Division and Chair of Cardiology
EP Laboratory
Spedali Civili – University of Brescia

Alessandro Lipari, MD

# *Lead extraction in patients with endocardial vegetations: when and how?*

Advances in Cardiac Arrhytmias and Great Innovations in Cardiology

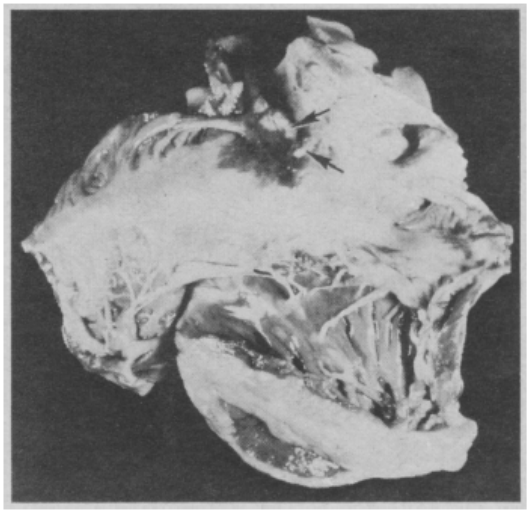
Turin October 23-25, 2014

# Bacterial Endocarditis Associated With a Permanent Transvenous Cardiac Pacemaker

Ira S. Schwartz, MD, and Nafees Pervez, MD

*To our knowledge, the first case of acute bacterial endocarditis in a patient with a permanent pervenous cardiac pacemaker occurred on the mural endocardium of the right atrium along the course of the pacemaker catheter. It is suggested that bacteremia, probably originating from a sacral decubitus ulcer, resulted in implantation of organisms on the damaged atrial endocardium with subsequent septic embolization.*

JAMA, Nov 1, 1971 • Vol 218, No 5



*1. Right side of heart showing endocarditis in right atrium beneath trance of superior vena cava. icterial vegetations are present*

**References**

1. Spencer WJ, Miller HS Jr, Headley RN, et al: Initial experience with permanently implanted transvenous pacemakers. *Arch Intern Med* **122**:291-297, 1968.
2. Wheelis RF, Cobb LA: Pathologic findings in perforation of the myocardium by a permanent endocardial electrode. *JAMA* **210**:1278-1280, 1961.
3. Beregovich J, Fenig S: Complications with permanent transvenous pacemakers. *NY State J Med* **70**:761-766, 1970.
4. Alegre JM, Yore R: Perforation of myocardium by pacemaker catheter. *JAMA* **212**:481, 1970.
5. Prozan GB, Shipley RE, Madding GF, et al: Pulmonary thromboembolism in the presence of an endocardial pacing catheter. *JAMA* **206**:1564-1565, 1968.
6. Robboy SJ, Hawthorne JW, Leinbach RC, et al: Autopsy findings with permanent pervenous pacemakers. *Circulation* **39**:495-501, 1969.

It is reasonable to postulate that the areas of endocardium in contact with the pacemaker catheter, being subject to mechanical trauma, may serve as fertile soils for bacterial proliferation, ie, bacterial endocarditis.

# BACKGROUND

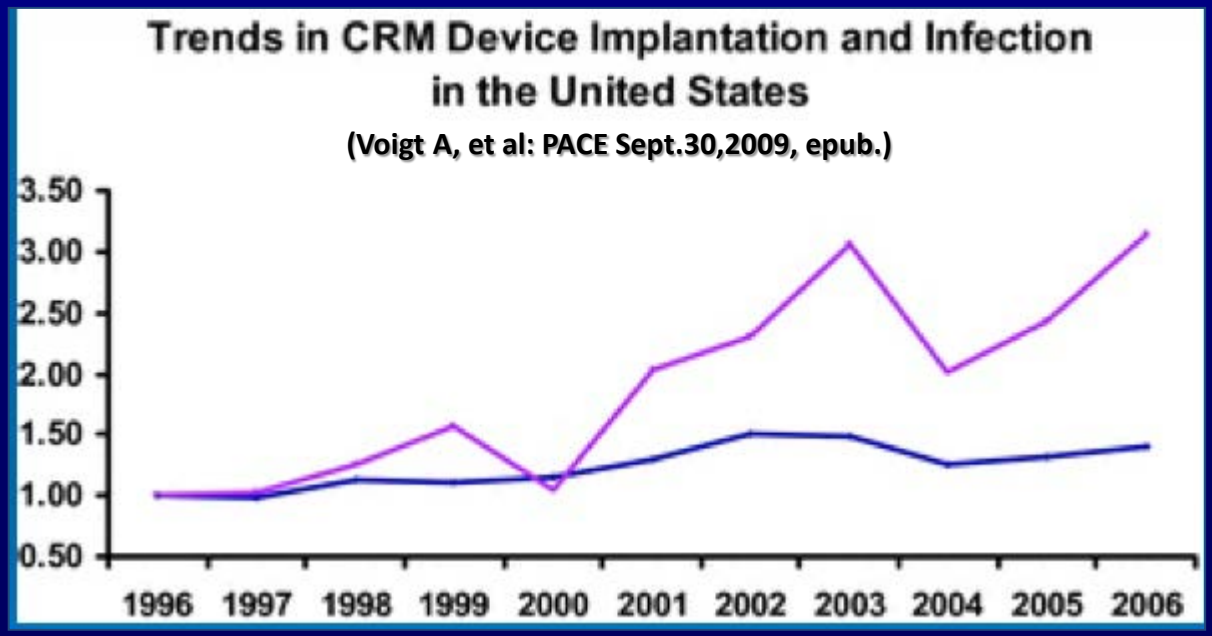
- The prevalence of both permanent pacemakers (PPM) and implantable cardioverter defibrillators (ICD) utilizing transvenous leads is increasing as the population lives longer
- With the increased prevalence of these devices, physicians are faced with more patient complications, including PPM and ICD infections
- While this is an unusual complication with a reported incidence of 0.2–16%[1] its associated mortality can reach 30–35%.[2]
- Antimicrobial therapy and extraction of the transvenous system is generally required for definitive treatment of lead-associated endocarditis or device infection.

