CENTRES HOSPITALIERS JOLIMONT ASBL

PM et ICD … les complications infectieuses : dépistage précoce au traitement

Wanze, le 10 septembre 2016

Antoine de Meester, Groupe Jolimont

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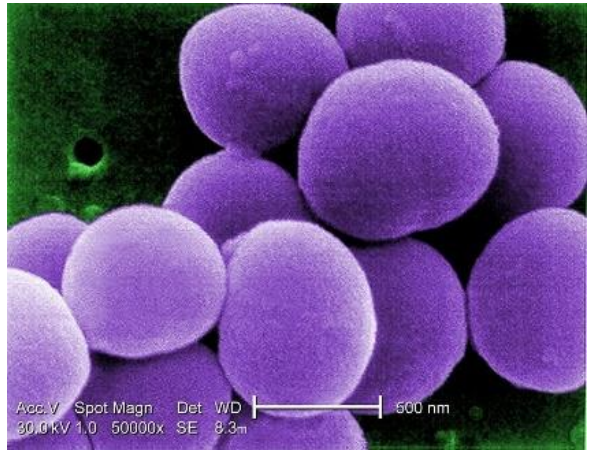
PM et ICD … les complications infectieuses

- **Incidence** … rare ?
  - Soit 01-0,7% PM; 0,7-1,2% ICD; ↑ si CRT
  - Soit pour 1.000 implants-année
    - 1,9 (DZ. Uzlan, et al. Arch Intern Med 2007; 167: 669-75)
    - Cohorte danoise : 4,82 (12,12 si remplacement)
  - ↑ implants, pts+ âgés, + comorbidités



- **Diagnostic** : hémocultures, ETO et « bon sens clinique »
- **Microbiologie** : Gram+ (60-80%), 50% methicilline-resistants
- ☠ **Mortalité** élevée, si abstention thérapeutique (ABΘ + extraction)

  (***autres facteurs*** : FEVG basse, IRC, échec d'extraction de sonde)

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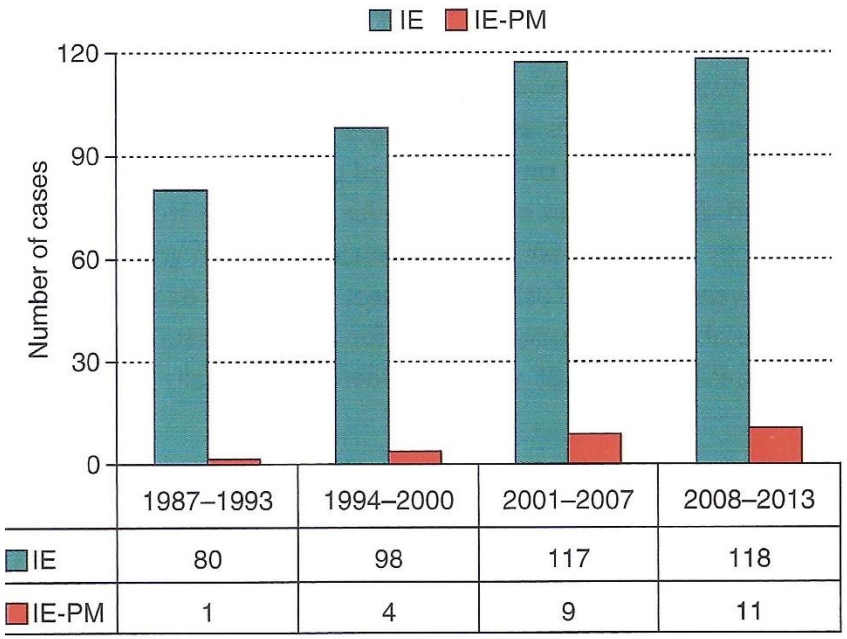
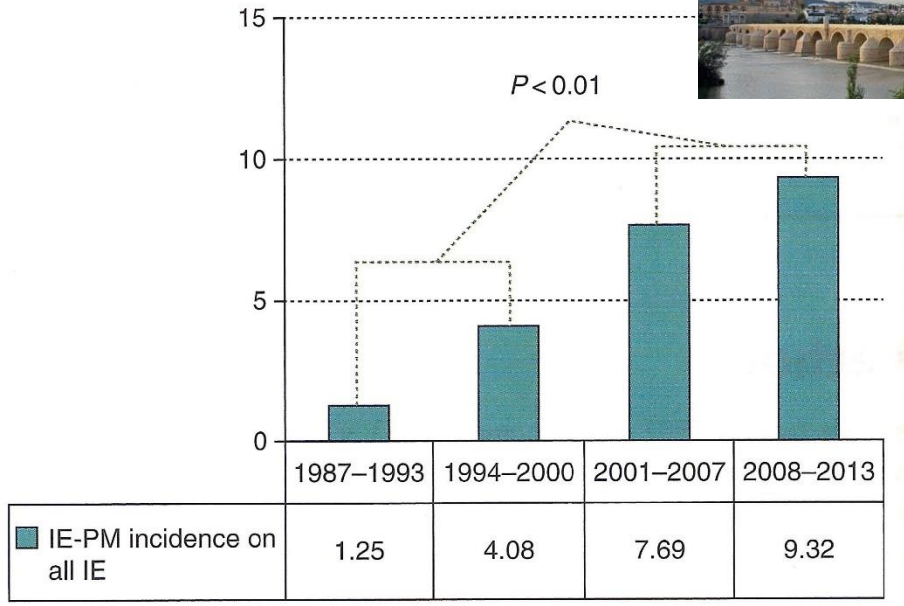
- Ref : Clinical features and changes in epidemiology of infective endocarditis on pacemaker devices over a 27-year period (1987-2013). F. Carrasco, et al. Europace 2016; 18: 836-41.



	1987–1993	1994–2000	2001–2007	2008–2013
IE	80	98	117	118
IE-PM	1	4	9	11

%



	1987–1993	1994–2000	2001–2007	2008–2013
IE-PM incidence on all IE	1.25	4.08	7.69	9.32

Cordoba

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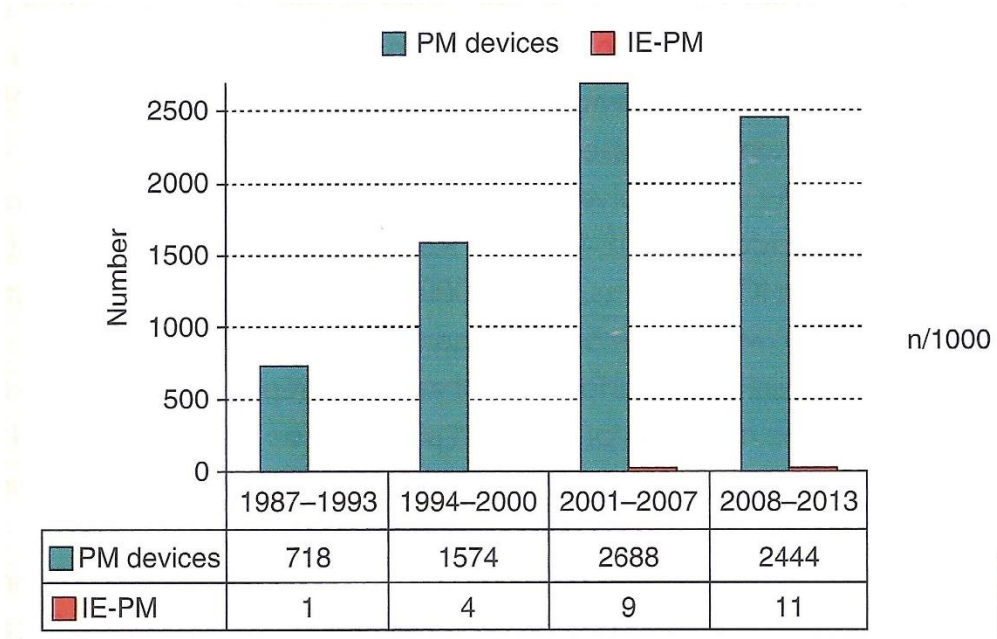
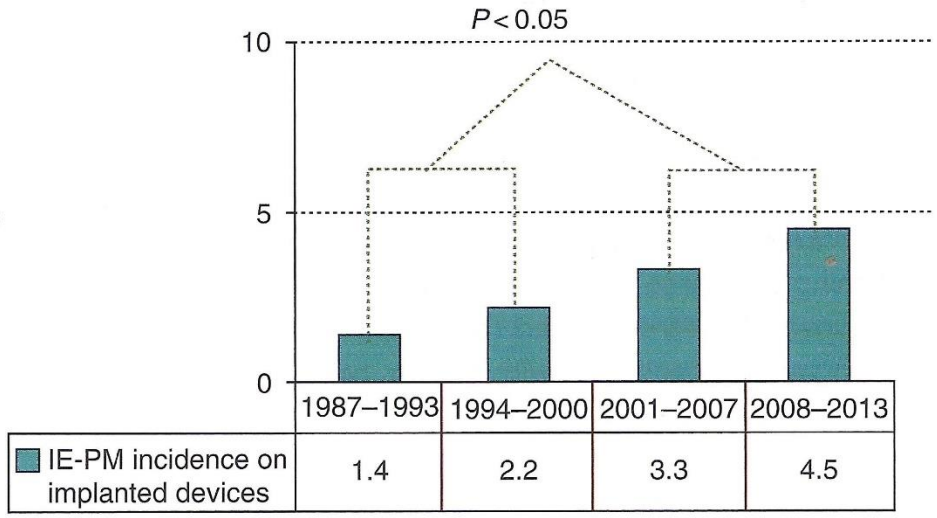


	1987–1993	1994–2000	2001–2007	2008–2013
PM devices	718	1574	2688	2444
IE-PM	1	4	9	11



	1987–1993	1994–2000	2001–2007	2008–2013
IE-PM incidence on implanted devices	1.4	2.2	3.3	4.5

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Définition … Distinction (souvent difficile)

- **« Infection locale de l'implant »** (LDI : Local Device Infection),
  - infection limitée à la poche du générateur,
  - signes locaux d'inflammation : érythème, chaleur, érosion, pus, …
- **« Endocardite infectieuse due à l'implant cardiaque »** (CDRIE : Cardiac Device-Related Infective Endocarditis),
  - infection → sondes, valves et surface de l'endocarde cardiaque.
  - hémocultures (+) et emboles septiques au niveau pulmonaire = fréquents

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Physiopathologie

- (infection du boitier/sonde(s) … avant implantation)
- **Infection de la poche** lors de l'implantation, … érosion, hématome, fermeture de plaie
- **Bactériémie** due à une infection locale/générale … entrainant la formation de végétations (VCS, sonde, valve tricuspide, endocarde) risque élevé d'emboles pulmonaires septiques

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Facteurs de risque d'endocardite

- **Lié au patient :**
  - Insuffisance rénale chronique, usage de corticoïdes, cancer, insuffisance cardiaque, diabète, prise d'anticoagulants
- **Caractéristique de la procédure :**
  - Type de procédure (ICD > PM), révision ou remplacement, expérience de l'opérateur, durée de procédure, fièvre < 24h, absence de prophylaxie antimicrobienne, sonde de pacing temporaire per-procédure, …

