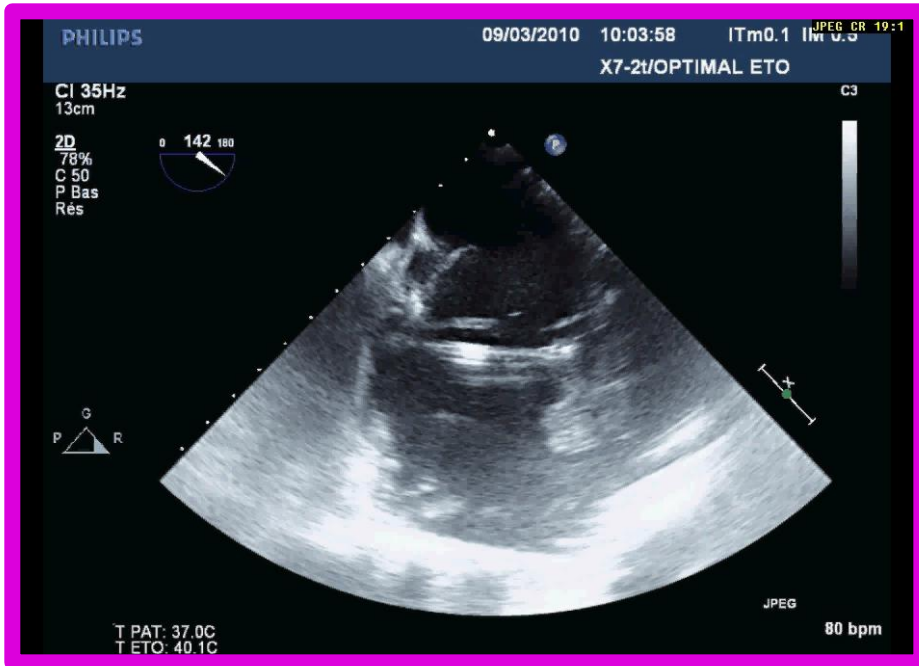


Q1: is the diagnosis of IE ?

1. definite ?
2. ***possible***
3. rejected ?
4. other investigations are needed ?



Diagnosis and decision



1. Possible PMLIE
2. Empiric ATB therapy

CDRIE

1. Diagnosis

2. Treatment

3. Follow-up



Q2: what is the best treatment ?

1. medical therapy alone ?
2. percutaneous extraction ?
3. surgical extraction ?
4. other ?



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
In patients with native or prosthetic valve endocarditis and an intracardiac device with no evidence of associated device infection, device extraction may be considered	IIb	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
C – REIMPLANTATION:		
After device extraction, reassessment of the need for reimplantation is recommended	I	B
When indicated, reimplantation should be postponed if possible to allow a few days or weeks of antibiotic therapy	IIa	B
Temporary pacing is not recommended	III	C
D - PROPHYLAXIS		
Routine antibiotic prophylaxis is recommended before device implantation	I	B

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
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CDRIE: ESC guidelines 2009

Recommendations: IE on pacemakers and implantable defibrillators

Class^a

Level^b

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



CDRIE: treatment

- **mandatory**
 1. Prolonged antibiotic therapy
 2. Device extraction
- **percutaneous extraction: +++**
- **surgical extraction**
 1. failure of percutaneous extraction
 2. severe tricuspid damage
 3. associated left heart IE
 4. very large vegetations (> 25 mm ?)



PMLIE and PFO



**before
extraction**



**after
extraction**

Paradoxical embolism in IE

Le Dolley Y – Circulation 2009; 119: e223-4



Q2: what is the best treatment ?

1. medical therapy alone ?
2. percutaneous extraction ?
3. surgical extraction ?
4. other ?



Q2: what is the best treatment ?

1. medical therapy alone ?
2. ***percutaneous extraction***
3. surgical extraction ?
4. other ?