1-Wasson S et Coll, Echocardiography 2003;20:289–290.
2-Del Rio A, et Coll, Chest 2003; 124:1451–1459.

# CIED INFECTIONS

Incidence [1] :

- Medicare (USA) data : 1990-1999
  - Increasing use : + 42% (P< 0.001 for trend )
  - Increasing infections : + 124% (P<0.001 for trend )




(1)Cabell CH, et al: AHJ 2004; 147:582-586

# CIED INFECTIONS

- Reasons for disproportionate rise in CIED infections ?
  - Host related
  - Procedure related
  - Device related
  - Multifactorial

Cabell CH, et al: AHJ 2004; 147:582-586

# CLINICAL PRESENTATION

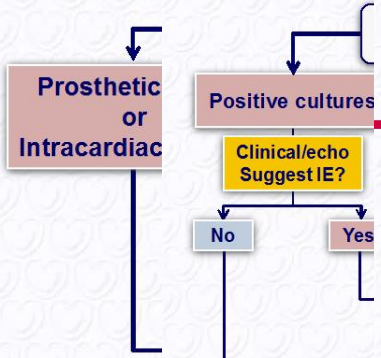
- Generator poket infection
  - Most common
  - After implantation or manipulation
- Deeper infection
  - Leads
  - Endocarditis

## Classification and definitions

## Indications for echocardiography

### Clinical suspicion of IE

### Microbiological diagnosis







## Modified Duke criteria for the diagnosis of IE

(Adapted from Li & al)

**MAJOR CRITERIA**

**Blood cultu**

- Typical mi
  *Viridans s*
  *acquired*
- Microorga
  *At least 2*
  *≥ 4 separa*
- Single pos

**Evidence**

- Echocardi
- New valvu

- Predispos
- Fever: ten
- Vascular p
- Intracrania
- Immunolo
- Microbiolo
  evidence

### Diagnosis of IE

| Diagnosis of IE is definite in the presence of | Diagnosis of IE is possible in the presence of |
|---|---|
| 2 Major criteria<br>or<br>1 major and 3 minor criteria<br>or<br>5 minor criteria | 1 Major and 1 minor criteria<br>or<br>3 minor criteria |

Adapted from LI Js et al., *Clin Infect Dis.* 200;30:633-638

www.escardio.org/guidelines

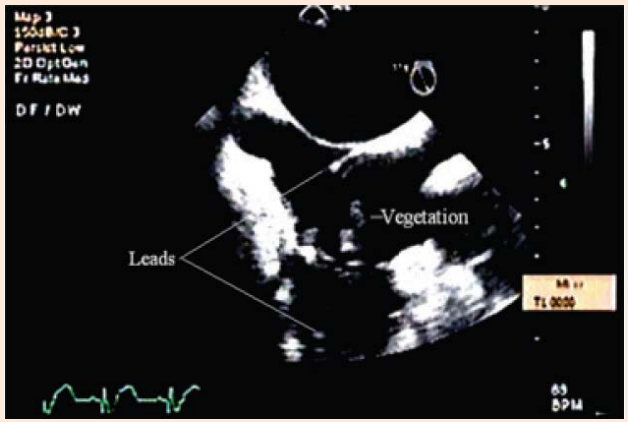
European Heart Journal (2009) 30:2369–2413

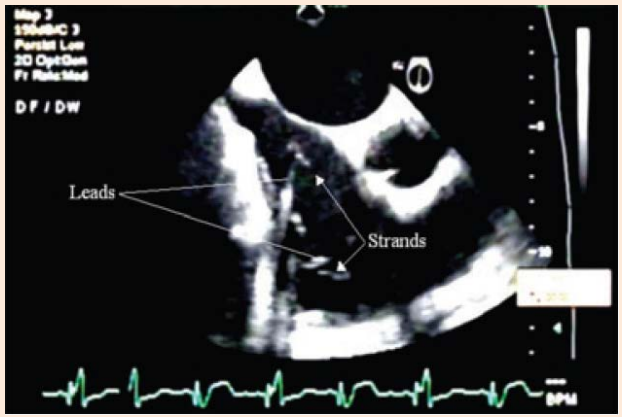
EUROPEAN SOCIETY OF CARDIOLOGY®

# Incidence and Significance of Pacemaker and Implantable Cardioverter-Defibrillator Lead Masses Discovered during Transesophageal Echocardiography

