TI GULLIO 2010
S. Margherita Ligure 11-13 Febbraio

LE INFEZIONI DELLA TASCA E L’ESTRAZIONE DEGLI ELETTROCATETERI

Maria Grazia Bongiorni
Direttore U.O. Malattie Cardiovascolari 2
Azienda Ospedaliero-Universitaria Pisana
Due to evolving indications, the rates of CIED implantation have increased and are expected to increase.

Younger patients and prolonged life expectancy will require multiple interventions during the follow-up.

As consequence, we expect an increase of infective and non infective complication and a widespread use of lead extraction procedures.
# DEVICE COMPLICATIONS

- 6913 patients
- 44 medical institutions in France

## TABLE 2. Incidence of Device Implantation–Related Complications Over 12 Months

<table>
<thead>
<tr>
<th></th>
<th>All, n (%)</th>
<th>Requiring Reintervention, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematoma</td>
<td>328 (5.34)</td>
<td>26 (0.42)</td>
</tr>
<tr>
<td>Lead dislodgment</td>
<td>112 (1.82)</td>
<td>102 (1.66)</td>
</tr>
<tr>
<td>Pacing threshold elevation</td>
<td>59 (0.96)</td>
<td>1 (0.01)</td>
</tr>
<tr>
<td>Impending erosion</td>
<td>34 (0.55)</td>
<td>31 (0.50)</td>
</tr>
<tr>
<td>Erosion</td>
<td>15 (0.24)</td>
<td>15 (0.24)</td>
</tr>
<tr>
<td>Overall</td>
<td>548 (8.93)</td>
<td>175 (2.85)</td>
</tr>
</tbody>
</table>

Klug  Circ 2007; 116
Complications leading to surgical revision in implantable cardioverter defibrillator patients: comparison of patients with single-chamber, dual-chamber, and biventricular devices

Gabor Z. Duray, Joern Schmitt, Sule Cicek-Hartvig, Stefan H. Hohnloser*, and Carsten W. Israel
Table 2  Risk factors associated with shorter revision-free survival (univariable analysis)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Relative risk</th>
<th>95.0% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biventricular device</td>
<td>2.44</td>
<td>1.43 - 4.16</td>
<td>0.001</td>
</tr>
<tr>
<td>Female gender</td>
<td>1.86</td>
<td>1.21 - 2.87</td>
<td>0.005</td>
</tr>
<tr>
<td>Single chamber</td>
<td></td>
<td></td>
<td>0.003</td>
</tr>
<tr>
<td>Dual chamber</td>
<td>1.02</td>
<td>0.64 - 1.63</td>
<td>0.93</td>
</tr>
<tr>
<td>Primary prophylaxis</td>
<td>0.74</td>
<td>0.50 - 1.11</td>
<td>0.147</td>
</tr>
<tr>
<td>LVEF below 25%</td>
<td>0.96</td>
<td>0.60 - 1.56</td>
<td>0.88</td>
</tr>
<tr>
<td>Age over 65 years</td>
<td>1.19</td>
<td>0.80 - 1.78</td>
<td>0.38</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>0.58</td>
<td>0.33 - 1.039</td>
<td>0.067</td>
</tr>
</tbody>
</table>

LVEF, left ventricular ejection fraction.
Figure 1  Time to first surgical revision procedure in patients with single-chamber, dual-chamber, and biventricular implantable cardioverter defibrillator devices (Kaplan–Meier analysis).
CARDIAC DEVICE
RATE OF INFECTION

0.13-19.9% (1975-1985)
Conklin EF et al. J Thorac Cardiovasc Surg 1975; 69

1-7% (1993-1998)
Frame R et al. PACE 1993;16.
Smith PN et al. PACE 1998;21.
CARDIAC DEVICE INFECTION

Rates of CDI (recent studies)

0.68% in PEOPLE study

1.9 per 1000 device-years F-U

Klug Circ 2007; 116

Uslan Arch Intern Med 2007; 167
PM/ICD INFECTION

Clinical Presentation

SYSTEMIC INFECTION

Blood stream infection
Endocarditis
Vegetations

and rarely... septic arthritis, spondilitis, recurrent pneumonia, metastatic abscess (lung, liver, brain)

WITH AND WITHOUT LOCAL SIGNS OF INFECTION
TREATMENT STRATEGIES OF PM AND ICD SYSTEMIC INFECTIONS

TRANSVENOUS REMOVAL OF DEVICE AND LEADS is MANDATORY

If the infected system is not removed MORTALITY ranges from 31% to 66%
1.1 LOCAL INFECTION

Clinical Presentation:

Eritema, swelling, warmth, drainage, erosion
PM/ICD INFECTION

Clinical Presentation

LOCAL INFECTION
Eritema, swelling, warmth, drainage, erosion

CONSERVATIVE APPROACH?
PM/ICD INFECTION
Undertreatment and overtreatment of patients with infected antiarrhythmic implantable devices.