KA Polyzos. Europace 2015

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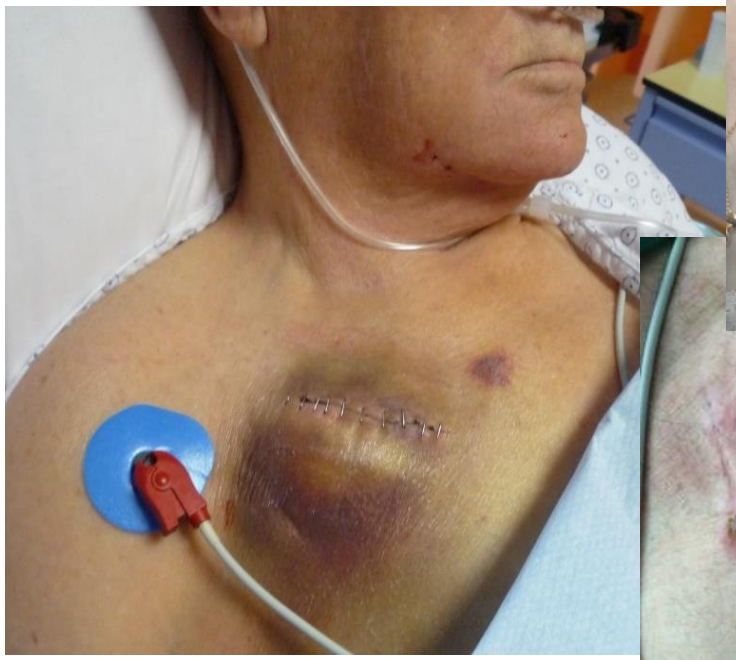
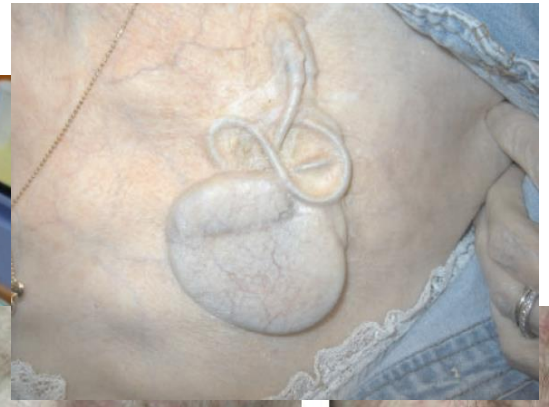
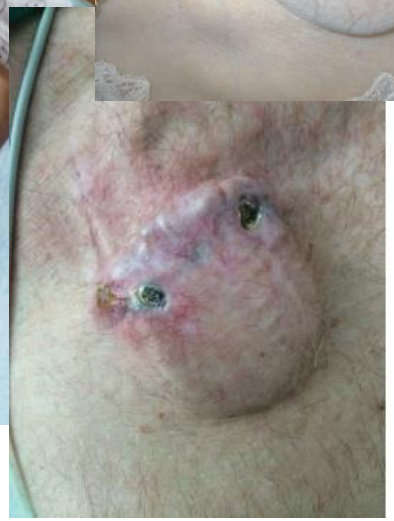
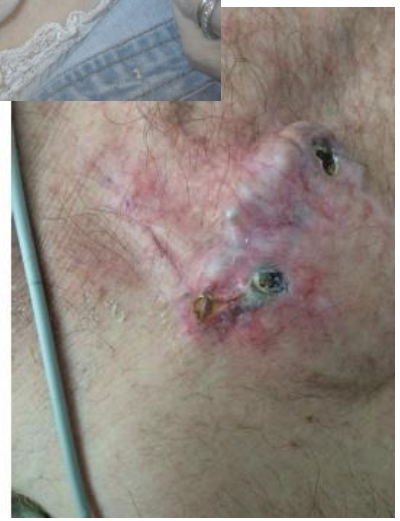
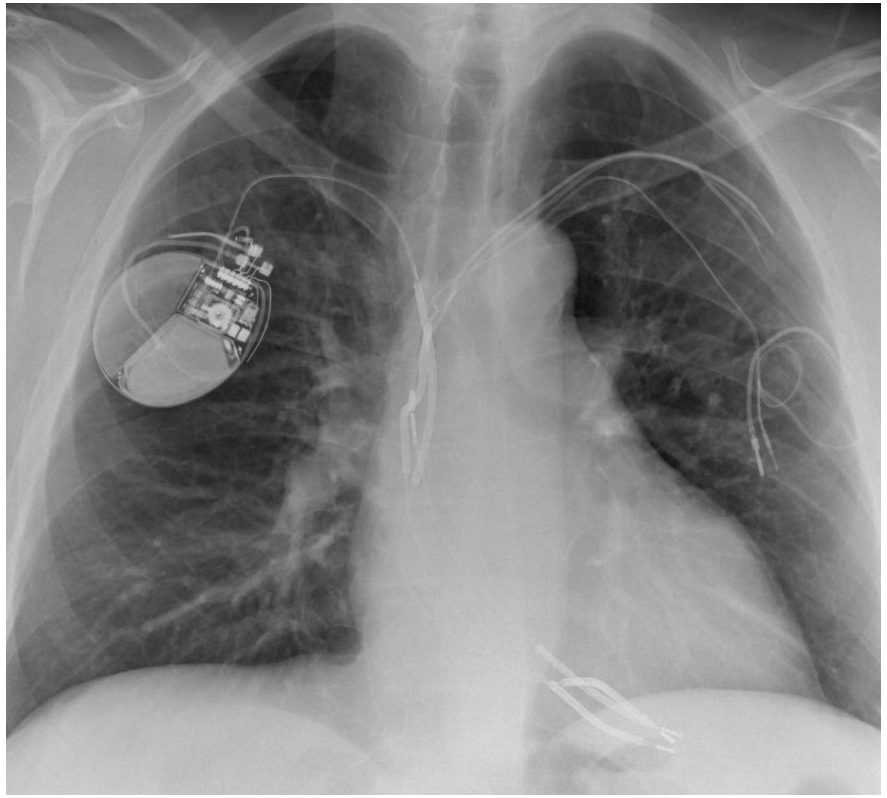
Eviter : hématome de poche, érosion et sondes abandonnées

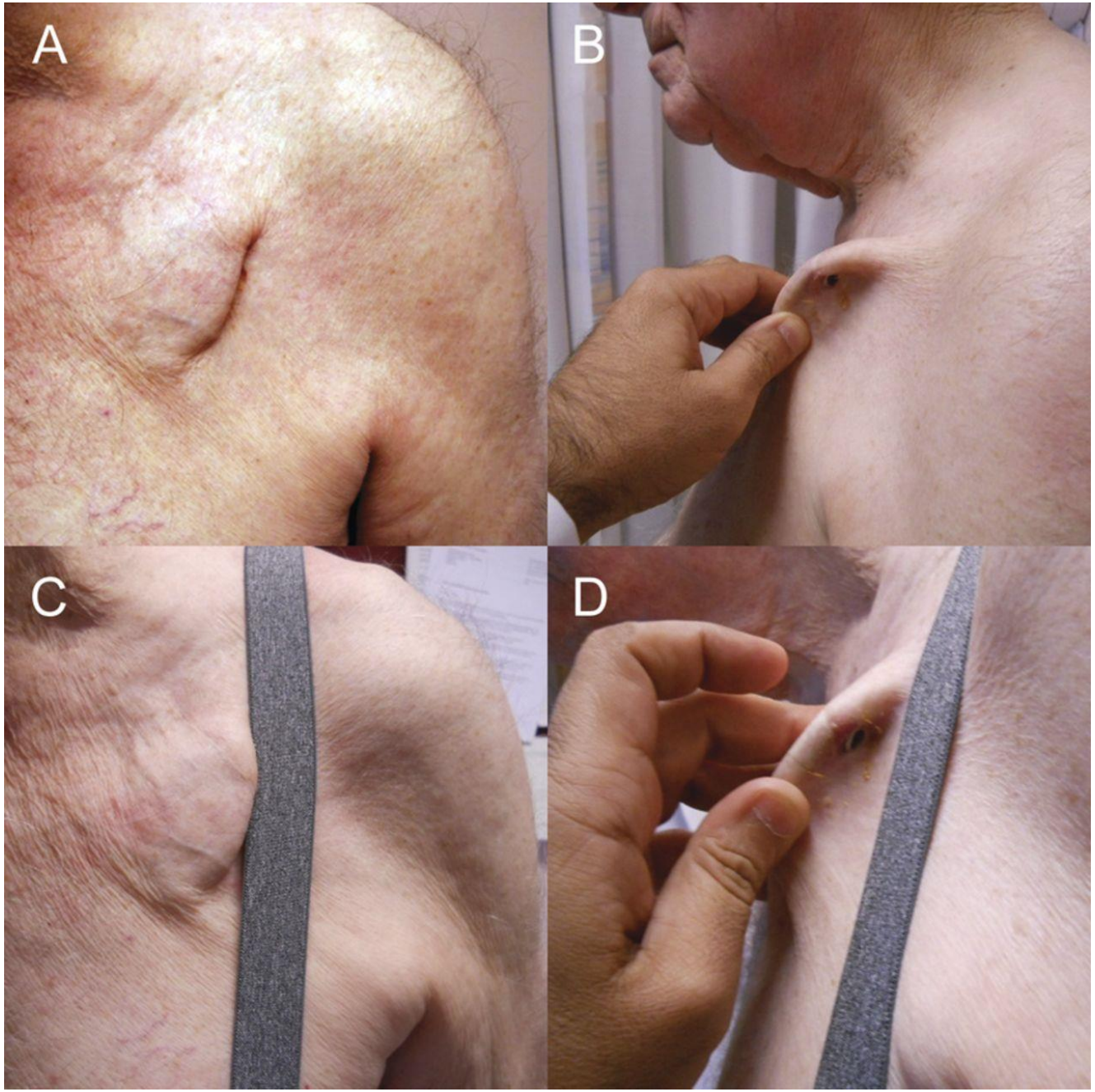











A
B
C
D

PM et ICD … les complications infectieuses

Diagnostic … *« dépistage tardif »*

- Fièvre d'origine indéterminée (+ rare chez patients âgés)
- Hémocultures et échocardiographie
- Symptômes respiratoires ou rhumatologiques … ou signes locaux (poche)
- Choc septique < 10%

Echocardiographie

- Diagnostic : végétation de sonde (taille), atteinte tricuspide, quantification de l'insuffisance tricuspide, … et follow up après extraction !
- Facteurs pronostiques : effusion péricardique, FEVG, HTAP, …

ESC 2015 modified criteria for diagnosis of IE:

Major criteria

1. Blood cultures positive for IE

a. Typical microorganisms consistent with IE from 2 separate blood cultures:
- *Viridans streptococci, Streptococcus gallolyticus (Streptococcus bovis), HACEK group, Staphylococcus aureus*; or
- Community-acquired enterococci, in the absence of a primary focus; or

b. Microorganisms consistent with IE from persistently positive blood cultures:
- ≥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 samples drawn ≥1 h apart); or

c. Single positive blood culture for *Coxiella burnetii* or phase I IgG antibody titre >1:800

2. Imaging positive for IE

a. Echocardiogram positive for IE:
- Vegetation
- Abscess, pseudoaneurysm, intracardiac fistula
- Valvular perforation or aneurysm
- New partial dehiscence of prosthetic valve

CDRIE : echocardiography inconclusive in up to 30%

b. Abnormal activity around the site of prosthetic valve implantation detected by ^{18}F-FDG PET/CT (only if the prosthesis was implanted for >3 months) or radiolabelled leukocytes SPECT/CT.

c. Definite paravalvular lesions by cardiac CT.

European Heart Journal (2015);36:3075-3123 - doi:10.1093/eurheartj/ehv319

ESC 2015 modified criteria for diagnosis of IE:

Minor criteria
1. Predisposition such as predisposing heart condition, or injection drug use.
2. Fever defined as temperature >38°C.
3. Vascular phenomena **(including those detected only by imaging)**: major arterial emboli, septic pulmonary infarcts, infectious (mycotic) aneurysm, intracranial haemorrhage, conjunctival haemorrhages, and Janeway's lesions.
4. Immunological phenomena: glomerulonephritis, Osler's nodes, Roth's spots, and rheumatoid factor.
5. Microbiological evidence: positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with organism consistent with IE.

Silent events

Definite IE : pathological criteria (culture/vegetation) or clinical criteria (2 major, 1major+3minor or 5 minor)

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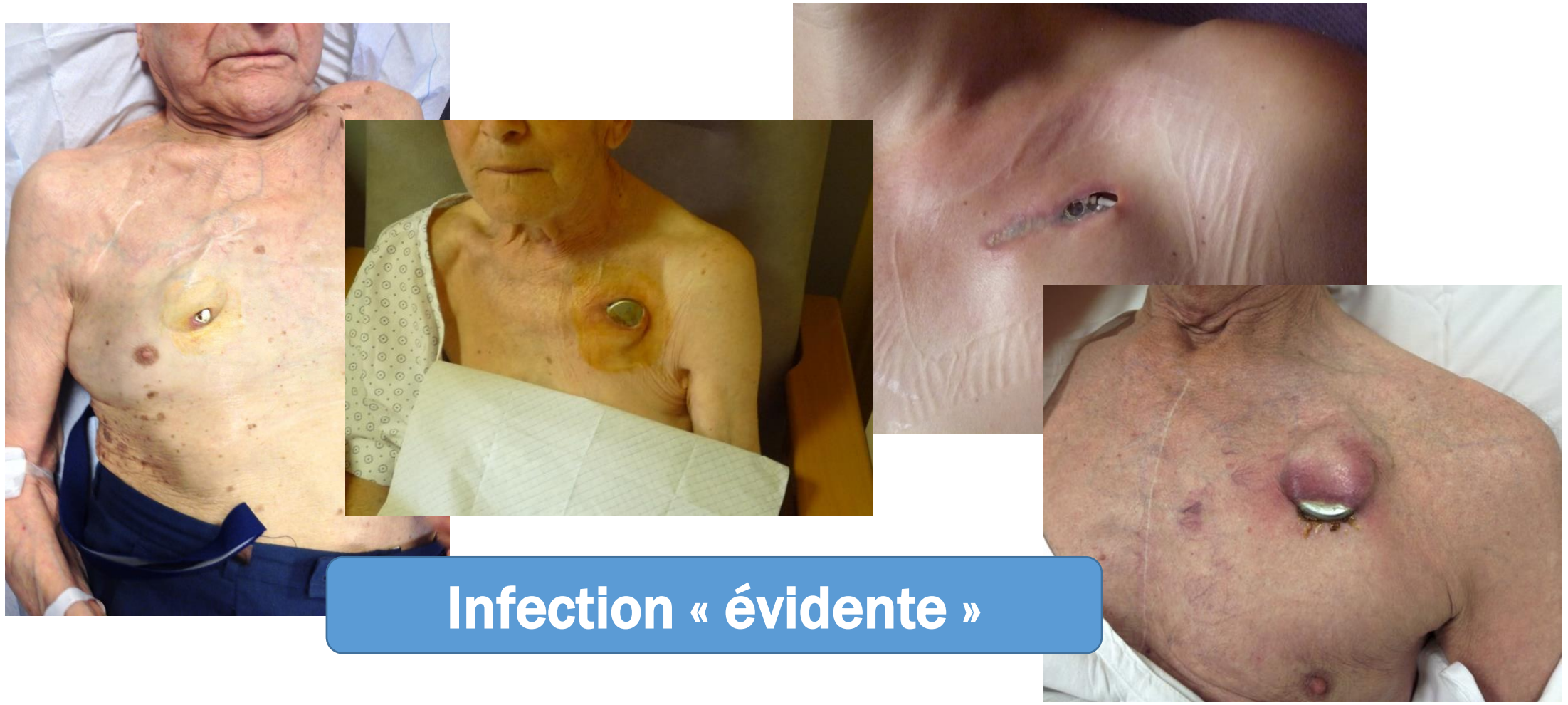


Infection « évidente »