BRIAN C. DOWNEY, M.D., WHITNEY E. JUSELIUS, M.D., NATESA G. PANDIAN, M.D., N. A. MARK ESTES, III, M.D., and MARK S. LINK, M.D.
From the Department of Medicine, Division of Cardiology, Tufts Medical Center, Boston, Massachusetts

Single center, retrospective study of consecutive patients ( n =162) with PPM and ICD devices undergoing echo-TEE to determine the prevalence of lead-associated masses, as well as their predictive value in diagnosing pacemaker endocarditis or device infection.




*PACE 2011; 34:679–683*

| | +TEE (26) | +TEE with + Device Infection | Vegetation | Strand | Both |
|---|---|---|---|---|---|
| Atrial fibrillation | 4/68 (6%) | 0/4 (0%) | 0 | 4 | 0 |
| Endocarditis | 12/40 (8%) | 7/12 (58%) | 8 | 5 | 1 |
| Valvular disease | 2/25 | 0/2 | 0 | 2 | 0 |
| Source of systemic embolus | 3/14 (33%) | 1/3 (0%) | 2 | 1 | 0 |
| LVAD | 3/9 | 0/3 | 2 | 2 | 1 |
| Other | 2/21 (10%) | 0/2 (0%) | 1 | 1 | 0 |

- *Lead-associated masses were found in 14% of patients.*
- *In 72% of patients, the mass did not prove to be secondary to infectious causes*

## *Conclusion:*

*The masses attached to a device lead should be interpreted in the overall clinical context and, in the absence of concomitant evidence of endocarditis, should not mandate device and lead removal.*

*PACE 2011; 34:679–683*

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

Pier Giorgio Golzio*, Anna Laura Fanelli, Melissa Vinci, Elisa Pelissero, Mara Morello, Walter Grosso Marra, and Fiorenzo Gaita

136 pts infective indications:

- 39.2% chronic draining sinus
- 20.9% pocket infections
- 28.8% systemic infections/sepsis.

Lead vegetation prevalence on Echo TEE was 40.4%:

- 62.2% in systemic infection
- 21.9 in local infection
- 36.4% chronic draining sinus

TEE should be mandatory in all patients undergoing LE for infective indications.

Europace/september 2012

# BACKGROUND

- Two techniques can be used:
  - **surgical removal :** by thoracotomy and extracorporeal circulation
  - **percutaneous removal :** by traction or intravascular extraction techniques.

• the perceived risk of embolic events in the presence of large (10 mm) vegetations has been considered a relative contraindication to transvenous removal [1-2]

• Surgical removal of pacemaker leads has been suggested in this situation to avoid occurrence of pulmonary embolization.

1 -Klug D et al. Circulation 1997;95:2098–107.
2-Robbins MJ et al. Influence of vegetation.Am J Med 1986;80:165–71.

## Management and Outcome of Permanent Pacemaker and Implantable Cardioverter-Defibrillator Infections

Muhammad R. Sohail, MD,* Daniel Z. Uslan, MD,* Akbar H. Khan, MD,‡ Paul A. Friedman, MD,† David L. Hayes, MD,† Walter R. Wilson, MD,* James M. Steckelberg, MD,* Sarah Stoner, MS,§ Larry M. Baddour, MD*

*Rochester, Minnesota*

Retrospective review 189 pts with CDI (138 PPM, 51 ICD): 90 % percutaneus / 10 % surgical

| Clinical presentation | |
|---|---|
| Pocket infection | 99 (52%) |
| Pocket infection with bacteremia | 32 (17%) |
| Device-related endocarditis | 44 (23%) |
| Bacteremia without localizing signs at pocket | 21 (11%) |
| Generator or lead erosion | 10 (5%) |

- The diameter of vegetations ranged from 0.3 to 7.0 cm.

## Result

- No clinical manifestations of pulmonary embolism as a complication of percutaneous lead extraction
- Lead removal by cardiotomy has been advocated to prevent symptomatic pulmonary embolism but, as shown in the current case series, this approach can be complicated by serious adverse events. (5 pts suffered massive hemorrhages postoperatively, and 1 died)