Molina JE
Division of Cardiovascular and Thoracic Surgery, University of Minnesota, Minneapolis 55455, USA.

BACKGROUND: Infection of implantable defibrillators or pacemakers is a serious complication..... This review is aimed to provide guidelines on how to deal with these infections....

38 pts with local infection

- 12 pts
  Antibiotics, no removal
  Failure 100%

- 19 pts
  Removal + 2 w AbTh
  Success 100%

- 7 pts
  Removal + 6 w AbTh
  Success 100%
CARDIAC DEVICE INFECTION MANAGEMENT

Results from surgical conservative treatment and antibiotics in the absence of hardware removal have been disappointing.¹,²

¹ Molina Ann Thorac Surg 1997; 63
² Chamis Circulation 2001; 104

No attempts should be made to save an infected system from removal because it endangers the patient's life, prolongs hospitalization, increases costs, and most likely will fail.
105 patients admitted for local inflammatory findings, impending pacemaker or lead exteriorisation, frank pacemaker or lead exteriorisation, or overt infection were studied prospectively.

After systematic lead extraction, the initial clinical presentation was related to the results of lead cultures.

Klug et al. Heart 2004
POCKET INFECTION

Pos culture (Extravasculare lead parts): 91.6% of patients

BUT

Pos culture (Intravasculare lead parts): 79.3% of patients

Klug et al. Heart 2004
CONCLUSION

Local complications at the site of pacemaker implantation are usually associated with infection of the intravascular part of the leads, with a risk of progressing to systemic infection.

Such local symptoms should prompt the extraction of leads even in the absence of other infectious manifestations.

Klug et al. Heart 2004
In these uploaded Recommendations Class IIb and Levels of Evidence (A, B, C) have been added.
Indications for Lead Removal

Class I

- Sepsis (including endocarditis) secondary to an infection of the pacing system
- Life-threatening arrhythmias secondary to a retained lead fragment
- Retained lead, lead fragment that poses an imminent physical threat to the patient
- Occlusion of all useable veins, with the need to implant a new lead
- Lead interfering with the operation of another implanted device

Class II

- Occult infection (no source can be found, pacing system is suspected)
- Chronic pain at the pocket or lead insertion site not manageable without lead removal

Heart Rhythm Society

Transvenous Lead extraction: Heart Rhythm Society Expert Consensus on Facilities, Training, Indications and Patients Management

Class I

- Complete device and lead removal is recommended in all patients with definite CIED system infection, as evidence by valvular endocarditides, lead endocarditides or sepsis. *(Level of evidence:B)*

- Complete device and lead removal is recommended in all patients with CIED pocket infection as evidenced by pocket abscess, device erosion, skin adherence, or chronic draining sinus without clinically evident involvement of transvenous portion of the lead system. *(Level of evidence:B)*

- Complete device and lead removal is recommended in all patients with valvular endocarditis without definite involvement of lead(s) and/or device*(Level of evidence:B)*

- Complete device and lead removal is recommended in all patients with occult gram-positive bacterimia (not contaminant) *(Level of evidence:B)*
PM/ICD INFECTION treatment

Clinical Presentation

SYSTEMIC INFECTION

LOCAL INFECTION

LEADS EXTRACTION
LEAD EXTRACTION

IN THE PAST

→ Ineffective
→ Life-threatening

CARDIOSURGERY

→ High costs
→ High morbidity
→ Restricted Indication
   (septycemia)
New scenario in lead extraction

- Extraction equipment is more complete, sophisticated and efficient
- Techniques have improved
- Physicians are more skilled
- Risk and morbidity of the procedure when performed by experienced physicians are low.
Transvenous Lead Extraction

Lead Extraction
An underestimated task

❤️ In the next future it is reasonable to expect a significant increase

❤️ N° of lead extraction procedures

❤️ N° of Centers performing TLE procedures
Where and Who should extract a lead?