Decision and follow-up

1. ATB therapy: Vancomycin + Gentamycin
2. Percutaneous extraction on day 7, without reimplantation
3. Good immediate outcome
4. Positive lead culture: Staphylococcus Aureus
5. Persisting CHF and LV dysfunction
6. No fever but persisting high inflammatory markers



CDRIE

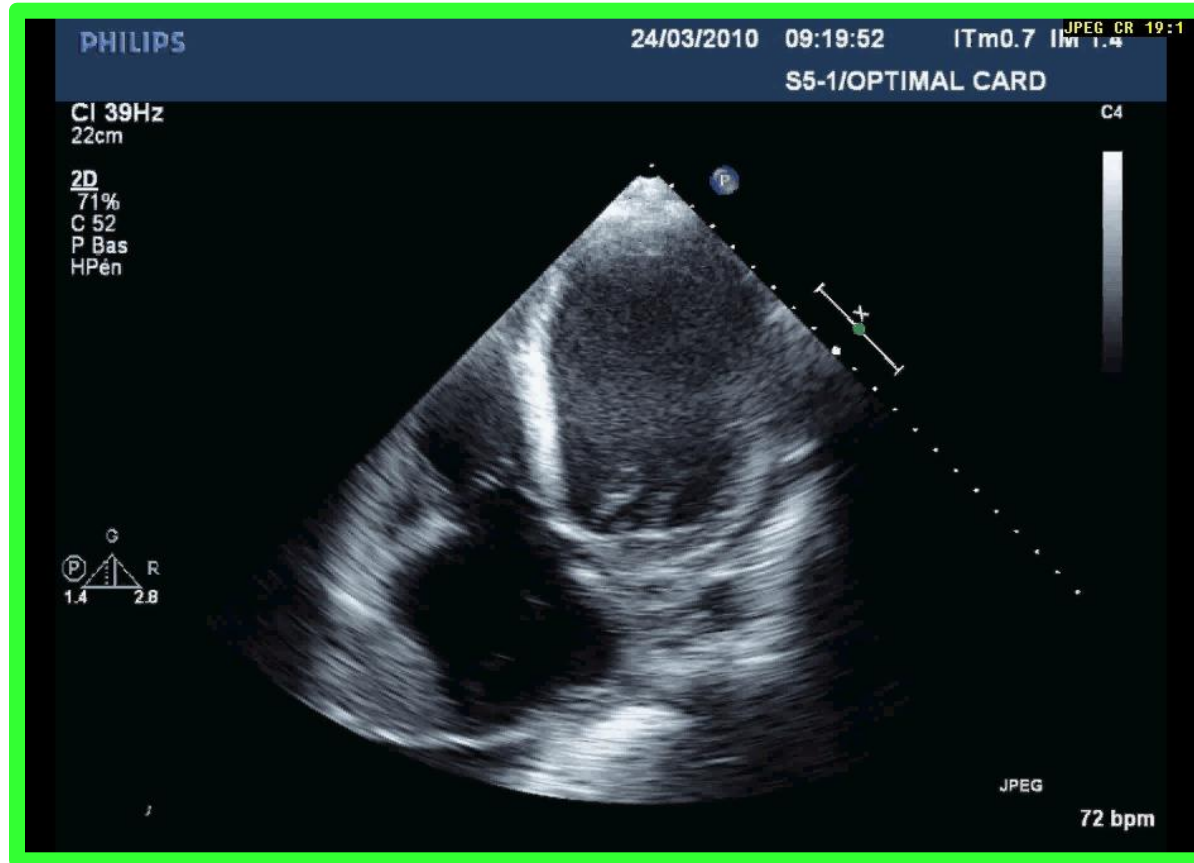
1. Diagnosis

2. Treatment

3. Follow-up



TTE after extraction



TEE after extraction



Q3: what is it?

1. Remaining pacemaker lead ?
2. Relapsing infective endocarditis ?
3. Ghost ?
4. Nothing ?



Q3: what is it?

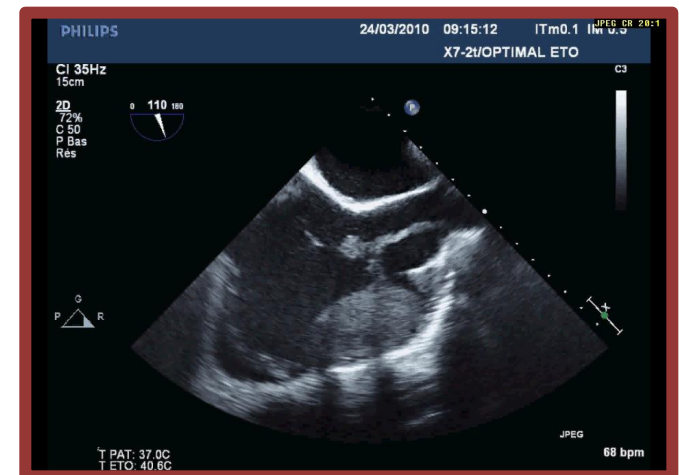
1. Remaining pacemaker lead ?
2. Relapsing infective endocarditis ?
3. ***Ghost***
4. Nothing ?