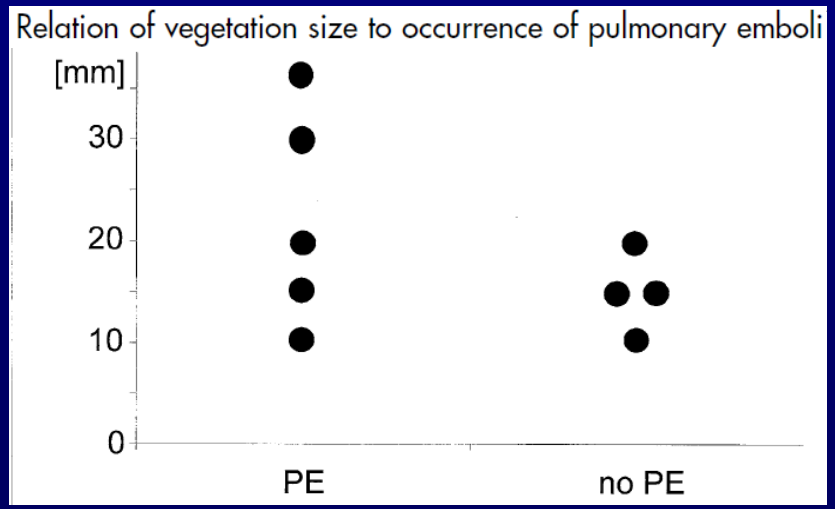
JACC Vol. 49, No. 18, 2007 :1851–9

# Endocardial pacemaker or defibrillator leads with infected vegetations: A single-center experience and consequences of transvenous extraction

Hans K. Meier-Ewert, MD, Mary-Ellen Gray, PAC, and Roy M. John, MD, PhD *Burlington, Mass*

38 pts :

- Vegetations were detected in 9 patients ( range10 - 38 mm )
- 5 of 9 patients (55%) had evidence of pulmonary embolism.( Spiral TC/Scintigraphy)
- no difference in hospitalization or survival between those with or without pulmonary embolism




Am Heart J 2003;146: 339–44.)

# Percutaneous Pacemaker and Implantable Cardioverter-Defibrillator Lead Extraction in 100 Patients With Intracardiac Vegetations Defined by Transesophageal Echocardiogram

0.2-4 cm

| | |
|---|---|
| Patients, n | 984 |
| Leads extracted, n | 1,838 |
| Patients infected, n (% of all patients) | 480 (49) |
| Infected leads, n (% of all leads) | 1,000 (54) |
| Infected patients with vegetation, n | 100 |
| Percent of total patients | 10 |
| Percent of infected patients | 21 |
| Infected leads from patients with vegetation, n | 215 |
| Percent extracted leads | 12 |
| Percent infected leads | 22 |

•2 pts :embolization of vegetation material, >2 cm before extraction).

•1 pt had presumptive embolization of a vegetation measuring 1.2 cm after extraction

• Post-operative 30-day mortality was 10% ( no deaths related directly to the procedure)

**Conclusions** :

percutaneous lead extraction techniques is safety in patients with intracardiac vegetations

Jon A. Grammes, et All . JACC 2010;55:886–94

# Transvenous Pacemaker Lead Removal Is Safe and Effective Even in Large Vegetations: An Analysis of 53 Cases of Pacemaker Lead Endocarditis

ELFRIEDE RUTTMANN,* HERBERT B. HANGLER,* JULIANE KILO,* DANIEL HÖFER,* LUDWIG C. MÜLLER,* FLORIAN HINTRINGER,† SILVANA MÜLLER,† GÜNTHER LAUFER,† and HERWIG ANTRETTER*

From the *Department of Cardiac Surgery, and †Department of Cardiac Surgery, Innsbruck Medical University, Anichstrasse 35, 6060 Innsbruck, Austria

Transvenous lead extraction (T.L.E) : 30 pts (successful 96.7%).

Surgical lead extraction(S.L.E.): 23 pts (large vegetations with the risk of obstructing a main stem of the pulmonary artery)

| | T.L.E | S.L.E | p |
|---|---|---|---|
| Pulm.Embolism | 14.8 % | 14.3 % | 0.68 |
| Vegetation size | 1.78 ±0.6 cm | 2.24± 1 cm | < 0,001 |
| Perioperative mortality | 0 % | 5.7 % | |
| | | | |

*PACE 2006; 29:231–236*

# Literature Review of Surgical and Percutaneous Lead Extraction Mortality

| First Author, Year (Ref. #) | n | Extraction Approach* | Post-Operative Mortality, % (n) | Major Complications† | Comments |
|---|---|---|---|---|---|
| Brodman, 1992 (18) | 11 | Surgical | 9% (1) | NA | Death related to sepsis |
| Frame, 1993 (10) | 13 | Surgical | 15% (2) | NA | Deaths related to sepsis |
| Klug, 1996 (14) | 12‡ | Surgical | 16.6% (2) | NA | Deaths related to sepsis; post-operative mortality 7.6%; 30% septic embolization |
| | 38‡ | Percutaneous | | | |
| Cacoub, 1998 (28) | 29‡ | Surgical | 12.4% (4) | NA | Post-operative period defined as <8 days; IE proven by histology; overall mortality 24% |
| | 4‡ | Percutaneous | | | |
| Byrd, 1999 (33) | 2,338 | Percutaneous | 0.4% | 1.6% | U.S. lead extraction database |
| Victor, 1999 (15) | 9‡ | Surgical | 11% (1) | NA | Deaths related to sepsis and heart failure; 12 patients had vegetations >1 cm |
| | 14‡ | Percutaneous | 21% (3) | | |
| Byrd, 2002 (44) | 1,684 | Percutaneous | 0.8% (13) | 1.9% | Total laser experience in U.S. (1995–99) |
| del Rio, 2003 (29) | 5‡ | Surgical | 40% (2) | 40% | 12.5% "surgical" mortality includes surgical and percutaneous approaches |
| | 25‡ | Percutaneous | 4% (1) | 8% | |
| Meier-Ewert, 2003 (30) | 9‡ | Percutaneous | 11% (1) | NA | Death from sepsis; 55% septic emboli |
| Massoure, 2007 (35) | 20‡ | Surgical | 5.3% (3) | NA | 90% with IE; mean vegetation size 1.3 cm; deaths related to sepsis |
| | 37‡ | Percutaneous | | | |
| Sohail, 2007 (31) | 19 | Surgical | 5.3% (1) | 26% | 7 deaths during IH, only 2 procedure related; 5 deaths (11%) due to sepsis in 23% with IE |
| | 166 | Percutaneous | 0.6% (1) | 12% | |
| Camboni, 2008 (45) | 21 | Surgical | 9.5% (2) | 14% | Long-term survival between groups similar (p = 0.11) |
| | 53 | Percutaneous | 0% | 6% | |
| Jones, 2008 (34) | 485 | Percutaneous | 0% | 0.4% | Limited data on 85 patients with IE |