**Equipments**

- High-quality fluoroscopy
- Extraction tools
- CIED implantation tools
- Surgical instruments
- Transthoracic and transesophageal echocardiography
- Anesthesia cart for general anesthesia
- Invasive and noninvasive arterial pressure monitoring
- Oxygen saturation and CO2 monitoring
- Water seal/vacuum containers for chest tube drainage
- Temporary transvenous pacemaker and connectors
- Transcutaneous temporary pacing and defibrillation equipment
- Intravenous contrast agents
- Fluids, pressors, and other emergency medications
- Pericardiocentesis tray
Mechanical dilatation using single sheath

A single-centre experience of over a thousand lead extractions

Pacemaker and ICD lead extraction with electrosurgical dissection sheaths and standard transvenous extraction systems: results of a randomized trial

1 Cardiology Department, Na Homolce Hospital, Raongenova 2, Prague 5 150 30, Czech Republic and 2 Cardiac Arrhythmia Service, Department of Medicine, Massachusetts General Hospital and Harvard Medical School, Boston, MA, USA
...Even if recent meta-analysis and large experiences have demonstrated a low major complication rate, TLE represents a difficult procedure that require preparation and attention, in order to avoid exposing patients at a serious risks.
Team approach

“...Each member of the team is crucial to successful outcomes, a low complication rate and the rescue of a patient should a complication occur.”

Where and Who should extract a lead?

Recommended required personnel........
Transvenous Lead Extraction - Results and Complications

Jugular approach

Personal Data (1997 - 2008)  
1365 Patients  2413 Leads
Outcome of Transvenous Lead-Extraction

1. CLINICAL FACTORS
   - Implant Duration
   - Multiple Leads
   - Age and Gender
   - PM/ICD leads

2. MECHANICAL CHARACTERISTICS
   - Adhesion
   - Calcifications
   - Vegetations
   - Fracture of lead
   - Protrusion
   - Insulation Failure
   - Damage from unsuccessfull attempts

3. TOOLS FOR EXTRACTION
   - Simple traction
   - Snare, Catcher, Lassos
   - Stylets
   - Mechanical, Laser, RF Sheaths

4. TECHNIQUES
   - Superior Approach
   - Femoral Approach
   - Jugular Approach

5. PHYSICIANS EXPERIENCE

Arrhythmology Unit – CardioThoracic Department AOUP – Pisa, Italy
Major complication:

Death

Complications requiring transfusion or surgical intervention.
- Cardiovascular avulsions or tears
- Emo-pneumothorax
- Pulmonary embolism
- Respiratory arrest
- Septic shock
- Stroke
Scar Tissue Locations

72%

48%

36%

41%

16%  71%

ACC 4/92
ICD LEAD EXTRACTION
3. TOOLS FOR EXTRACTION

- No tools: simple traction
- Stylets
- Snare, Catcher, Lassos
- Sheath: Mechanical, Laser, RF.
ELECTROSURGICAL ABLATION
## CLINICAL EXPERIENCES