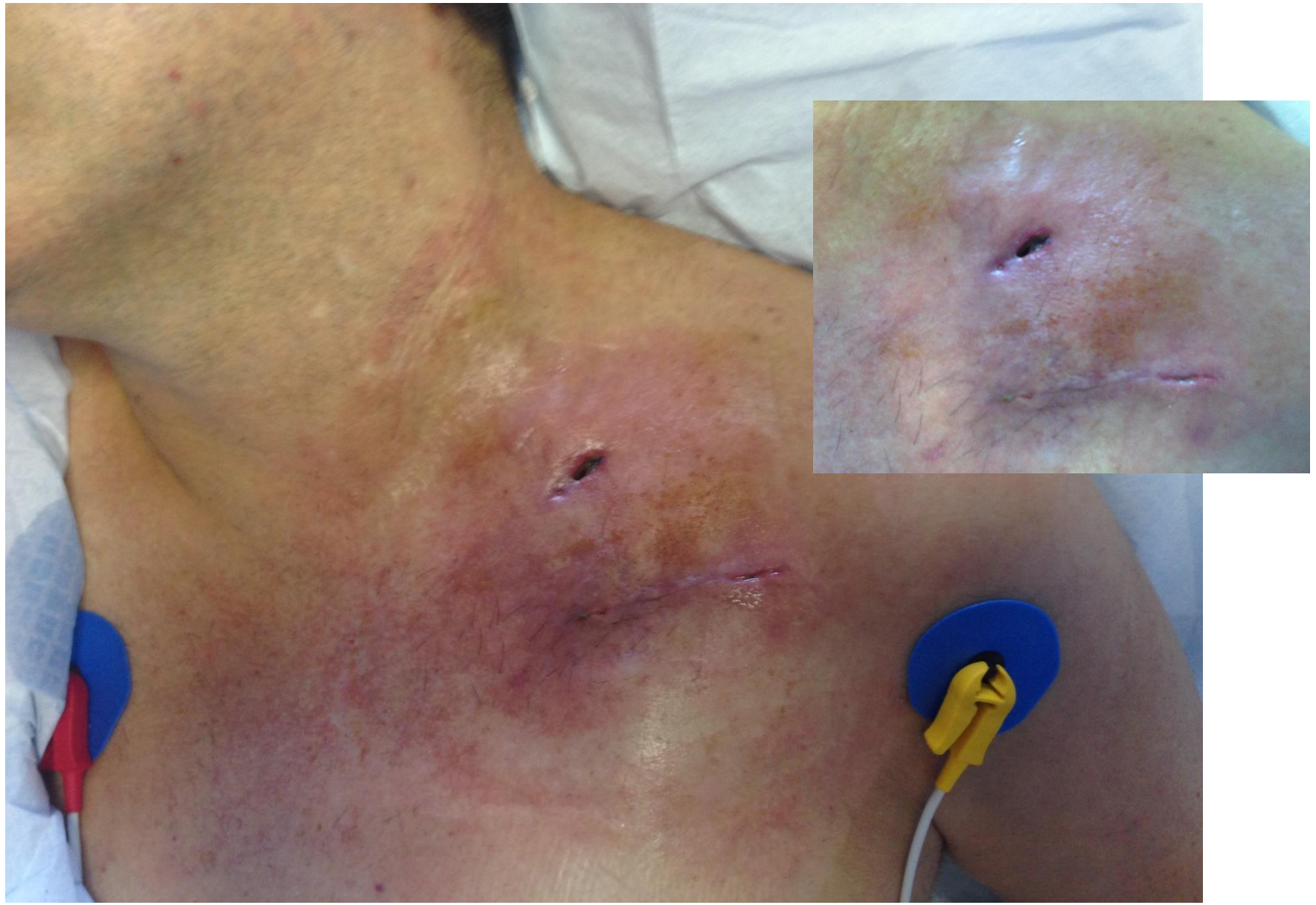
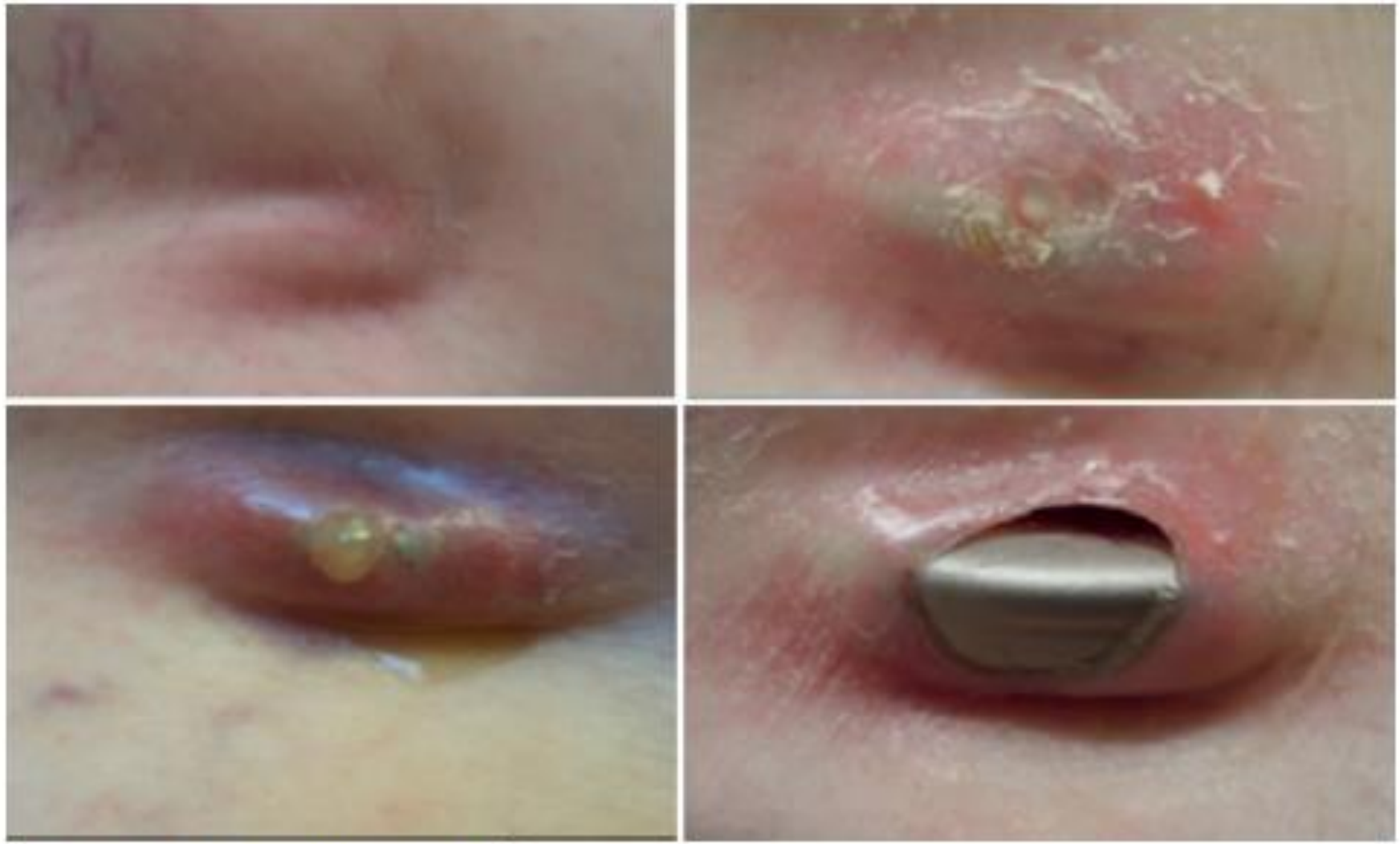


Figure 1: Images of Pocket Infection Over Two Years



Source: Tarakji and Wilkoff, 2013.[35]

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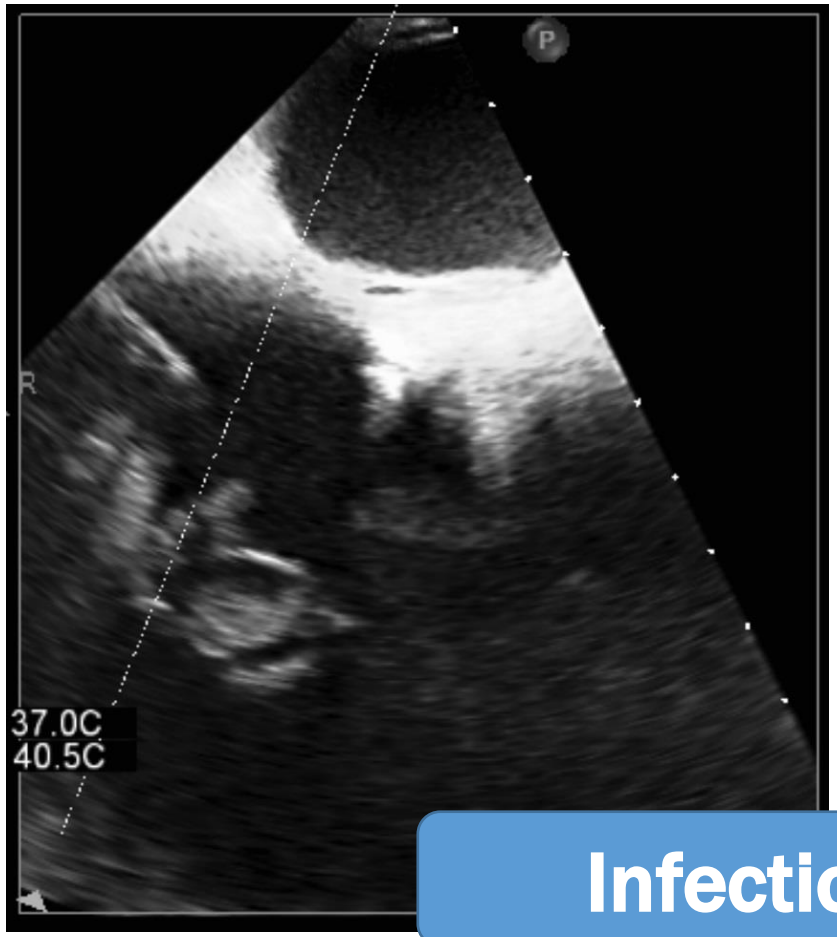

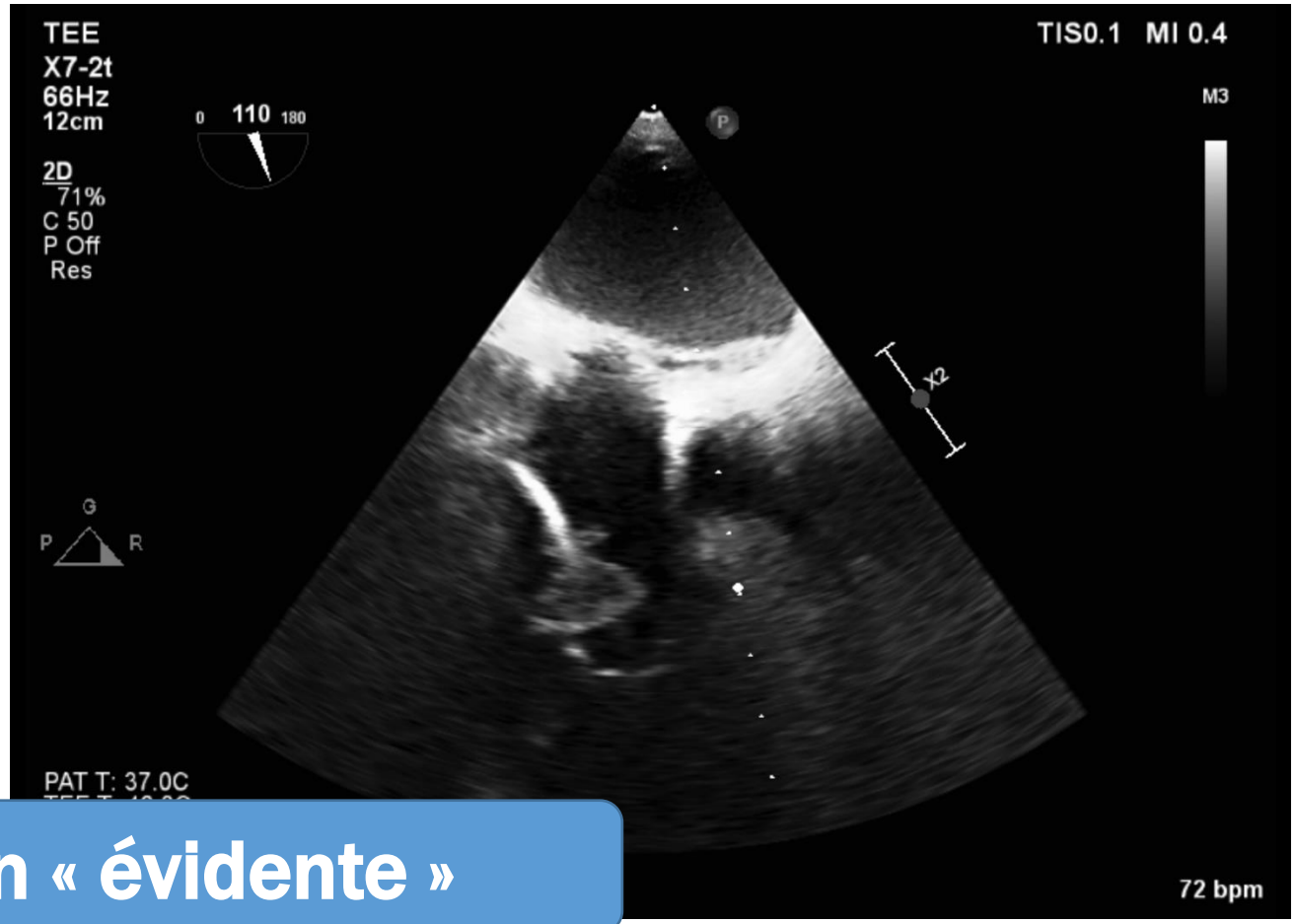

Infection « évidente »