J Am Coll Cardiol 2010;55:886–94

# Transvenous Extraction of Pacemaker Leads in Infective Endocarditis With Vegetations >20 mm: Our Experience

Gabriel Pérez Baztarrica, MD; Luis Gariglio, MD; Flavio Salvaggio, MD; Estela Reolón, MD; Norberto Blanco, MD; Hector Mazzetti, MD; Sebastián Villecco, MD; Alejandro Botbol, MD; Rafael Porcile, MD
Department of Cardiology and Cardiovascular Surgery, University Hospital, Universidad Abierta Interamericana, Faculty of Medicine, Buenos Aires, Argentina

percutaneous removal of CIEDs in patients with IE withlarge vegetations.

***Aim:***

- *in-hospital* morbidity and mortality related to percutaneous removal of vegetations ≥20 mm.
- 8 cases with a follow-up period of 20 months.
- We removed 100% of leads in the study population.

***Conclusions:***

- *Transvenous extraction of pacing leads with larger vegetations is a feasible technique.*
- *There* was a tendency toward symptomatic pulmonary embolism in patients with vegetations larger than 20 mm;
- morbidity and mortality were not influenced

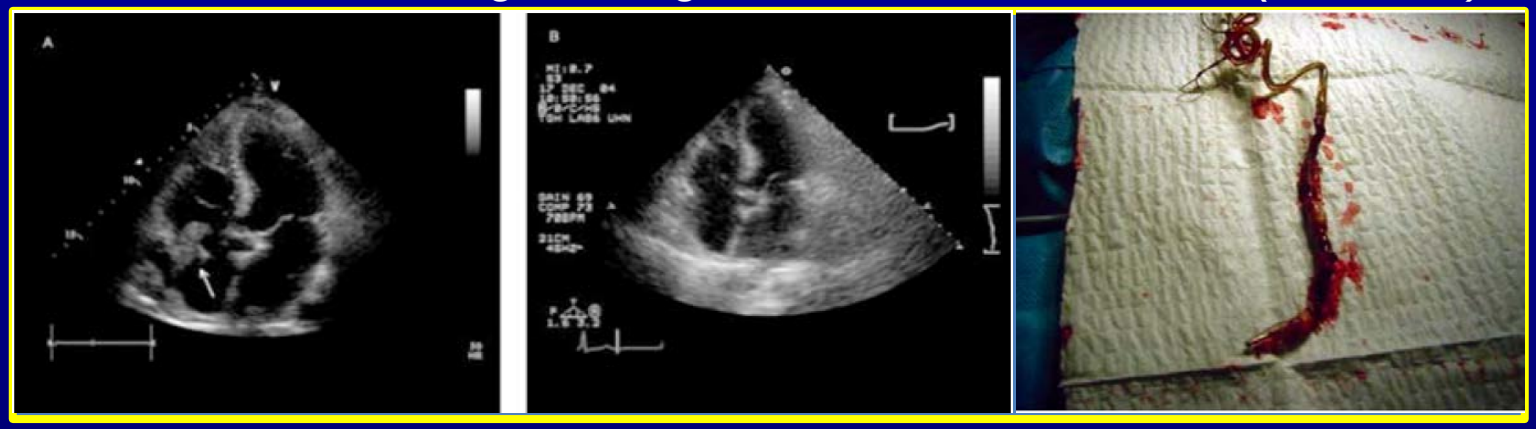
Clin. Cardiol. 35, 4, 244–249 (2012)