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



Final outcome

1. Persisting heart failure
2. Urgent heart transplantation 2 months later
3. Good outcome



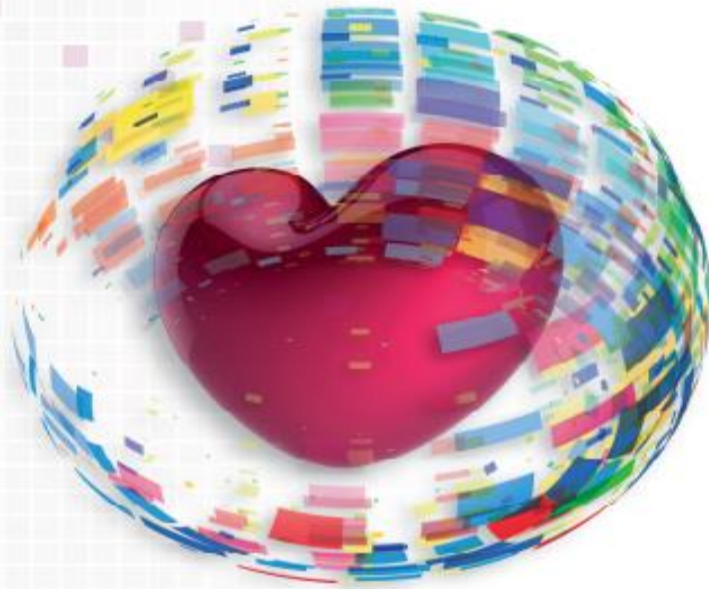
Take-home message

1. Clinical presentation is frequently misleading, particularly in elderly patients
2. Both TTE and TEE are mandatory in suspected CDRIE
3. Risk of pulmonary embolism is high and is related to the size of the vegetation
4. Prolonged antibiotic therapy and device removal are recommended in definite CDRIE
5. Percutaneous extraction is feasible in the majority of patients
6. Optimal timing and mode of reimplantation are still debated



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Speaker



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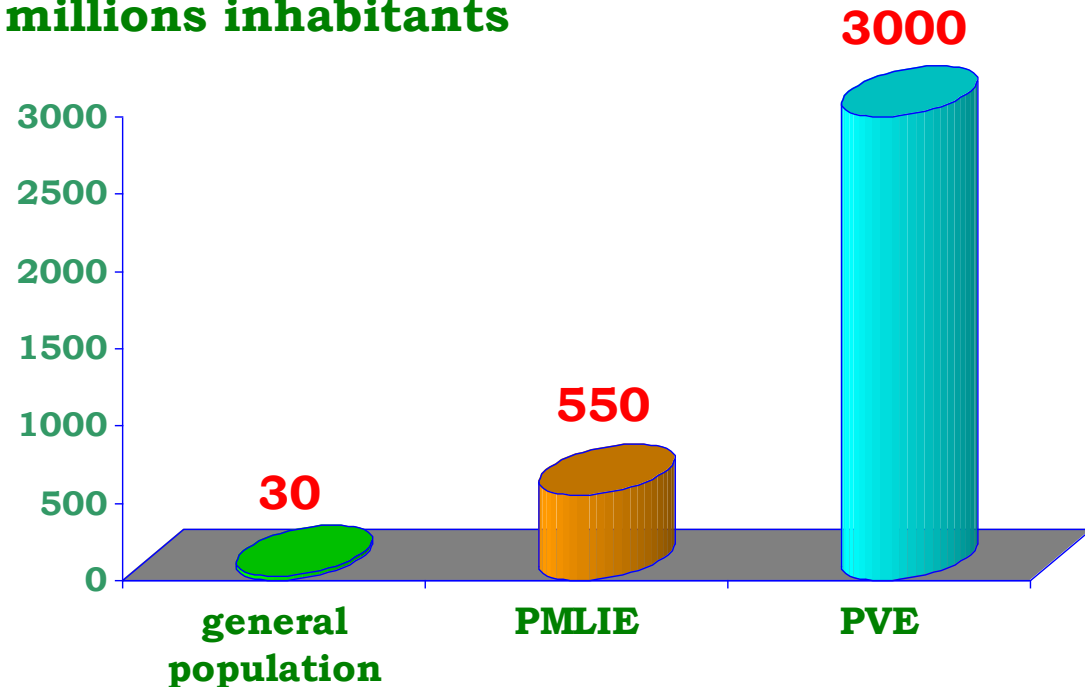
CDRIE: incidence

