Extraction of Pacemaker and Defibrillator Leads
Indications and Technical Approaches

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Disclosures

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Pacemaker/ICD Lead Extraction
Device Implantation – Current Status

- 400,000 device implantations per year
- > 3,000,000 patients with cardiac devices
- Expanding numbers of patients requiring device/electrode explantation
  - > 15,000 explants/year
Pacemaker/ICD Lead Extraction

Indications

- Pocket and electrode infections
  1º and 2º
Pacemaker/ICD Lead Extraction

Device Infections

Primary

Secondary
Indications

- **Pocket and electrode infections**
  - $1^{\circ}$ and $2^{\circ}$

- **Dysfunctional and recalled electrodes**

- **Upgrades/ Superfluous leads (>4)**

- **Venous obstruction/SVC syndrome**
**Mayo Clinic study 2009**

- 78 ICD patients with 101 abandoned electrodes
- 1 – 5 year follow-up

**Results**

- No sensing malfunctions detected
- No increase in DFTs
- No thromboembolic events identified
Pacemaker/ICD Lead Extraction

Vascular Occlusion
Pacemaker/ICD Lead Extraction

Chronic Lead Issues

Чронічно імплантовані електроди формують кілька Thrombo-fibrotic адгезій.

*Schneider,2016*
Pacemaker/ICD Lead Extraction

Chronic Leads - Sites of adhesion

Chronically implanted electrodes form multiple fibrotic adhesions.
Pacemaker/ICD Lead Extraction

Chronic Lead Issues

*Chronically implanted electrodes form multiple Thrombo-fibrotic adhesions*
Pacemaker/ICD Lead Extraction
Basic Techniques

- **Electrode traction**  
  *(Recent lead placement—Pull it !!)*

- **Traction with counterweights**

- **Traction with locking stylet**
Pacemaker/ICD Lead Extraction

Basic Techniques

- Traction with counterweights
- Traction with locking stylet

- *Traction with locking stylet*
Pacemaker/ICD Lead Extraction

Basic Techniques

- Electrode traction
- Traction with counterweights
- Traction with locking stylet

❖ Traction with locking stylet
Pacemaker/ICD Lead Extraction
Advanced Techniques

- Mechanical dissection
- Laser-assisted extraction
- Open Surgical explantation
Pacemaker/ICD Lead Extraction

Mechanical Dissection

Tissue Dilators

Snares
Pacemaker/ICD Lead Extraction
Mechanical Dissection
Pacemaker/ICD Lead Extraction
Laser Extraction

Spectranetics
Excimer Laser system
Pacemaker/ICD Lead Extraction

Laser Extraction

Mechanical extraction versus Laser extraction ??

Techniques are complementary . . . .
Pacemaker/ICD Lead Extraction

Counter Pressure / Counter Traction

Diagram showing the concept of counter pressure and counter traction in lead extraction.
Pacemaker/ICD Lead Extraction

Counter Traction

Ventricular invagination

Counter Traction
Snaring technique via femoral approach enhances removal

Inferior traction creates linear rail to extract
Pacemaker/ICD Lead Extraction

SVC syndrome

Baseline - - 15 years post-DDDR pacemaker implantation (age – 32)

Post-bending forward x 5 minutes
Venous obstruction due to pacemaker electrodes
SVC Syndrome
Post-pacemaker

Laser-assisted lead extraction and angioplasty
SVC Syndrome
Post-pacemaker

Dilatation with
18 x 80 mm
PTA balloon
SVC Syndrome
Post-pacemaker

Laser-assisted lead extraction and angioplasty
All symptoms resolved

CTA
6 months post-PTA
May, 2007

May, 2007
Pacemaker/ICD Lead Extraction
Procedural Considerations

Surgical backup availability essential as preparation for potential catastrophic events...

Rapid Resources

- Pericardiocentesis
- Large PTA balloon to occlude torn SVC/Subclavian vein
- Emergency thoracotomy

“deploys in under 2 minutes”
### Lead Extraction Study - 2011

<table>
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<tr>
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<th>Cases</th>
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<td><strong>OR</strong></td>
<td><strong>533</strong></td>
</tr>
<tr>
<td><strong>EP</strong></td>
<td><strong>831</strong></td>
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### OR vs EP Lab

<table>
<thead>
<tr>
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<th>Success rates</th>
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<tr>
<td><strong>OR</strong></td>
<td><strong>93%</strong></td>
</tr>
<tr>
<td><strong>EP</strong></td>
<td><strong>91%</strong></td>
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### Outcomes similar

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<tr>
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<th>Complications</th>
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<tr>
<td><strong>OR</strong></td>
<td><strong>2.8%</strong></td>
</tr>
<tr>
<td><strong>EP</strong></td>
<td><strong>2.2%</strong></td>
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Pacemaker/ICD Lead Extraction
Overview - 2016

• High risk features
  ❖ Age, co-morbidities
  ❖ Older leads
  ❖ Ongoing infection/sepsis
  ❖ More intense fibrosis may be observed in younger patients

• Success rates
  95 - 99%

• Mortality
  1%
Until recently . . .

All Pacemakers and ICDs required placement of transvenous electrodes to directly monitor and stimulate the cardiac electrical system.
• An expanding number of device patients will require electrode extraction.

• Leadless devices will become the preferred option for both pacing and defibrillation.
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