# Successful Laser-Assisted Removal of an Infected ICD Lead with a Large Vegetation

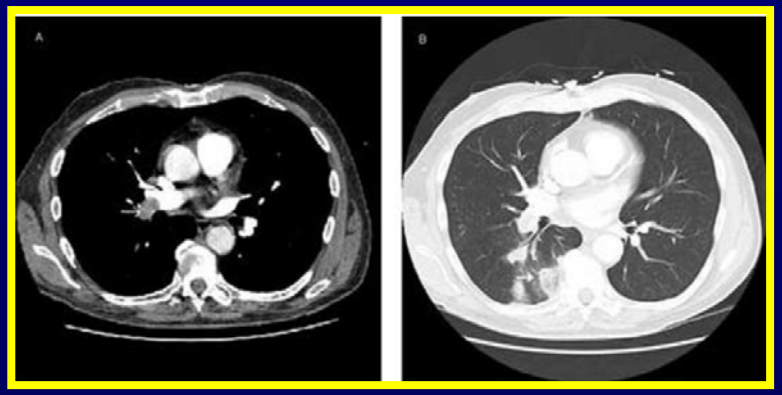
RAJNEESH CALTON,* DOULAS CAMERON,* ROBERT J. CUSIMANO,† NAEEM MERCHANT,‡ and VIJAY CHAUHAN*

From the *Division of Cardiology, †Division of Cardiothoracic Surgery, and ‡Department of Medical Imaging, University Health Network, Toronto, Canada

*ICD lead with vegetation greater than 41 × 12.5 mm (512 mm2)*



*The resulting pulmonary embolus produced a 33 × 20 mm pulmonary infarction without hemodynamic or respiratory compromise*



*PACE 2006; 29:910–913*

# Risk Factors for Mortality in Patients With Cardiac Device-Related Infection

Timir S. Baman, MD; Sanjaya K. Gupta, MD; Javier A. Valle, MD; Elina Yamada, MD, FACC, FASE

- 210 patients with CDI -observational and retrospective analysis
- Prognostic significance of key clinical and echo variables at high-risk for mortality

**Table 1. Unadjusted Hazard Ratios for 6-Month Mortality Associated With Age, Sex, and Treatment Group**

| | Total (n=210) | Survived (n=173) | Died (n=37) | HR | 95% CI | *P* Value |
|---|---|---|---|---|---|---|
| Age, y | 63±17 | 61±17 | 71±11 | 1.04 | 1.01–1.06 | ≤0.01 |
| Male gender | 138 (66) | 112 (65) | 26 (70) | 1.56 | 2.91–3.45 | 0.28 |
| Treatment option | | | | | | |
| Medical management | 23 (11) | 15 (9) | 8 (22) | 1.00 | . . . | (reference) |
| Percutaneous device removal | 170 (81) | 142 (82) | 28 (76) | 0.44 | 0.20–0.96 | 0.04 |
| Cardiac surgical removal | 17 (8) | 16 (9) | 1 (3) | 0.15 | 0.02–1.19 | 0.07 |

Values are n (%) or mean±SD.

percutaneous removal was found to be significantly associated with better survival

*Circ Arrhythmia Electrophysiol. 2009;2:129-134*

**Table 2. Adjusted Hazard Ratios for 6-Month Mortality Associated With Patient Characteristics and Controlling for Age, Sex, and Treatment Group**

| | Total (n=210) | Survived (n=173) | Died (n=37) | HR | 95% CI | *P* Value |
|---|---|---|---|---|---|---|
| Type of device | | | | | | |
| Pacemaker | 126 (60) | 103 (60) | 23 (62) | 1.00 | | (reference) |
| ICD | 69 (33) | 59 (34) | 10 (27) | 0.93 | 0.47–2.41 | 0.88 |
| Biventricular PM/ICD | 15 (7) | 10 (6) | 5 (14) | 1.53 | 0.56–5.44 | 0.47 |
| Previous device upgrade/replacement | 38 (18) | 34 (20) | 4 (11) | 1.37 | 0.48–3.94 | 0.56 |
| Clinical variables | | | | | | |
| Diabetes | 57 (27) | 45 (26) | 12 (32) | 1.59 | 0.78–3.22 | 0.20 |
| Coronary artery disease | 110 (52) | 83 (48) | 27 (73) | 2.12 | 1.10–5.00 | 0.07 |
| CABG | 51 (24) | 42 (24) | 9 (24) | 0.81 | 0.37–1.74 | 0.58 |
| Hypertension | 137 (65) | 106 (61) | 31 (84) | 2.20 | 0.90–5.36 | 0.08 |
| Abnormal creatinine >1.5 mg/dl | 99 (47) | 70 (40) | 29 (78) | 3.99 | 1.71–9.30 | ≤0.01 |
| Positive blood culture | 108 (51) | 77 (45) | 31 (84) | 6.05 | 2.30–15.97 | ≤0.01 |
| Positive device culture | 147 (70) | 120 (69) | 27 (73) | 1.52 | 0.62–3.75 | 0.37 |
| Echocardiographic variables | | | | | | |
| Lead vegetation visualized | 48 (23) | 37 (21) | 11 (30) | 1.47 | 0.69–3.15 | 0.32 |
| Lead vegetation size | | | | | | |
| Absent/not obtained | 168 (80) | 139 (81) | 29 (78) | 1.00 | . . . | (reference) |
| 1–10 mm | 10 (5) | 9 (5) | 1 (3) | 0.84 | 0.11–6.21 | 0.86 |
| 11–20 mm | 19 (9) | 13 (8) | 6 (16) | 2.05 | 0.81–5.23 | 0.13 |
| ≥21 mm | 13 (6) | 11 (6) | 2 (5) | 1.03 | 0.23–4.73 | 0.97 |