<table>
<thead>
<tr>
<th>Center</th>
<th>Technique</th>
<th># patients</th>
<th># leads</th>
<th>Clin. success</th>
<th>Major Compl.</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byrd 1999</td>
<td>Mechanical</td>
<td>2338</td>
<td>3540</td>
<td>98 %</td>
<td>1,4 %</td>
<td></td>
</tr>
<tr>
<td>Byrd 2001</td>
<td>RF-sheath</td>
<td>265</td>
<td>542</td>
<td>99,4 %</td>
<td>2,6 %</td>
<td></td>
</tr>
<tr>
<td>Neuzil et al 2007</td>
<td>RF-sheath</td>
<td>60</td>
<td>84</td>
<td>99 %</td>
<td>3,3 %</td>
<td></td>
</tr>
<tr>
<td>Wilkoff 2007</td>
<td>Laser</td>
<td>1850</td>
<td>3238</td>
<td>99,4 %</td>
<td>0,3 %</td>
<td></td>
</tr>
<tr>
<td>Bongiorni et al 2008</td>
<td>Single sheath &amp; Transjugular</td>
<td>1193</td>
<td>2062</td>
<td>99,7 %</td>
<td>0,7 %</td>
<td>0,3 %</td>
</tr>
<tr>
<td>Epstein et al. 2008</td>
<td>Laser</td>
<td>498</td>
<td>975</td>
<td>99,1 %</td>
<td>0,4 %</td>
<td>0</td>
</tr>
<tr>
<td>Kennergren 2009</td>
<td>Laser</td>
<td>647</td>
<td>1032</td>
<td>99,3 %</td>
<td>0,9 %</td>
<td>0</td>
</tr>
<tr>
<td>Saba et al. 2008</td>
<td>Laser</td>
<td>212</td>
<td>456</td>
<td>98 %</td>
<td>4,2 %</td>
<td>0,4 %</td>
</tr>
<tr>
<td>LExl Con Study, 2009</td>
<td>Laser</td>
<td>1449</td>
<td>2405</td>
<td>97,7 %</td>
<td>1,4 %</td>
<td>1,8 %</td>
</tr>
<tr>
<td>LExl Con Study, Fidelis, 2009</td>
<td>Laser</td>
<td>71</td>
<td>100 %</td>
<td>0</td>
<td>0,4 %</td>
<td></td>
</tr>
<tr>
<td>Platou et al. 2009</td>
<td>Single sheath</td>
<td>420</td>
<td>692</td>
<td>97,6 %</td>
<td>1,9 %</td>
<td>0,4 %</td>
</tr>
</tbody>
</table>
Personal Experience on Lead Extraction

Single Sheath Technique
4. TECHNIQUES and APPROACHES

1. Superior Approach: using the implant vein

2. Inferior Approach or Femoral Approach

3. Internal Jugular Approach (personal technique from ‘97)
European perspective on lead extraction: Part II

Charles Kennergren, MD, PhD, FETCS

From the Department of Cardiothoracic Surgery, Sahlgrenska University Hospital, Gothenburg, Sweden.

The Pisa approach

Realizing that curved fibrotic leads are major obstacles, Bongiorni et al.² devised techniques to avoid this problem. Left-sided leads are cut and dragged down into the inferior vena cava or lower by a femoral gooseneck snare catheter. The lead is grabbed again, but now from the right jugular vein, then pulled out and reinforced with a locking stylet. Finally, the lead is extracted using a mechanical sheath on a surprisingly straight line from the jugular vein to the atrium or ventricle. The straight line makes all the difference compared with the lead that originally followed the brachiocephalic curve. I have used the Bongiorni technique in combination with laser sheaths introduced through the right jugular vein and it has worked well on very fibrotic leads. This positive impression of the right jugular approach was reinforced when I extracted free-floating leads using special short Needle’s Eye snares.
THE INTERNAL JUGULAR APPROACH

Exposed unextracted leads

Internal Jugular Approach
INTERNAL JUGULAR APPROACH

Standard Procedure: 90.4%
Jugular Approach: 98.4%

Complications:
- Standard: 0.55%
- Jugular: 0.64%
Transvenous removal of pacing and implantable cardiac defibrillating leads using single sheath mechanical dilatation and multiple venous approaches: high success rate and safety in more than 2000 leads

Maria Grazia Bongiorni, Ezio Soldati, Giulio Zucchelli, Andrea Di Cori, Luca Segreti, Raffaele De Lucia, Gianluca Solarino, Alberto Balbarini, Mario Marzilli, and Mario Mariani

Received 19 November 2007; revised 19 September 2008; accepted 29 September 2008
Patients and Leads Characteristics
(January 1997 - June 2009)

<table>
<thead>
<tr>
<th>Patients</th>
<th>1424</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean</td>
<td>65.4</td>
</tr>
<tr>
<td>range</td>
<td>3-95</td>
</tr>
<tr>
<td>Sex</td>
<td>M / F</td>
</tr>
<tr>
<td>Exposed / Intravascular</td>
<td>1074/350</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Leads</th>
<th>2523</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean pacing period (months)</td>
<td>69.1</td>
</tr>
<tr>
<td>range</td>
<td>1-336</td>
</tr>
<tr>
<td>Pacing / Defibrillating leads</td>
<td>2184/339</td>
</tr>
<tr>
<td>Exposed / Intravascular</td>
<td>2442/81</td>
</tr>
</tbody>
</table>