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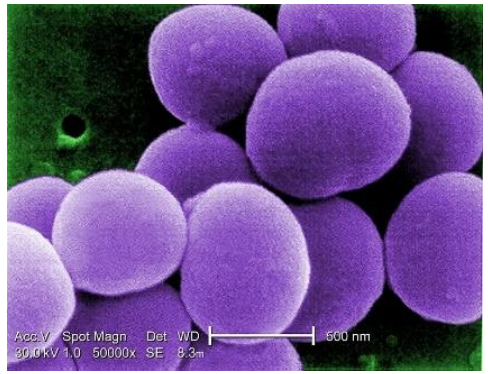
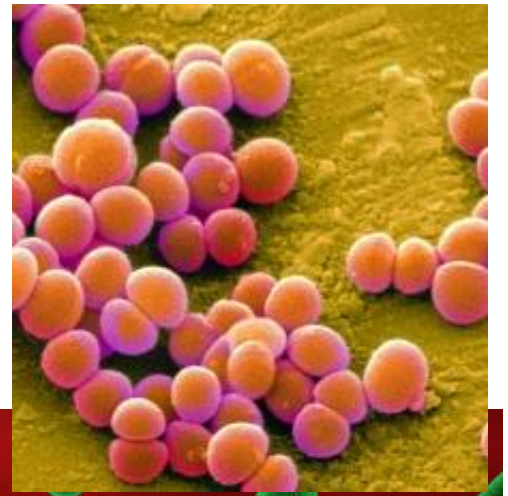
JAT Sandoe et al. Guidelines for the diagnosis, prevention and management of implantable cardiac electronic device infection. J Antimicrob Chemother 2014.

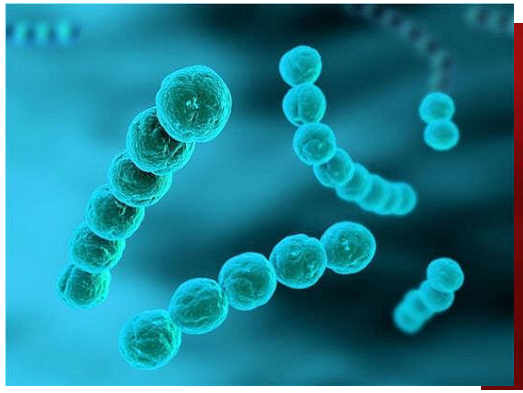
Table 1. Summary of the microbiology of implantable cardiac electronic device infection

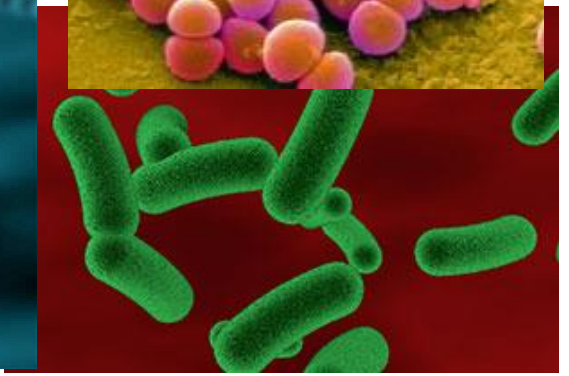
Pathogen (number of studies reporting this pathogen)	Range in studies using patients as the denominator	Range in studies using isolates as the denominator
CoNS (17)	10%[a]–68%	42%–77%
Staphylococcus aureus (16)	24%–59%	10%–30%
Gram-negative bacilli (11)	1%–17%	6%–11%
Enterococcus spp. (6)	5%–6%[b]	0.4%–10%[b]
Streptococcus spp. (5)	4%–6%[b]	3%–10%[b]
Propionibacterium spp. (3)	—	0.8%–8%
Fungi (5)	0.5%–2%	0.4%–1.4%

[a]This study only used blood cultures and had high culture negativity (49%).
[b]This study reported *Streptococcus* and *Enterococcus* spp. together.









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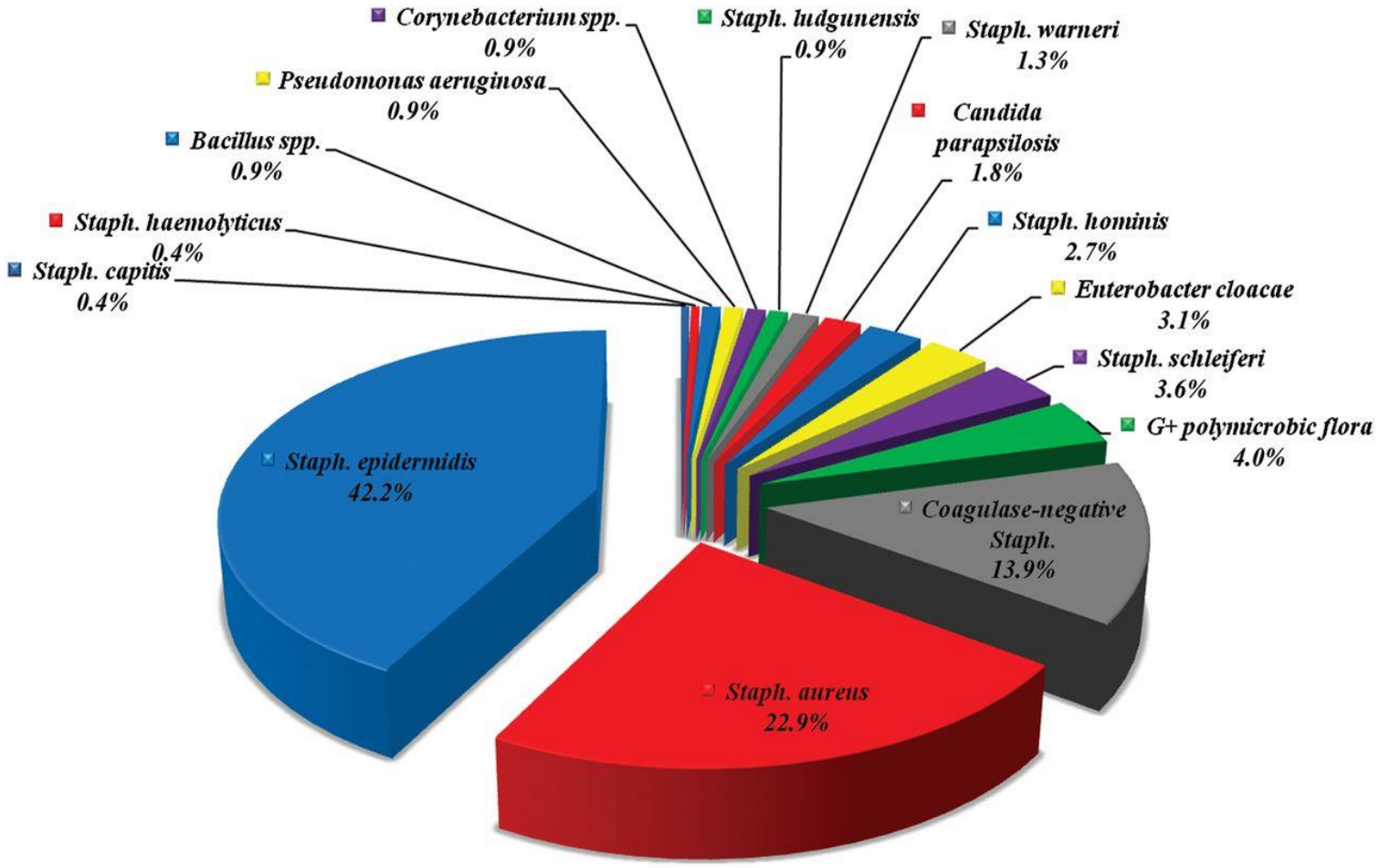
Lead vegetations in patients with local and systemic cardiac device infections: prevalence, risk factors and therapeutic effects.

- 293 leads (136 pts)
- Mean age 70,5 years
- Lead vegetation 40,4%
- Risk factors : renal failure & dialysis, revision, CRT, fever & WBC, …



PG.Golzio. Europace 2013

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15-20% de (hémo)cultures négatives

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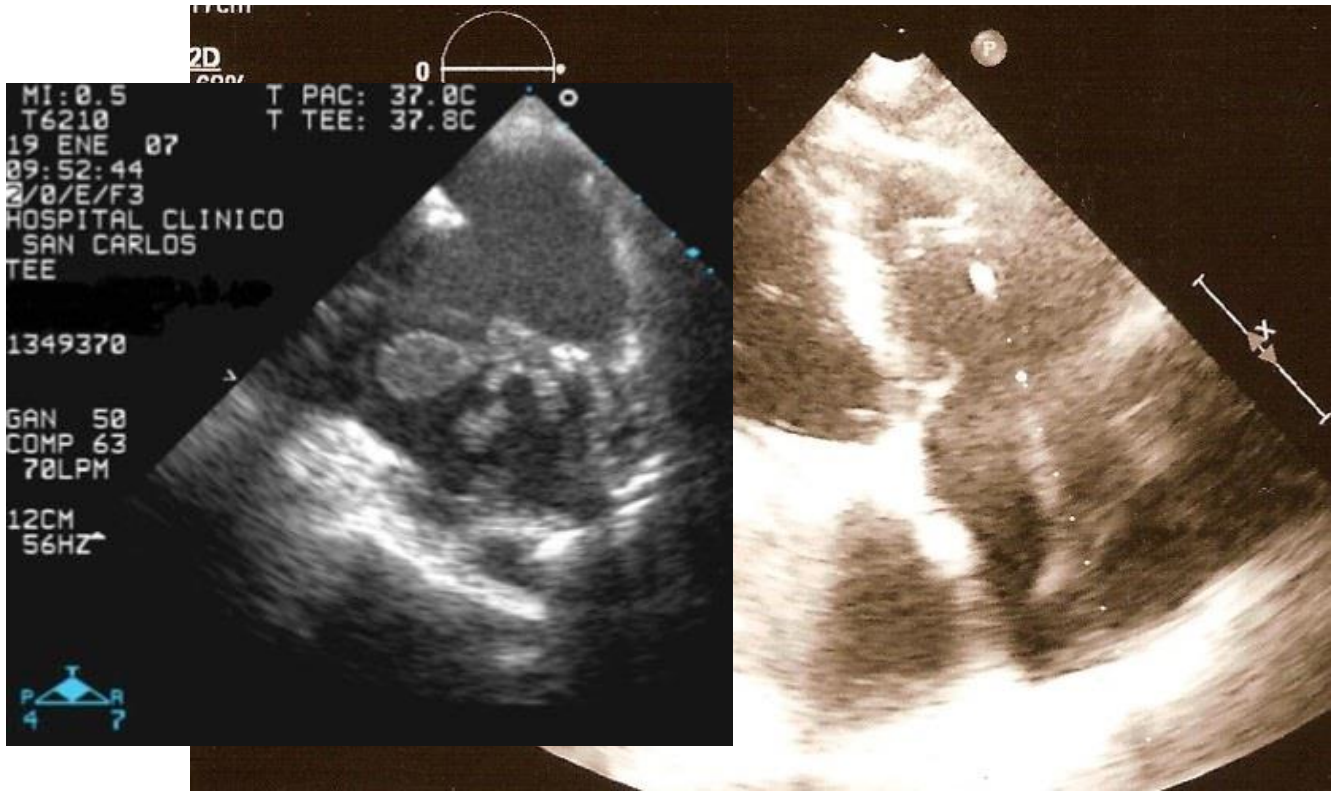
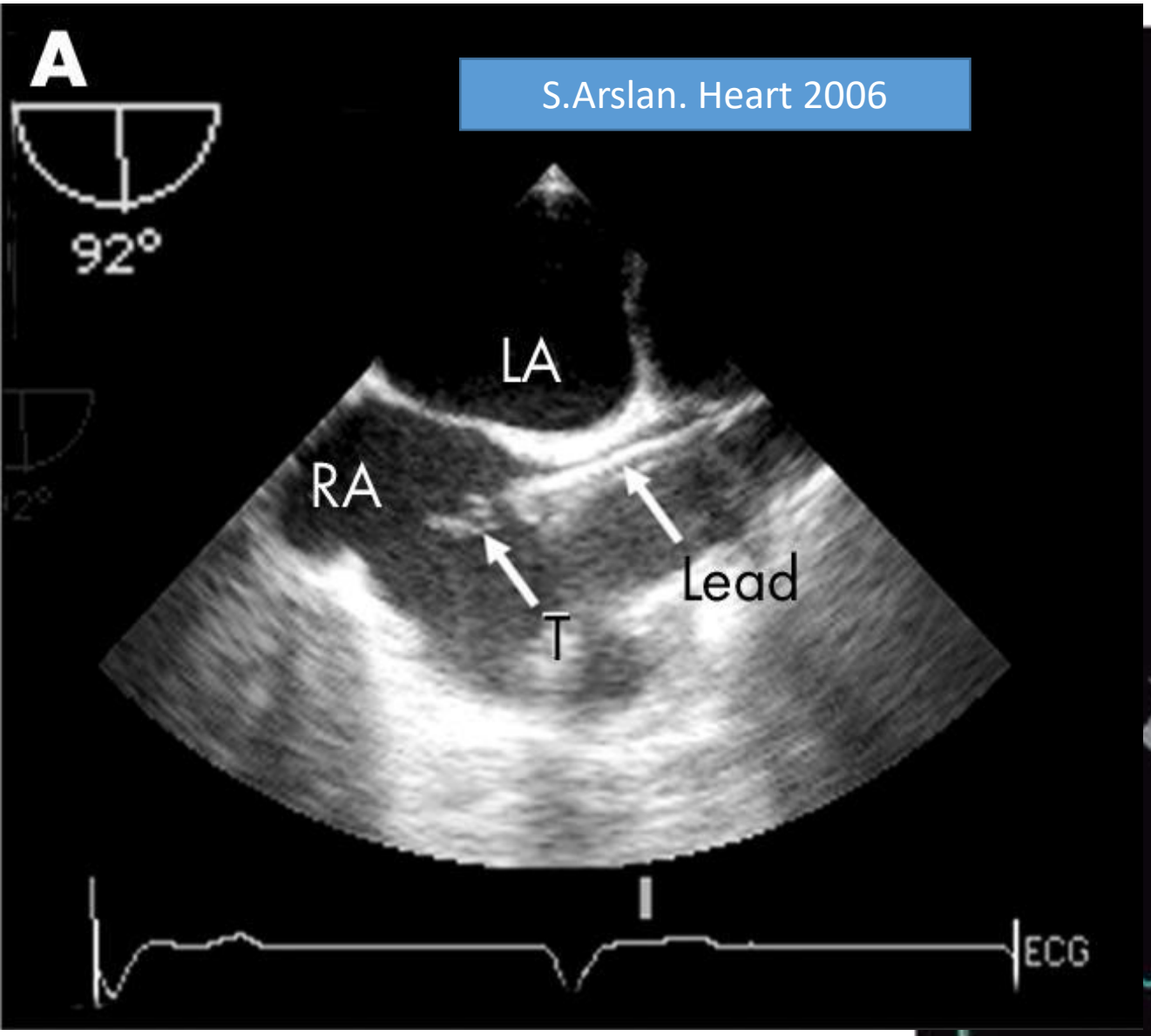
Problématique = « bactériémie + device »