*Circ Arrhythmia Electrophysiol. 2009;2:129-134*

**Table 2. Adjusted Hazard Ratios for 6-Month Mortality Associated With Patient Characteristics and Controlling for Age, Sex, and Treatment Group**

| | Total (n=210) | Survived (n=173) | Died (n=37) | HR | 95% CI | *P* Value |
|---|---|---|---|---|---|---|
| Lead vegetation mobility | | | | | | |
| Absent/not obtained | 169 (80) | 139 (80) | 30 (81) | 1.00 | . . . | (reference) |
| Low | 16 (8) | 12 (7) | 4 (11) | 1.65 | 0.56–4.83 | 0.36 |
| Moderate | 13 (6) | 12 (7) | 1 (3) | 0.37 | 0.05–2.74 | 0.33 |
| Severe | 12 (6) | 9 (5) | 3 (8) | 2.04 | 0.54–7.67 | 0.29 |
| Left ventricular dysfunction | | | | | | |
| Normal | 93 (44) | 79 (46) | 14 (38) | 1.00 | . . . | (reference) |
| Mild | 14 (7) | 13 (8) | 1 (3) | 0.43 | 0.06–3.33 | 0.42 |
| Moderate | 22 (10) | 17 (10) | 5 (14) | 1.33 | 0.47–3.77 | 0.59 |
| Severe | 42 (20) | 30 (17) | 12 (32) | 1.68 | 0.75–3.74 | 0.21 |
| Abnormal right ventricular function | 35 (17) | 22 (13) | 13 (35) | 4.22 | 1.91–9.29 | ≤0.01 |
| Moderate to severe tricuspid regurgitation | 20 (10) | 9 (5) | 11 (30) | 5.93 | 2.73–12.89 | ≤0.01 |
| Right ventricular systolic pressure (RVSP) | | | | | | |
| RVSP not obtained | 69 (33) | 60 (35) | 9 (24) | 1.00 | . . . | (reference) |
| 10–39 mm Hg | 52 (25) | 46 (27) | 6 (16) | 0.74 | 0.26–2.09 | 0.57 |
| 40–59 mm Hg | 35 (17) | 23 (13) | 12 (32) | 2.19 | 0.88–5.44 | 0.09 |
| ≥60 mm Hg | 15 (7) | 9 (5) | 6 (16) | 4.40 | 1.48–13.02 | 0.01 |
| Aortic stenosis | 7 (3) | 5 (3) | 2 (5) | 0.86 | 0.45–1.63 | 0.63 |
| Aortic insufficiency | 9 (4) | 7 (4) | 2 (5) | 1.07 | 0.56–2.02 | 0.85 |
| Moderate to severe mitral regurgitation | 31 (15) | 19 (11) | 12 (32) | 1.61 | 1.12–2.31 | ≤0.01 |
| Prosthetic valve | | | | | | |
| Aortic | 9 (4) | 7 (4) | 2 (5) | 1.21 | 0.12–7.02 | 0.81 |
| Mitral | 6 (3) | 5 (3) | 1 (3) | 1.08 | 0.09–13.36 | 0.94 |
| Clinical events | | | | | | |
| Pulmonary embolism | 9 (4) | 5 (3) | 4 (11) | 3.76 | 1.25–11.30 | 0.02 |
| Systemic embolization | 23 (11) | 10 (6) | 13 (35) | 9.02 | 3.95–20.57 | ≤0.01 |

*Circ Arrhythmia Electrophysiol. 2009;2:129-134*

**Table 4. Predictors of Pulmonary Embolism (Logistic Regression Analysis)***

| | Pulmonary Embolism (n=9) | No Pulmonary Embolism (n=201) | OR | 95% CI | *P* Value |
|---|---|---|---|---|---|
| Lead vegetation size | | | | | |
| 0–10 mm | 6 (67) | 172 (86) | 1.00 | . . . | (reference) |
| >10 mm | 3 (33) | 29 (14) | 0.88 | 0.14–5.42 | 0.89 |
| Lead vegetation mobility | | | | | |
| Absent to low | 6 (67) | 179 (89) | 1.00 | . . . | (reference) |
| Moderate to severe | 3 (33) | 22 (11) | 2.38 | 0.45–12.48 | 0.31 |

*All final models controlled for age, sex, and treatment group as well as other variables listed in the table.

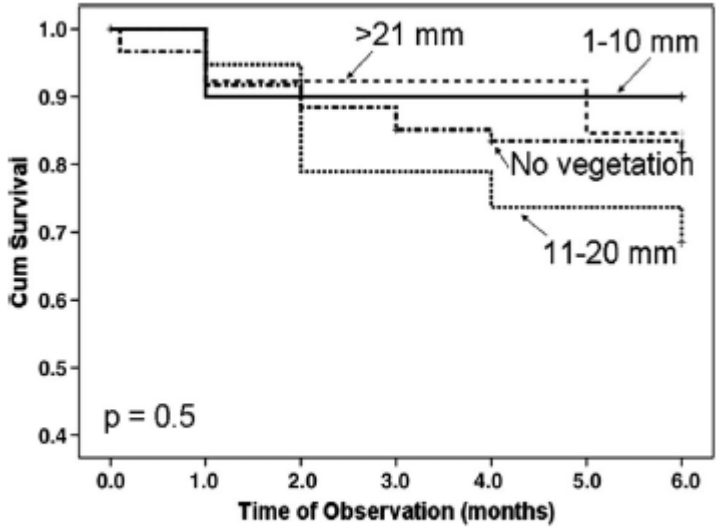



**Figure.** Kaplan–Meier plot of survival according to size of lead vegetation in millimeters (mm) adjusting for age, sex, and treatment strategy.