Division of Cardiovascular Diseases - University Hospital of Pisa (Italy)
INDICATIONS TO LEAD REMOVAL (January 1997 – June 2009)

- 55% LOCAL INFECTION
- 29% SEPSIS
- 10% MALFUNCTION
RESULTS

- 98.1% Total removal
- 0.7% Partial Removal
- 0.2% Failure
- 1.0% Not Applicable
# RESULTS

<table>
<thead>
<tr>
<th></th>
<th>N° of leads</th>
<th>Total Extr.</th>
<th>Partial Extr.</th>
<th>Failure</th>
<th>Compl.</th>
<th>Pacing Period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A&amp;V PM</strong></td>
<td>2062</td>
<td>97.7%</td>
<td>1.2%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>76.84</td>
</tr>
<tr>
<td><strong>CS</strong></td>
<td>122</td>
<td>99.2%</td>
<td>0%</td>
<td>0.8%</td>
<td>0%</td>
<td>29.68</td>
</tr>
<tr>
<td><strong>ICD</strong></td>
<td>339</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>43.46</td>
</tr>
</tbody>
</table>
# Major Complications (0.56%)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Count</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Tamponade</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Hemothorax</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Deaths**

3/1424 pts (0.2%)
HOW TO AVOID LEAD INFECTION
CARDIAC DEVICE INFECTION
RISK FACTORS

Risk Factors Related to Infections of Implanted Pacemakers and Cardioverter-Defibrillators
Results of a Large Prospective Study

Didier Klug, MD, PhD; Mamadou Balde, MD; Dominique Pavlin, MD; Françoise Hidden-Lucet, MD; Jacques Clementy, MD; Nicolas Sadiou, MD; Jean Luc Rey, MD; Gilles Lande, MD; Arnaud Lazarus, MD; Jacques Victor, MD; Claude Barnay, MD; Bruno Grandbastien, MD; Salem Kacet, MD; for the PEOPLE Study Group

Background—The Prospective Evaluation of Pacemaker Lead Endocarditis study is a multicenter, prospective survey of the incidence and risk factors of infectious complications after implantation of pacemakers and cardioverter-defibrillators.

Methods and Results—Between January 1, 2000, and December 31, 2000, 6319 consecutive recipients of implantable systems were enrolled at 44 medical centers and followed up for 12 months. All infections complications were recorded, and their occurrence was related to the baseline demographic, clinical, and procedural characteristics. Among 5866 pacing systems, 3789 included 2 and 117 had >2 leads; among 453 implantable cardioverter-defibrillators, 178 were dual-lead systems. A total of 4461 de novo implantations occurred and 1838 pulse generator or lead replacements. Reinterventions were performed before hospital discharge in 101 patients. Single- and multiple-variable logistic regression analyses were performed to identify risk factors; adjusted odds ratios (aORs) and 95% confidence intervals (CIs) were calculated. At 12 months, device-related infections were reported in 42 patients (0.88%; 95% CI, 0.47 to 0.89). The occurrence of infection was positively correlated with fever within 24 hours before the implantation procedure (aOR, 5.83; 95% CI, 2.00 to 16.08), use of temporary pacing before the implantation procedure (aOR, 2.46; 95% CI, 1.09 to 5.13), and early reinterventions (aOR, 15.04; 95% CI, 6.7 to 33.73). Implantation of a new system (aOR, 0.46; 95% CI, 0.24 to 0.87) and antibiotic prophylaxis (aOR, 0.4; 95% CI, 0.18 to 0.86) were negatively correlated with risk of infection.

Conclusions—This study identified several factors of risk of device infection and confirmed the efficacy of antibiotic prophylaxis in recipients of new or replacement pacemakers or implantable cardioverter-defibrillators. (Circulation. 2007;116:1349-1355.)