Incidence de thrombus ou filaments sur les sondes

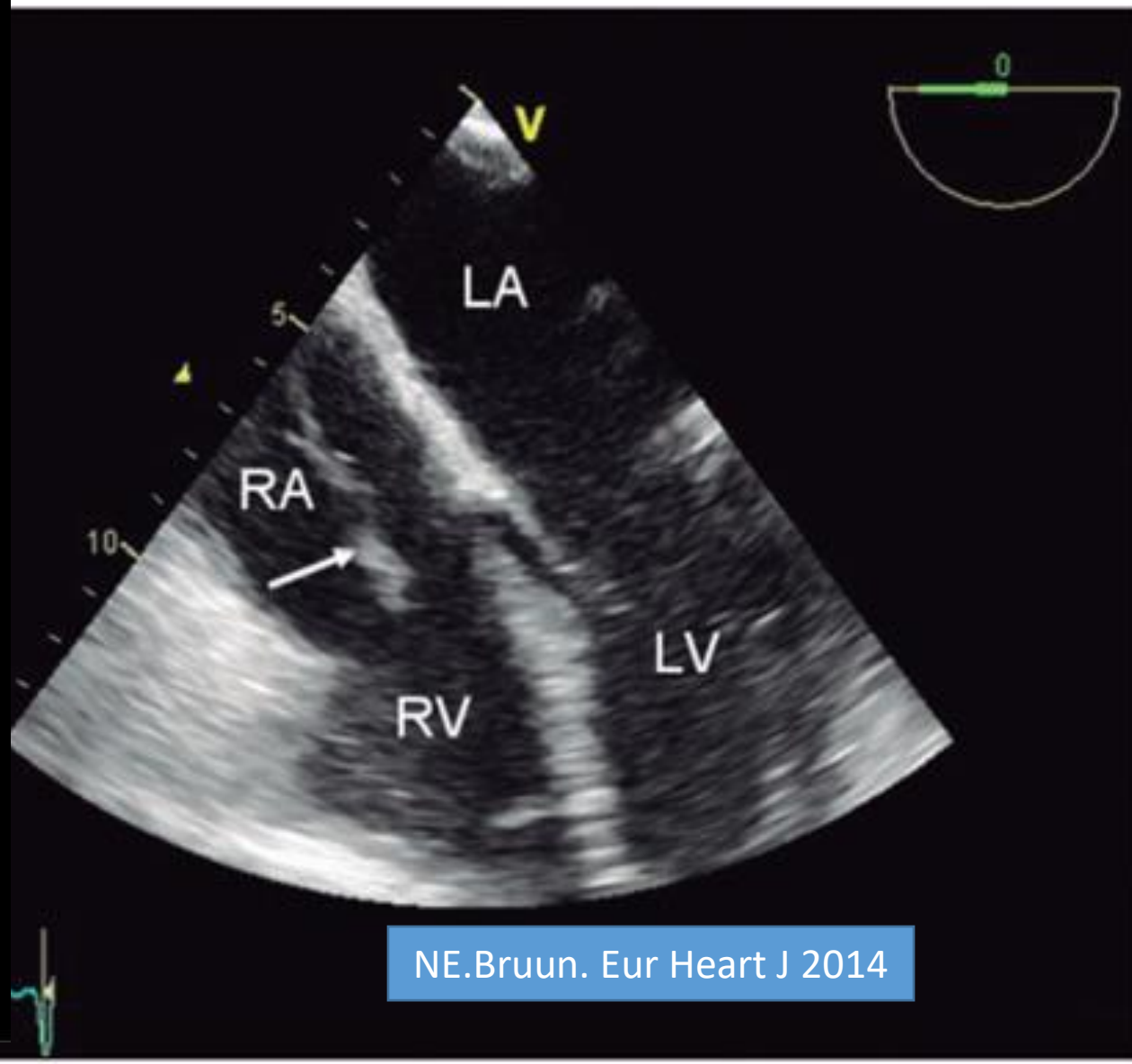
→ Mobiles :

- 10-15% en ETT (tout venant)
- 30% (ICE) lors de procédures d'ablation (Circulation 2011)
  - Thrombus +/- 20 mm
  - OD >> VD





S.Arslan. Heart 2006



NE.Bruun. Eur Heart J 2014

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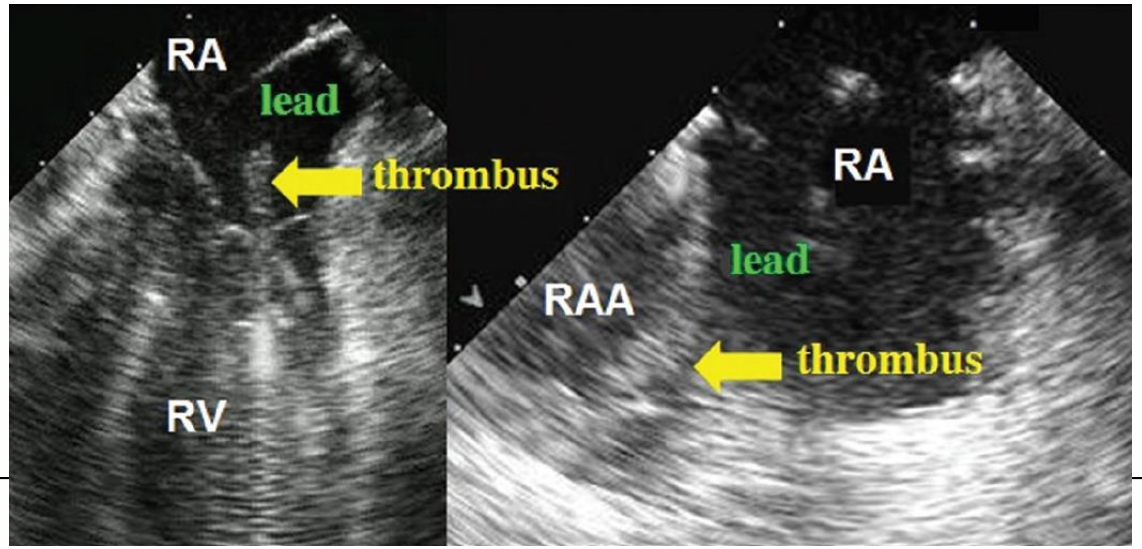
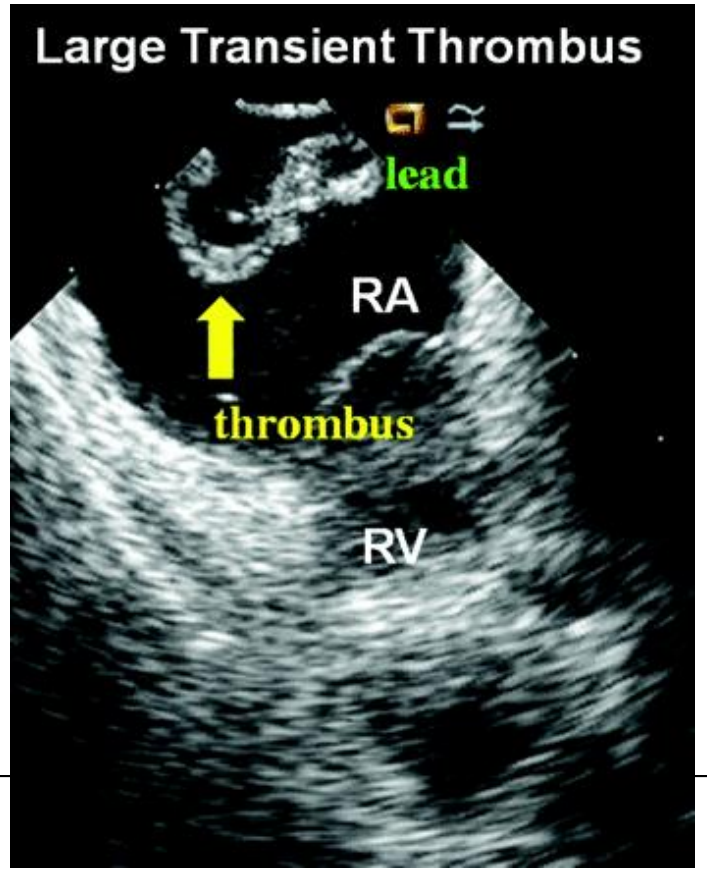
- Ref : GE. Supple, et al. Mobile thrombus on device leads in patients undergoing ablation. Circulation 2011; 124: 772-8
- Thrombi with ICE
  - in 26 of 86 patients (30%) … only 1/26 on ETT
  - mobile, 18±5.9 mm long by 4.4±2.3 mm wide





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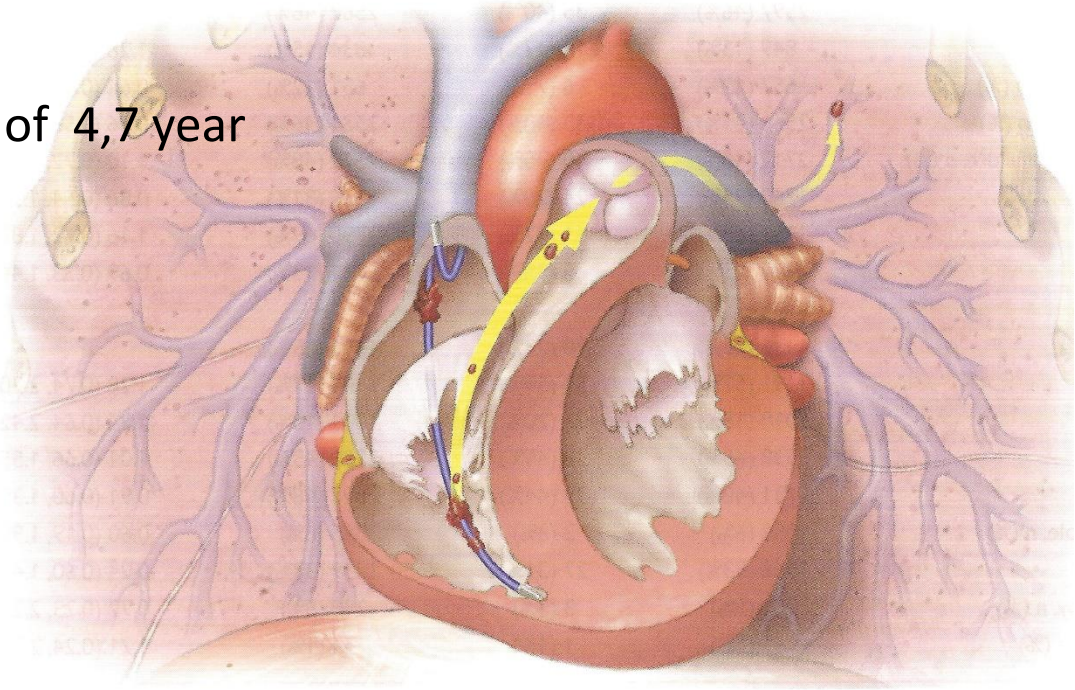
- Ref : A. Noheria, et al. Pulmonary embolism in patients with transvenous cardiac implantable electronic device leads. Europace 2016; 18: 246-252
- Mayo Clinic (2000-2010) :
  - 88 PE / 5646 CIED patients (1,6%), mean FU of 4,7 year
  - … incidence 3,32 per 1,000 person/years
- Pulmonary Embolism :
  - 22% despite anticoagulation therapy,
  - 84% had other causes of PE
    = recent surgery, malignancy,
    prior history of DVT/PE)
  - 51% deaths