- Neither lead vegetation size or mobility was found to correlate with an increased risk for pulmonary embolism
- Lead vegetation size was not significantly associated with decreased 6-month survival

*Circ Arrhythmia Electrophysiol. 2009;2:129-134*

# Brescia experience (2003 - 6/2014)

| | |
|---|---|
| **Patients (n°)** | 1033 |
| **Mean age population (ys)** | 68,4 ± 13 |
| **Leads (n°)** | 2128 |
| **Mean age leads (mth)** | 120,6 ± 124 |
| **Sex** | M 76%<br>F 24% |

| | **Percentage(%)** |
|---|---|
| **PM** | 46 |
| **ICD** | 30 |
| **CRT** | 22 |
| **SINGLE CHAMBER** | 24 |
| **DOUBLE CHAMBER** | 51 |
| **TRIPLE CHAMBER** | 22 |

# Extraction Tecniques

- Simple traction
- Simple traction through lead locking device (LLD)
- Mechanical Sheaths
- Powered Sheath
  - *Laser*
- Superior approach (giugular and subclavian veins)
- Femoral approach
- Hybrid approach

| Extraction tecnique | Percentage(%) |
|---|---|
| Manual | 38,9 |
| Mechanical | 2,1 |
| Femoral | 5 |
| Laser | 49,7 |
| Hybrid | 4,3 |

# Results

| Success | Percentage (%) |
| --- | --- |
| Complete | 96.2 |
| Partial | 3,0 |
| Faliure | 0,8 |

# Complications

| Complications | Percentage (%) |
|---|---|
| **No complications** | **93.4** |
| VT | 2 |
| Hypotension | 0.6 |
| Premature pericardial effusion | 0.3 |
| Deferred pericardial effusion | 0.3 |
| Exitus | 0.09 |

# Indications

- Infection : 60%
  - Local
  - Systemic/sepsis
- Malfunction : 28 %
- Other : 12 %

**Subgroup analysis : infection group ( all pts underwent transesophageal echo):**

- **Lead vegetation : 35 %**
- **No lead vegetation : 65 %**

| Extraction tecnique | Percentage(%) |
|---|---|
| Manual | 50 |
| Mechanical | 15 |
| Femoral | 5 |
| Laser | 22 |
| Hybrid | 8 |

# Subgroup analysis : infection group

| | |
|---|---|
| **Patients (n°)** | 619 |
| **Mean age population (ys)** | 74,4 ± 9 |
| **Leads (n°)** | 1237 |
| **Mean age leads (mth)** | 110 ± 84 |
| **Sex** | M 68%<br>F 32% |

Lead vegetation group 34,8%

| Ø average(mm) | % |
|---|---|
| < 10 | 72 |
| 10-20 | 23 |
| >20 | 5 |

| Success | Percentage (%) |
|---|---|
| Complete | 99 |
| Partial | 0.5 |
| Faliure | 0.5 |

**Patients syntomatic during or within 12 hours of the the procedure for :**

- Hypotension
- Fever
- Shaking chills

7 %

**Pulmonary TC**

| Ø average (mm) | P.E (n. pts) | CLINICAL SIGNIF |
|---|---|---|
| < 10 | **2** | NO |
| 10-20 | **6** | NO |
| >20 | **3** | NO |

# Therapeutic approach

•Identification of the infecting organism with cultures

•Pre-procedure transesophageal echocardiography

•Pre-procedure management of antibiotics to suppress bacteremia or to reduce the size of vegetations for at least 2 weeks

•Extraction of all pacing sistem using all percutaneous extraction tools and techniques

•Post-lead extraction/ transvenous pacing, antibiotics, medical treatment of progressive heart failure and overwhelming sepsis, plus subsequent reimplantation of new, usually transvenous, implanted pulse generator–lead systems when appropriate.

# Conclusions

- The data on device infections confirm that there is no statistical difference in lead vegetation size between patients with and without pulmonary embolism.

*Circ Arrhythmia Electrophysiol. 2009;2:129-134*

# Conclusion

- With larger vegetations ( > 2 cm ), data is limited regarding the appropriateness of a transvenous versus a thoracic surgical approach but experience suggests that the leads can still be removed using intravascular techniques with an acceptably low complication rate and can be done without precipitating a clinically apparent pulmonary embolism.
- Until additional data are available, decisions regarding percutaneous versus surgical removal of leads with vegetations larger than 2 cm in diameter should be individualized and based on a patient's clinical parameters and the extractor's evaluation.