Klug Circ 2007; 116
PEOPLE STUDY

Risk factors for infection
- Fever 24 h before implant (OR 5.83)
- Temporary pacing wire (OR 2.46)
- Early reintervention (OR 15.04)

Protective factors for infection
- Antibiotic prophylaxis (OR 0.4)
- De novo implantation (OR 0.46)

Klug Circ 2007; 116
189 Patients with Cardiac Device Infection

- Long-term corticosteroid use (OR 13.90)
- The presence of >2 pacing leads versus 2 leads (OR 5.41).
- Use of antibiotic prophylaxis prior to PM implantation had a protective effect (OR 0.087).
Several study have demonstrated that preimplantations antibiotics are effective in decreasing infectious complications

Klug Circ 2007; 116
Sohail CID 2007; 45
Bertaglia PACE 2006; 29
Da Costa Circ 1998; 97
ANTIBIOTIC PROPHYLAXIS

*Staphylococci* account for more than 2/3 of CDI cases in most published series.

*Chua Ann Intern Med* 2000; 133
*Klug Heart* 2004; 90
*Sohail JACC* 2007; 49
Microbiology of PPM/ICD Infections (n = 189)

- Culture negative: 7%
- Fungal: 2%
- Polymicrobial: 7%
- Gram negative bacilli: 9%
- Other Gram positive cocci: 4%
- Methicillin-resistant S. aureus: 4%
- Methicillin-sensitive S. aureus: 25%
- Coagulase-negative staphylococci: 42%

= 71%
Why
Staphylococcal infection is so frequent?
Why Staphylococcal infection is so frequent?

PM infections are mainly caused by a contamination by local bacterial flora during implantation.

Da Costa et al. Circulation 1998;97
HOW TO AVOID LEAD INFECTION

Take home messages

- Postoperative infection
  - Early
  - Late

- Metastatic infection
HOW TO AVOID Postoperative LEAD INFECTION

General rules

Before starting……..

Is that implant necessary?
Consider that in 13 to 52% of the cases of infected system removed, no reimplantation was performed

Cacoub P et al. Am J Cardiol 1998;8
Bohm A et al. PACE 1996; 19
Chua Ann Intern Med 2000; 133

If Yes
Utilize technique and hardware that allow for less difficult implantation (intervention time < 2 hrs)
(e.g. AAIR, VDD single lead)
HOW TO AVOID Postoperative LEAD INFECTION
General rules

1. Patients

2. Operators and OR

3. Intervention
**HOW TO AVOID** Postoperative **LEAD INFECTION**

**General rules**

**1. Patients**

1. Elimination of *ongoing infection* and potential *source* of bacteremia (Foley, CV lines)
2. Special attention in patients with poor control of *diabetes* or pts treated with *steroids*
3. **Nasal swab** specimens can be sent for S. *aureus amplification* before surgery
4. **Scrub body pts** with antiseptic cleanser the night before the procedure.
HOW TO AVOID Postoperative LEAD INFECTION
General rules

2. Operators and OR

1. If the implantation take place in an electrophysiology laboratory it should be treated as an OR.
2. Full surgical scrubbing is an absolute necessity for the primary and secondary operators.
3. All personnel must wear appropriate OR attire.
4. All of the radiographic and lighting equipment should be covered with sterile plastic.
5. Minimize the traffic of doctors and nurses in OR.
HOW TO AVOID Postoperative LEAD INFECTION

General rules

3. Intervention

1. Avoid temporary pacing wire if possible
2. Keep in mind the time (particular in longer procedure and reoperations)
3. Perform a correct subcutaneous or subpectoral pocket to reduce erosion
4. Prevent bleeding and hematoma (hemostasis, compression dressing and control ongoing anticoagulants drugs)
5. Prophylactic antibiotics
HOW TO AVOID Postoperative LEAD INFECTION

General rules

3. Intervention

6. PM or ICD replacement, revision, upgrade are at higher risk of infection.

7. “Simple” reoperation must be done in OR with all the above mentioned precautions.

8. The consequences of an early reintervention can be more serious than the original complication itself.

9. If the reintervention can be delayed, the therapeutic abstension might be preferable to exposing the patient to a high risk of infection.
HOW TO AVOID LEAD INFECTION

Take home messages

- Postoperative infection
  - Early
  - Late

- Metastatic infection
HOW TO AVOID Metastatic LEAD INFECTION

- **Antibiotic prophylaxis** in PM or ICD pts undergoing dental procedure, Foley catheters positioning or other circumstances causing bacteremia is still unanswered in the literature.
- In my opinion the antibiotic therapy used should be similar to the protocols published for pts with diseased or prosthetic heart valves
- Finally, any **intravenous fluid** should not be administered on the same side as the implant.
GRAZIE PER L’ATTENZIONE