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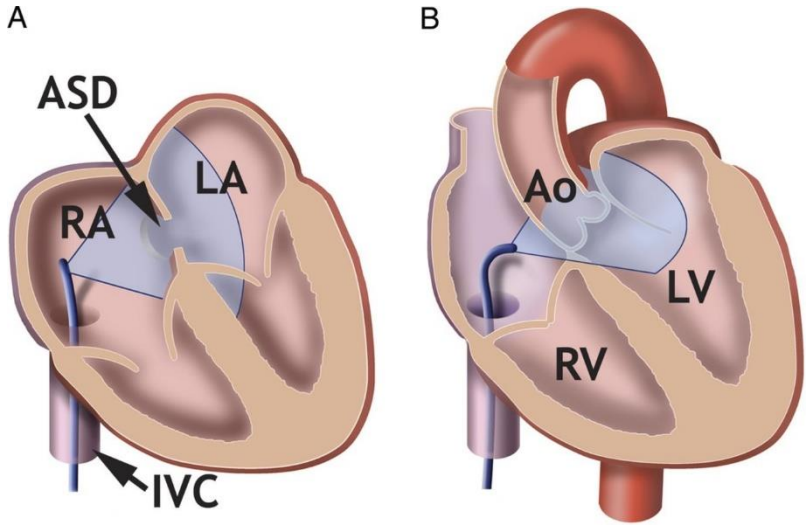
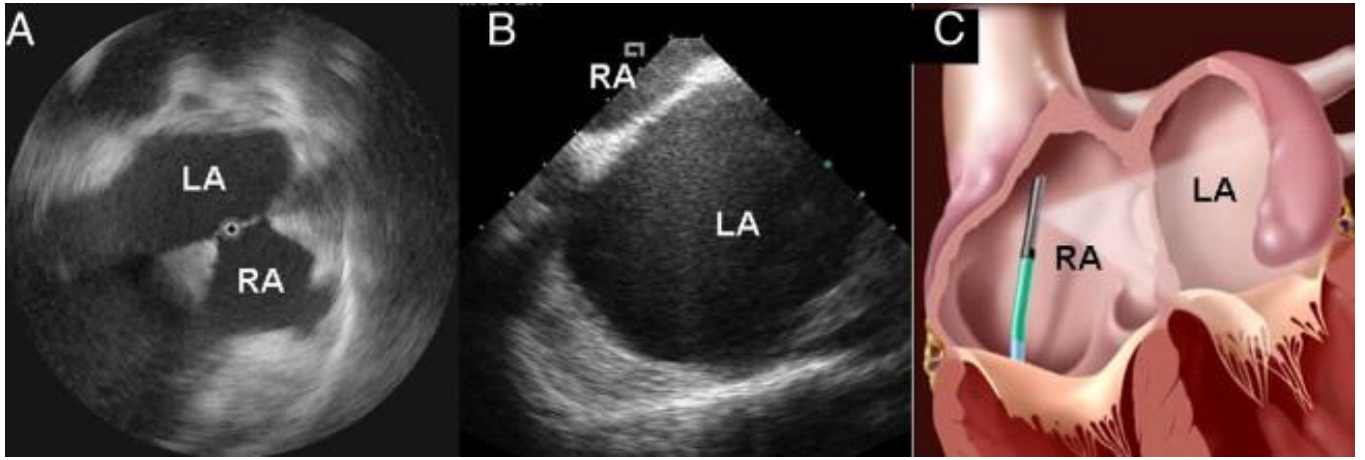
ICE

- Excellente résolution, limite l'irradiation, sureté
- Prix (usage unique), courbe d'apprentissage, …





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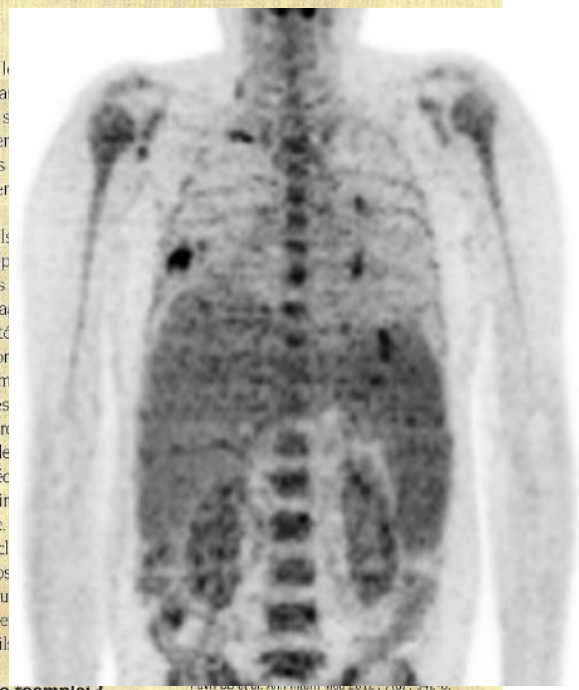
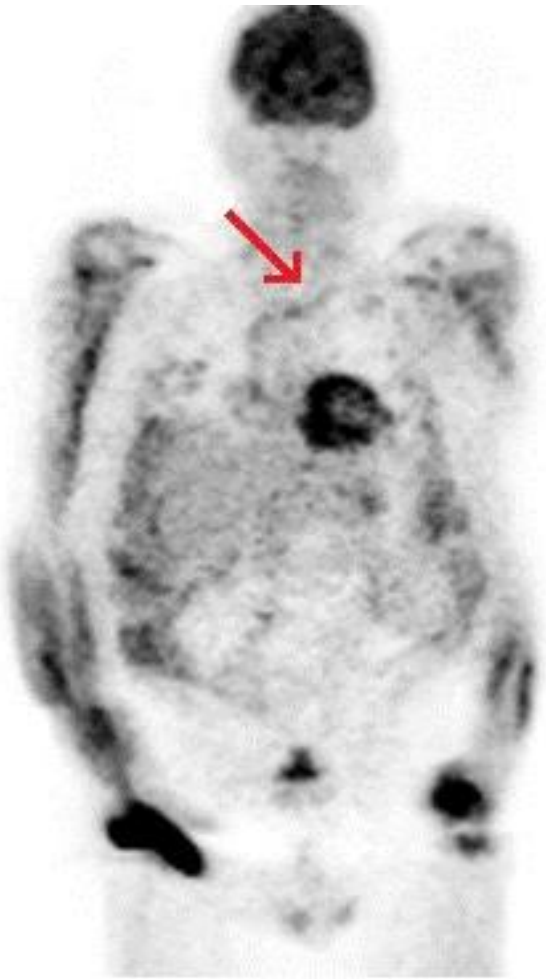
CONGRÈS

SOCIÉTÉ BELGE DE CARDIOLOGIE

Les infections sur appareils cardiaques implantables, cela existe

Comme tout matériel étranger, les appareils cardiaques implantables peuvent favoriser la formation de foyers infectieux. Au congrès de la Société Belge de Cardiologie, l'équipe de l'Hôpital de Jolimont a rapporté un cas. La littérature en fait état également.





germes responsables l
sont ceux de la peau, pa
phylocoque doré et les s
agulase négatifs occuper
tante. Mais des cas dus

de reemploi ?

étude indienne (Pavri *et al.*) qui s'est intéressée au réemploi des défi-

six mois fut totalement rassurant.

ou encore l'appareillage lui-même. Les

• Pirson N et al. Poster présenté au 32th Annual Scientific Meeting de la Société Belge de Cardiologie (Bruxelles, 31/1-1/2 2013).

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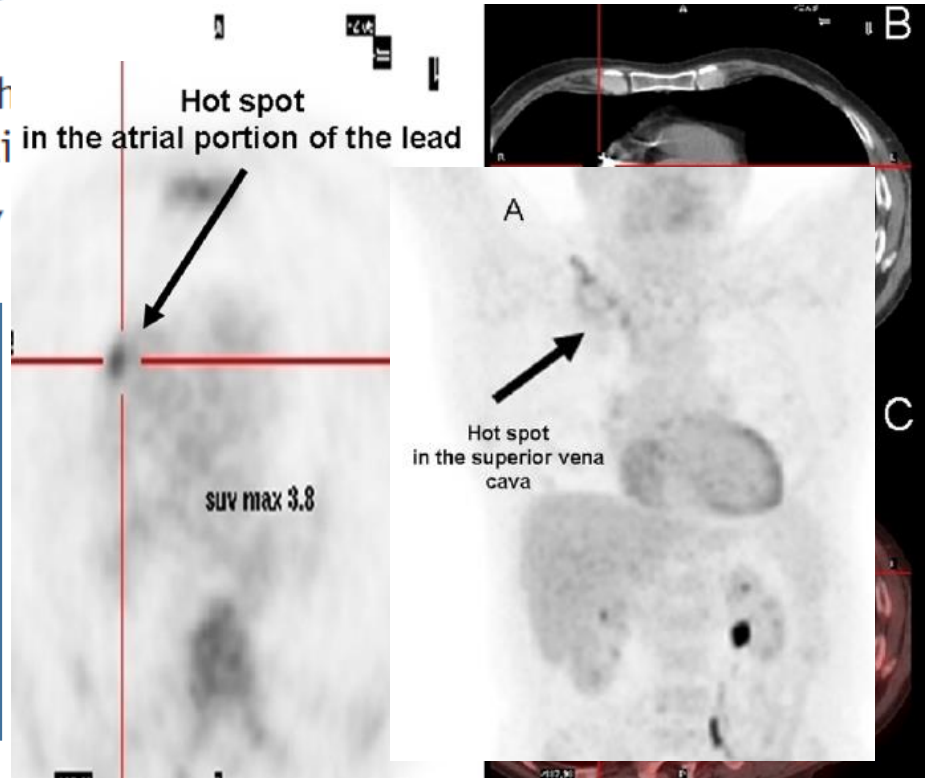
Positron emission tomography in patients with suspected pacing system infections may play a critical role in difficult cases

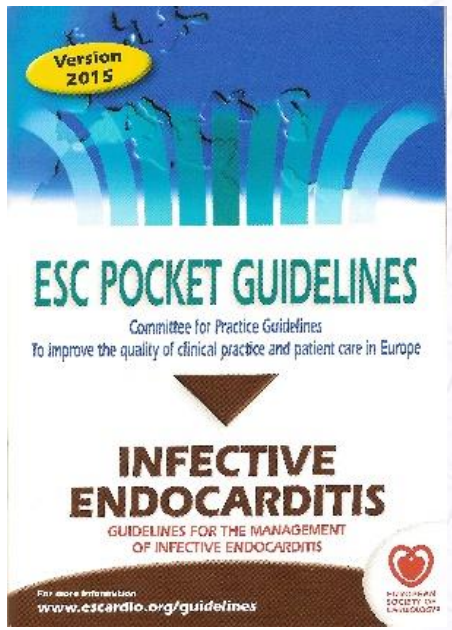
(Heart Rhythm 2011;8:1478–1481) © 2011 Published by Elsevier Inc. on behalf of Heart Rhythm Society.

Sylvain Ploux, MD,* Annalisa Riviere, MD,* Sana Amraoui, MD, Zach
Laurent Barandon, MD, PhD, Stephane Lafitte, MD, PhD, Philippe Ri
Georgios Papaioannou, MD, Jacques Clementy, MD, Pierre Jais, MD,
Michel Haissaguerre, MD, Pierre Bordachar, MD

- Dix pts + PM avec fièvre d'origine indéterminée malgré ETO + 40 patients dans le groupe contrôle
- FDG Pet Scanner
  - 37/40 (92,3%) normal Pet Scanner
  - 6/10 + fièvre : positif → extraction + cultures (+)
  - 4/10 + fièvre : négatif → pas d'extraction et FU (-)



Cardiac device-related infective endocarditis (CDRIE)



Recommendations	Class	Level
A. Diagnosis		
1. Three or more sets of blood cultures are recommended before prompt initiation of antimicrobial therapy for CIED infection.	I	C
2. Lead-tip culture is indicated when the CIED is explanted.	I	C
3. TOE is recommended in patients with suspected CDRIE with positive or negative blood cultures, independent of the results of TTE, to evaluate lead-related endocarditis and heart valve infection	I	C
4. Intracardiac echocardiography may be considered in patients with suspected CDRIE, positive blood cultures and negative TTE and TOE.	IIb	C
5. Radiolabelled leukocyte scintigraphy and ^{18}F-FDG PET/CT scanning may be considered additive tools in patients with suspected CDRIE, positive blood cultures, and negative echocardiography.	IIb	C

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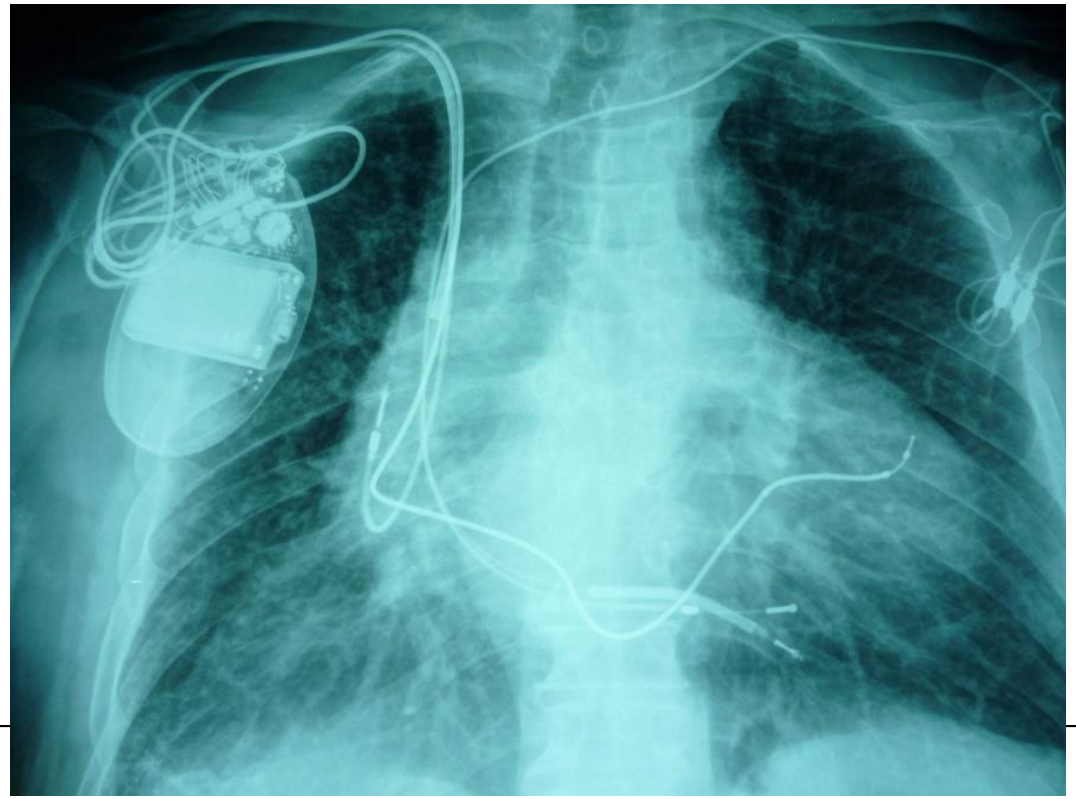
PM et ICD … les complications infectieuses

Et maintenant … mon patient a une endocardite de sondes … que faire ???