Duval X – CID 2004 ; 39 : 68-74

- French survey 1999: (1-year epidemiologic survey): **559 IE**
- **45 had pacemaker**

- **33 pacemaker IE (6%)**
- **12 native valve IE**

n / millions inhabitants



CDRIE: pathophysiology

● **Main mechanisms:**

- contamination by local bacteriological flora
- infection spreads along the electrode to the endocardium
- formation of vegetations
- septic pulmonary embolisms

● **Factors associated with CDRIE:**

- fever before implantation
- use of temporary pacing
- early reimplantation
- ATB prophylaxis is protective



CDRIE: definitions

● **Local device infection (LDI)**

- ✦ infection limited to the pocket of the cardiac device
- ✦ local signs of inflammation

● **CDRIE: infection extending to:**

- ✦ the electrode leads
- ✦ the cardiac valve leaflets
- ✦ the endocardial surface



Modified Duke criteria

Li JS , CID 2000 ; 30 : 633-8

Definite infective endocarditis

Pathologic criteria

- (1) Microorganisms demonstrated by culture or histologic examination of a vegetation, a vegetation that has embolized, or an intracardiac abscess specimen; or
- (2) Pathologic lesions; vegetation or intracardiac abscess confirmed by histologic examination showing active endocarditis

Clinical criteria^a

- (1) 2 major criteria; or
- (2) 1 major criterion and 3 minor criteria; or
- (3) 5 minor criteria

Possible infective endocarditis

- (1) **1 major criterion and 1 minor criterion; or**
- (2) **3 minor criteria**

Rejected

- (1) Firm alternate diagnosis explaining evidence of infective endocarditis; or
- (2) Resolution of infective endocarditis syndrome with antibiotic therapy for ≤ 4 days; or
- (3) No pathologic evidence of infective endocarditis at surgery or autopsy, with antibiotic therapy for ≤ 4 days; or
- (4) Does not meet criteria for possible infective endocarditis, as above



Modified Duke criteria

Klug D, Circulation 1997

- 1 – major criteria:
 - positive blood cultures
 - vegetation on pacemaker lead

- 2 – minor criteria:
 - fever
 - vascular phenomena
 - immunologic phenomena:
 - ***sleevelike appearance (echo)***
 - minor bacteriological criterion

- 3 – new major criteria
 - ***local symptoms***
 - ***pulmonary symptoms***



Ghost of Infected Leads

A New Criterion for the Diagnosis of Cardiac Device-Related Infective Endocarditis?

Yvan Le Dolley, MD, Franck Thuny, MD, Julien Mancini, MD, PhD, Jean-Paul Casalta, MD, Alberto Riberi, MD, Frédérique Gouriet, MD, Emilie Bastard, MD, Sebastien Ansaldi, MD, Frederic Franceschi, MD, Sebastien Renard, MD, Sebastien Prevot, MD, Roch Giorgi, MD, PhD, Laurence Tafanelli, MD, Jean-François Avierinos, MD, Didier Raoult, MD, PhD, Jean-Claude Deharo, MD, Gilbert Habib, MD

Marseille, France

OBJECTIVES We sought to determine the incidence, diagnostic value, and outcome of intracardiac masses observed by echocardiography after device removal. We hypothesized that these “ghosts” of leads could be associated with the diagnosis of cardiac device-related infective endocarditis (CDRIE).

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ORIGINAL RESEARCH

Diagnosis of Cardiac Device–Related Infective Endocarditis After Device Removal

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Jean-Paul Casalta, MD,† Alberto Riberi, MD,* Frédérique Gouriet, MD,†
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BACKGROUND The echocardiographic appearance of residual floating masses in the right atrium