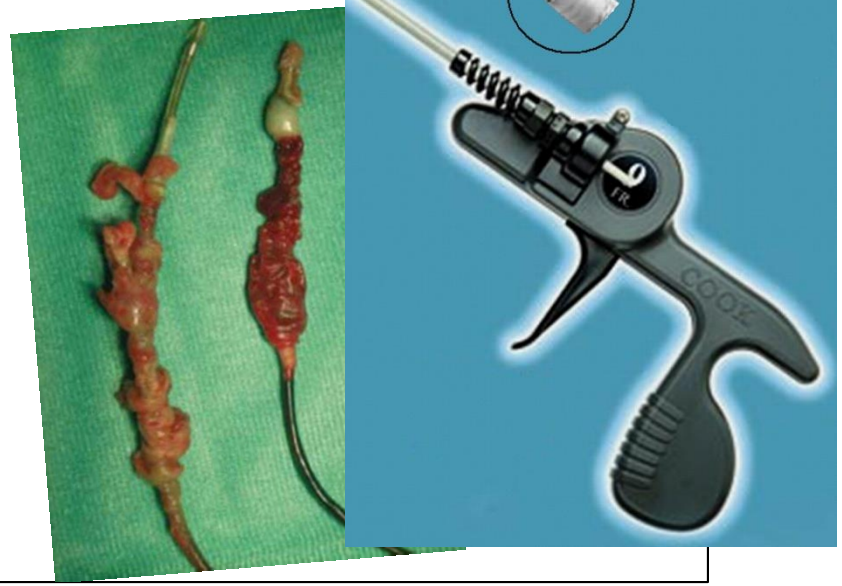


CENTRES HOSPITALIERS JOLIMONT ASBL

PM et ICD … les complications infectieuses

Traitement = antibiotiques IV + retrait complet du matériel implanté (boitier + sonde(s))

4-6 semaines



… dont 2 semaines après extraction

CENTRES HOSPITALIERS JOLIMONT ASBL

PM et ICD … les complications infectieuses

Traitement = antibiotiques IV + retrait complet du matériel implanté (boitier + sonde(s))

- Antibiotiques … vancomycine IV, puis selon les hémocultures
- Traitement médical seul = mortalité élevée et récidives +++ (même si suspicion dans le cas d'infection occulte sans source apparente que le PM/ICD)
- Procédure d'extraction :
  - procédure transveineuse >> chirurgie (végétations > 2 cm)
  - (risque décès 0,1-0,6%)
  - uniquement dans des centres expérimentés (haut volume)
- 3-15% : refus d'extraction ou « unsuitable » pour extraction !! (J Antimicrob Chemother 2014)

PM et ICD ... les complications infectieuses

Europace (2012) **14**, 124–134
doi:10.1093/europace/eur338

EHRA POSITION PAPER

JC.Deharo, MG.Bongiorni, et al.

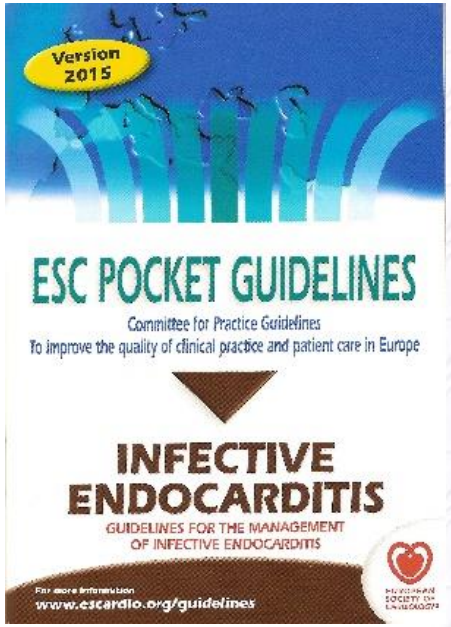
Pathways for training and accreditation for transvenous lead extraction: a European Heart Rhythm Association position paper

- Mimimun de training pour les **opérateurs**
- Minimum de volume pour les **centres**
- **Personnel requis** : opérateur, backup chirurgical, support anesthésique, nurses pour support respiratoire, échographiste
- **Equipement** : salle hybride
- **Protocole du centre**, database, registre

Table 3 Recommendations on minimum training and volume for lead extractor operators and centres

Lead extraction status	Minimum number of leads	Minimum number of procedures	Additional requirements
Trainee	40 leads under supervision: 10 ICD leads, 10 leads > 6 years old	30 10 with ≥ 2 leads	Full qualification in CIED implantation
Primary operator (trained)	20/year	15/year	
Supervisor trainer	75 total	30/year	
Non-training centre	20/year	15/year	1 primary operator
Training centre		30/year	1 supervisor trainer

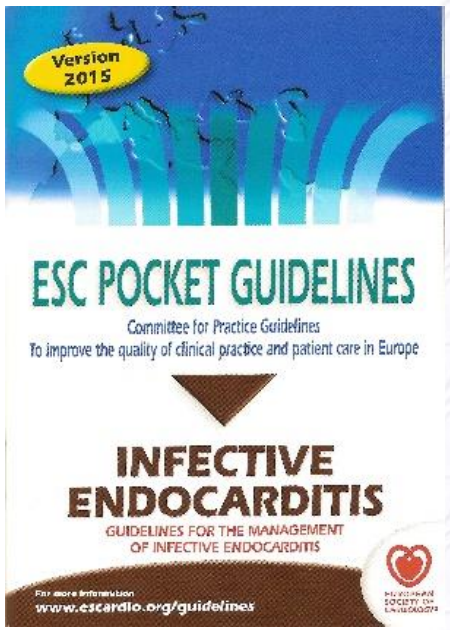
Cardiac device-related infective endocarditis (CDRIE)



Recommendations	Class	Level
B. Principles of treatment		
1. Prolonged (i.e. before and after extraction) antibiotic therapy and complete hardware (device and leads) removal are recommended in definite CDRIE, as well as in presumably isolated pocket infection.	I	C
2. Complete hardware removal should be considered on the basis of occult infection without other apparent source of infection.	IIa	C
3. In patients with NVE or PVE and an intracardiac device with no evidence of associated device infection, complete hardware extraction may be considered. (NVE - PVE : Native - Prosthetic Valve Endocarditis)	IIb	C
C. Mode of device removal		
1. Percutaneous extraction is recommended in most patients with CDRIE, even those with vegetations >10 mm.	I	B
2. Surgical extraction should be considered if percutaneous extraction is incomplete or impossible or when there is associated severe destructive tricuspid IE. (IE : Infective Endocarditis)	IIa	C
3. Surgical extraction *may* be considered in patients with large vegetations (>20 mm).	IIb	C

European Heart Journal (2015);36:3075-3123 - doi:10.1093/eurheartj/ehv319

Cardiac device-related infective endocarditis (CDRIE)



Recommendations	Class	Level
D. Reimplantation		
1. After device extraction, reassessment of the need for reimplantation is recommended.	I	C
2. When indicated, definite reimplantation should be postponed if possible to allow a few days or weeks of antibiotic therapy.	IIa	C
3. A "temporary" ipsilateral active fixation strategy may be considered in PM-dependent patients requiring appropriate antibiotic treatment before reimplantation.	IIb	C
4. Temporary pacing is not routinely recommended.	III	C
E. Prophylaxis		
1. Routine antibiotic prophylaxis is recommended before device implantation.	I	B
2. Potential sources of sepsis should be eliminated ≥2 weeks before implantation of a intravascular/cardiac foreign material, except in urgent procedures.	IIa	C

European Heart Journal (2015);36:3075-3123 - doi:10.1093/eurheartj/ehv319

EUROPEAN SOCIETY OF CARDIOLOGY®

CENTRES HOSPITALIERS JOLIMONT ASBL

PM et ICD ... les complications infectieuses

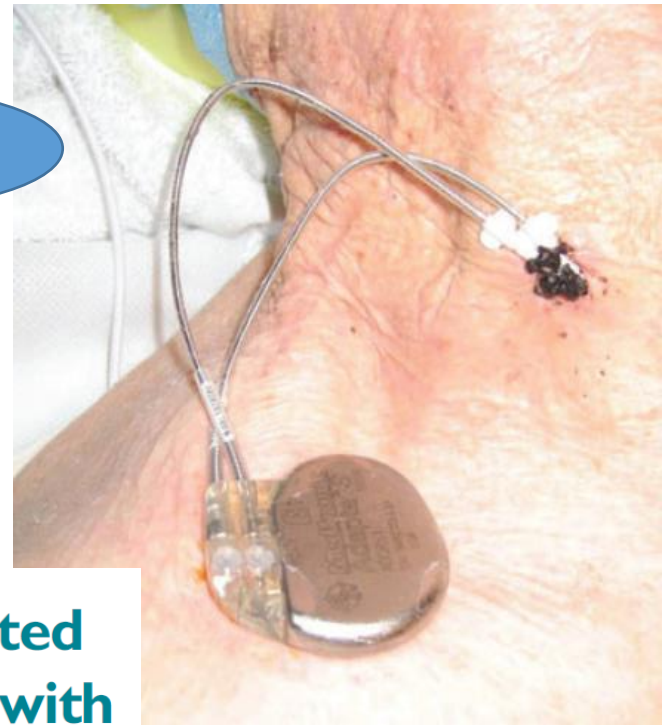
Europace (2013) 15, 1287–1291
doi:10.1093/europac

H. Kawata, et al.

CLINICAL RESEARCH
Pacing and resynchronization therapy

23 patients

Utility and safety of temporary pacing using active fixation leads and externalized re-usable permanent pacemakers after lead extraction



17 patients

S.Pecha, et al. Europace 2013

Transcutaneous lead implantation connected to an externalized pacemaker in patients with implantable cardiac defibrillator/pacemaker infection and pacemaker dependency

8 patients

A.Lepillier, et al. Europace 2012

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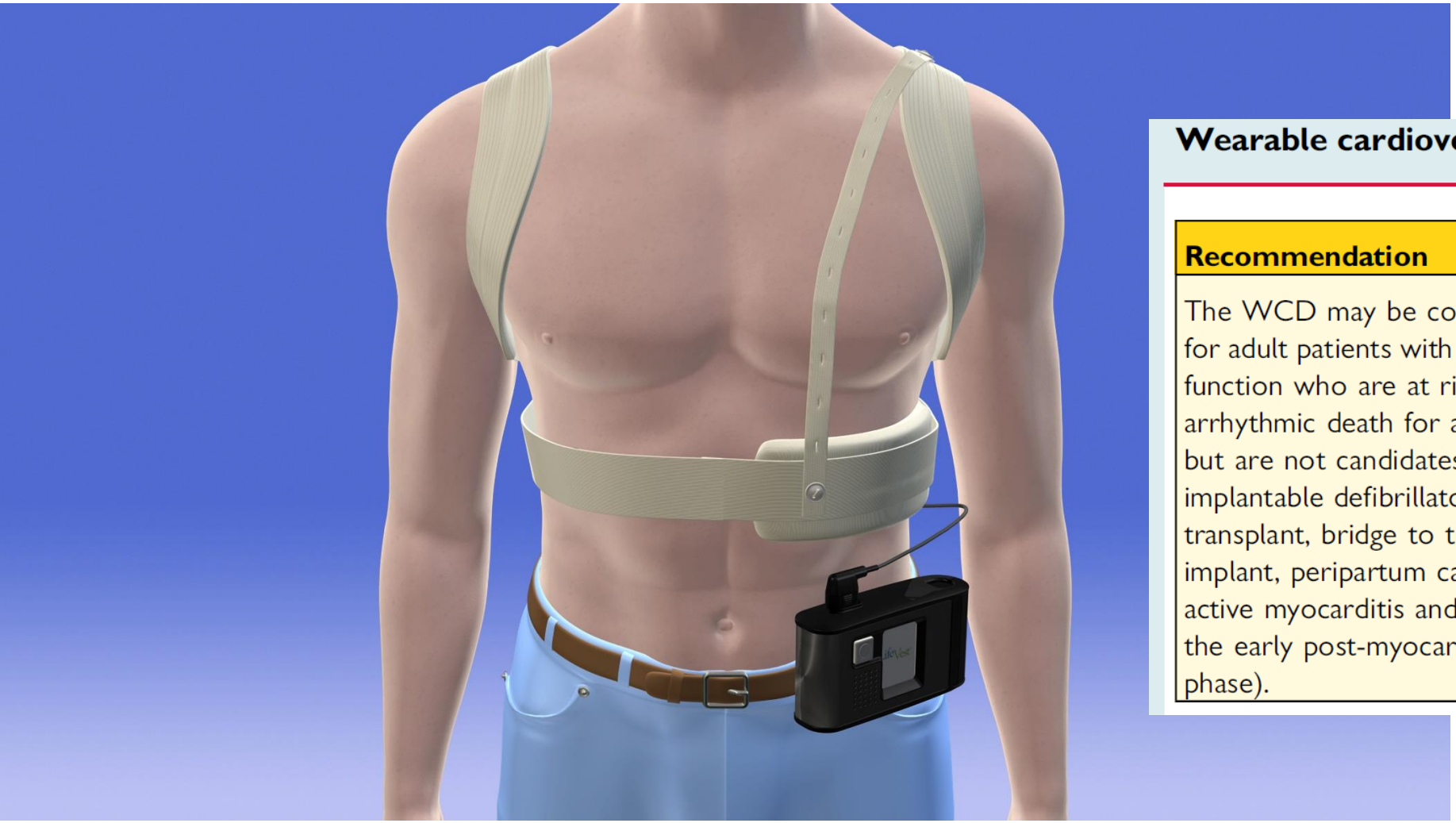


Wearable cardioverter defibrillator

Recommendation	Class[a]	Level[b]
The WCD may be considered for adult patients with poor LV systolic function who are at risk of sudden arrhythmic death for a limited period, but are not candidates for an implantable defibrillator (e.g. bridge to transplant, bridge to transvenous implant, peripartum cardiomyopathy, active myocarditis and arrhythmias in the early post-myocardial infarction phase).	IIb	C

CENTRES HOSPITALIERS JOLIMONT ASBL

PM et ICD … les complications infectieuses

Et l'avenir ???

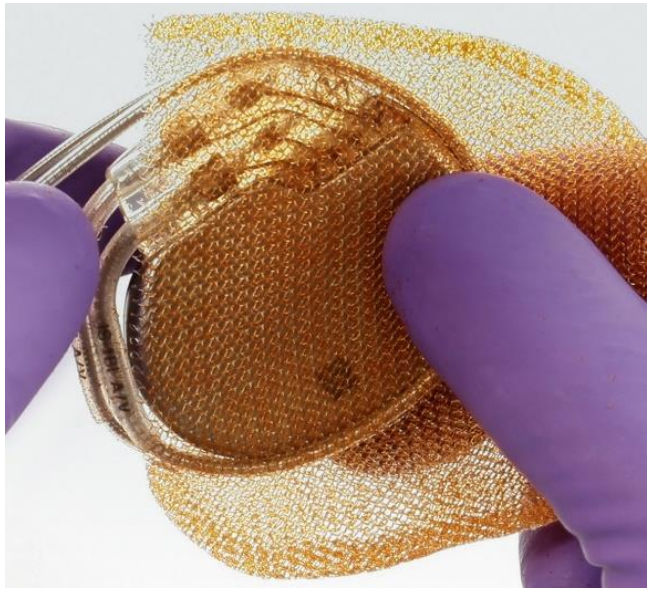
…. Prophylaxie antibiotique, c'est quoi ?

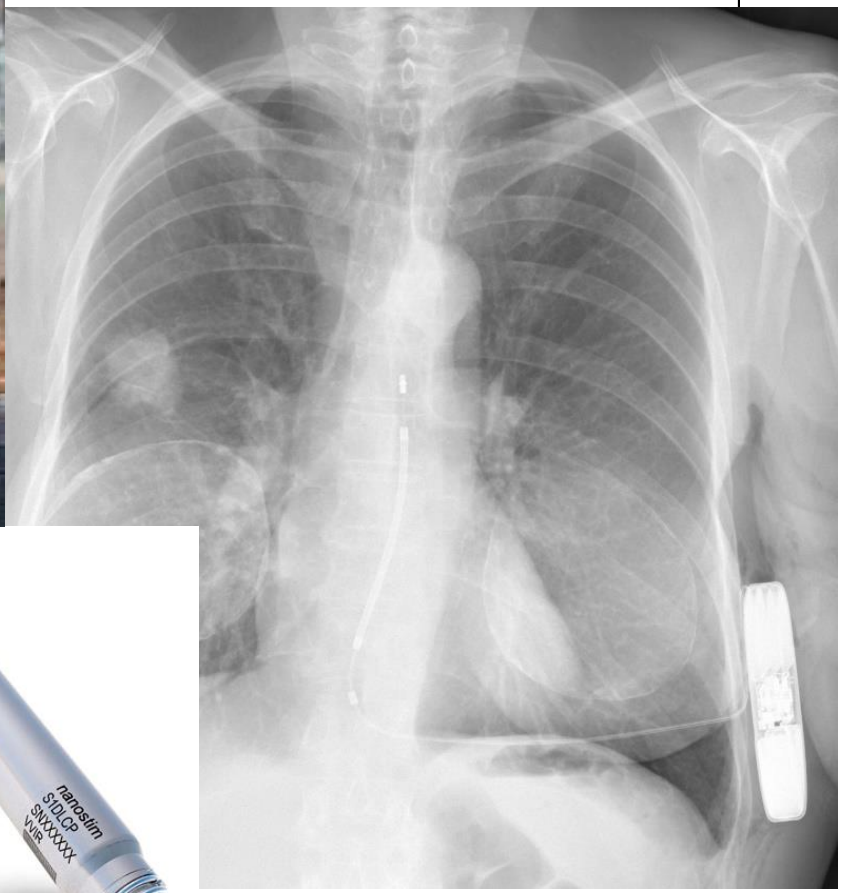
- Antibiotique ? Cefazolin (Kefzol 1g IV, 60-120 min avant procédure) ? Vancomycine ? Clindamycine ?
- Préopératoire ?
- Timing ? 60-120 min avant incision, ou après intervention ?
- Durée de la prophylaxie ? Cefazolin 6g par jour pd 24-36h
- Eradication du Staphylocoque doré si porteur nasal ?

CENTRES HOSPITALIERS JOLIMONT ASBL

PM et ICD … les complications infectieuses

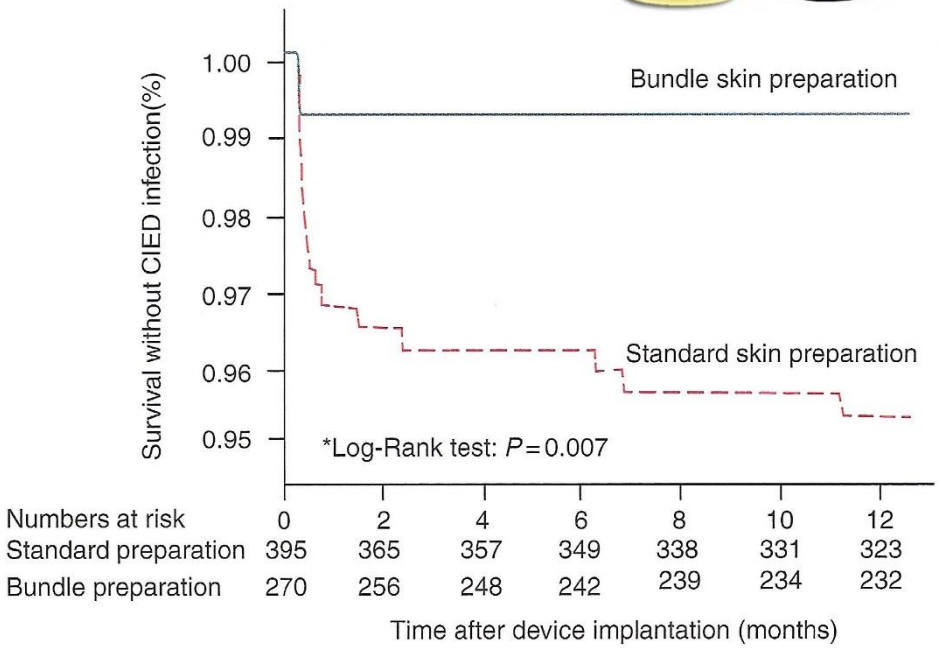
Et l'avenir ???





PM et ICD … les complications infectieuses

Et l'avenir ???



Europace (2016) 18, 858–867
doi:10.1093/europace/euv139

CLINICAL RESEARCH
Pacing and resynchronization therapy

Bundled preparation of skin antisepsis decreases the risk of cardiac implantable electronic device-related infection

Huang-Chung Chen[1], Mien-Cheng Chen[1]*, Yung-Lung Chen[1], Tzu-Hsien Tsai[1], Kuo-Li Pan[2], and Yu-Sheng Lin[2]

« Bundle skin antiseptic preparation » =

- Applying 75% alcohol over anterior chest on the night before the index day
- Povidone-iodine 10 min before operation
- The standard skin preparation before incision

CENTRES HOSPITALIERS JOLIMONT ASBL

PM et ICD … les complications infectieuses

Et l'avenir ???

CENTRES HOSPITALIERS JOLIMONT ASBL

PM et ICD … les complications infectieuses

Et l'avenir ???

« Endocarditis Team »

- Discussion de cas
- Prise de décision
- Définir le follow-up
- Participation au registres
- Améliorer la qualité du management (éducation)
- Revoir cause(s) de décès

CENTRES HOSPITALIERS JOLIMONT ASBL

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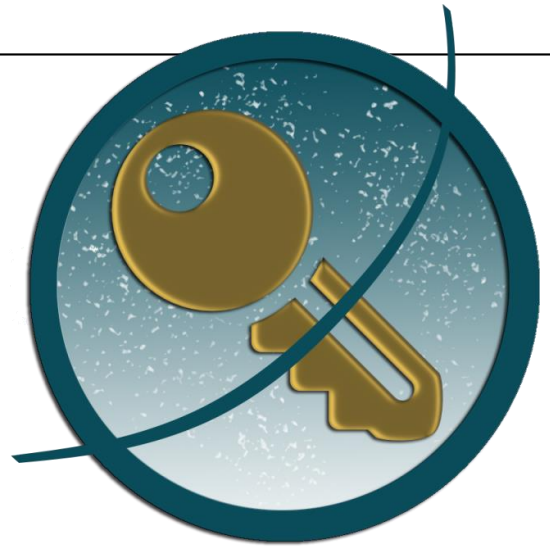
The TAKE AWAY



KEY MESSAGES

Conclusions

- Diagnostic difficile : Hémocultures + ETO
- Répétition d'Hémocultures + Pet-Scan
- Traitement = extraction de tout le matériel
- Prophylaxie

CENTRES HOSPITALIERS JOLIMONT ASBL

PM et ICD ... les complications infectieuses

European Heart Journal Advance Access published August 29, 2015

European Heart Journal
doi:10.1093/eurheartj/ehv319

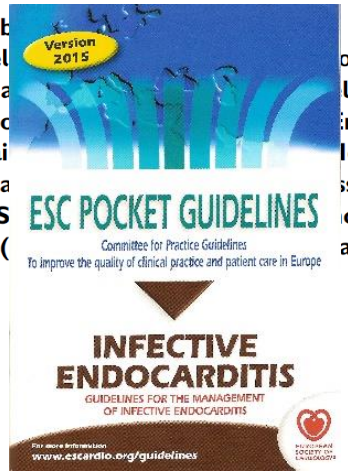
ESC GUIDELINES

2015 ESC Guidelines for the management of infective endocarditis

The Task Force for the Management of Infective Endocarditis of the European Society of Cardiology (ESC)

Endorsed by: European Association for Cardio-Thoracic Surgery (EACTS), the European Association of Nuclear Medicine (EANM)

Authors/Task Force Members: Gilbert Hab… Patrizio Lancellotti* (co-Chairperson) (Bel… ortugal), Maria Grazia Bongiorni (Italy), Jean-Paul Ca… l Zotti (Italy), Raluca Dulgheru (Belgium), Gebrine El Kho… rba[a] (Italy), Bernard Iung (France), Jose M. Miro[b] (Spai… letherlands), Edyta Plonska-Gosciniak (Poland), Susanna… sselink (The Netherlands), Ulrika Snygg-Martin (S… ce), Pilar Tornos Mas (Spain), Isidre Vilacosta (… ano (Spain)



Journal of Antimicrobial Chemotherapy Advance Access published October 29, 2014

J Antimicrob Chemother
doi:10.1093/jac/dku383

Journal of Antimicrobial Chemotherapy

Guidelines for the diagnosis, prevention and management of implantable cardiac electronic device infection. Report of a joint Working Party project on behalf of the British Society for Antimicrobial Chemotherapy (BSAC, host organization), British Heart Rhythm Society (BHRS), British Cardiovascular Society (BCS), British Heart Valve Society (BHVS) and British Society for Echocardiography (BSE)

Jonathan A. T. Sandoe[1]*, Gavin Barlow[2], John B. Chambers[3], Michael Gammage[4], Achyut Guleri[5], Philip Howard[1], Ewan Olson[6], John D. Perry[7], Bernard D. Prendergast[8], Michael J. Spry[9], Richard P. Steeds[10], Muzahir H. Tayebjee[1] and Richard Watkin[11]