Lead Extraction

정보영

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M/39, ICD 2.5 yr ago
The Chronic Lead
Prevalence

- Lead extraction may be necessary for a variety of reasons.
  - >45 years since endocardial leads introduced
  - Increased number of occasional implanters and non-operating room surgeries
  - On average, 10% of all leads implanted may require removal

USA
- Implantation; ≈ 400,000 devices/year
- >3 million patients with implanted cardiac devices currently
- On average, 10% of all leads implanted may require removal
The Chronic Lead

- Why dose an implanted cardiac lead pose such a problem at time of removal?
The Chronic Lead

Binding scar tissue
Lead Removal

- Within the general category of “lead removal”, the Heart Rhythm Society marks the distinction between:
  - Lead explant
    - < 1 yr, simple procedure
  - Lead extraction
    - > 1 yr, “specialized” equipment
Indication
Indication

- Transvenous Lead Extraction -

1. Infection
2. Chronic pain
3. Thrombosis or venous stenosis
4. Functional leads
5. Non functional leads

Infection

Year

Infected CRMD

Implanted CRMD
Prevalence of Infection

- ≈ 60% of the lead extractions required are due to infection.
- Infection and erosion are higher after elective unit replacement (6.5%) than after a first implant (1.4%).
- 25% of infections occurred with the first month, 33% occurred late (29-364 days), and 42% were delayed, presenting beyond one year.
Management

- Complete device and lead removal is important.
- Persistence of infection has been described in up to 77% of patients in whom only the generator was removed.
- Prolonged antibiotic treatment coupled with partial explantation results in further morbidity and cost.
Infection

• Class I
• 1. Complete device and lead removal is recommended in all patients with definite CIED system infection, as evidenced by valvular endocarditis. (Level of evidence: B)
• 2. 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 the transvenous portion of the lead system. (Level of evidence: B)
• 3. 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)
• 4. Complete device and lead removal is recommended in patients with occult gram-positive bacteremia (not contaminant). (Level of evidence: B)
Principles for CIED replacement following infected removal

• Class I
• 1. Each patient should be carefully evaluated to determine if there is a continued need for a new CIED. *(Level of evidence: C)*
• 2. The replacement device implantation should not be ipsilateral to the extraction site. Preferred alternative locations include the contralateral side, iliac vein, trans-atrial and epicardial implantation. *(Level of evidence: C)*
Chronic pain

• There is severe chronic pain, at the device or lead insertion site

• Pain that is not manageable by medical or surgical techniques and there is no other alternative
Thrombosis or Venous Stenosis

- Clinically significant thrombo-embolic events associated with thrombus on a lead or a lead fragment

- Bilateral subclavian vein or superior vena cava occlusion precluding implantation of a needed transvenous lead
Funtional and Non Functional Leads

- Life threatening arrhythmias secondary to retained leads or lead fragments
- Leads that, due to their design or their failure, may pose an immediate threat to the patients if left in place
- Leads that interfere with the operation of implanted cardiac device or the treatment of malignancy
Percutaneous Extraction Techniques
Percutaneous Extraction Techniques

• Superior Approach: Extraction via the implant site

• Femoral Approach: Extraction via the femoral vein (when the subclavian approach is not possible)
Alternative Approaches

- Pulling
- Weighed Traction
- Thoracotomoy
Lead Extraction™
Accessories

LEAD CLIPPER
COIL EXPANDER
PIN VISE
STYLET WIRES
SOF-GRIP HEMOSTAT
LEAD EXTRACTION™
LIBERATOR® LOCKING Stylet

Locks positively along a length at the distal end of the lead.
LEAD EXTRACTION™
Manual Mechanical Telescoping dilator Sheath Sets

POLYPROPYLENE

TFE

STAINLESS STEEL
Counter Traction

A

B
Lead Extraction
Laser Lead Sheath
Lead Extraction – Laser -
EVOLUTION®
Mechanical Dilator Sheat Set

Sheath rotates when the trigger handle is squeezed for maximum operator control

• The patented threaded barrel tip provides succinct passage past fibrous binding sites without the “forward depth of cut” of other powered sheaths
• Available in four sizes that are compatible with both pacing and defibrillator leads: 7, 9, 11 & 13 Fr. (I.D.)
Extraction by RF Energy
Femoral Extraction
Complications
Major Complications

- Death
- Surgical tear (cardiac or vascular)
- Pulmonary embolism requiring survival intervention
- Stroke
- New onset infection to the pacing system
- Anesthesia complications

The Danger Zone
- Tear of puncture of SVC

Perforation of the innominate vein

Avulsion of right ventricle
Predictors of Major Complications

- Implant duration of oldest lead
- Female gender
- ICD lead removal
- Use of laser
Minor Complications

- Pericardial effusion
- Hemothorax, arm-swelling or thrombosis of implant veins, pneumothorax, hematoma, vascular repair
- Hemodynamically significant air embolism
- Migrated lead fragment
- Blood transfusion
- Pulmonary embolism

Lead Management
Environment: Personnel

- Primary operator
- Cardiothoracic surgeon
- Anesthesia support
- Echocardiographer
- X-ray technician
Physician qualifications

• For physicians performing their first case, 12% of leads were not removed.
• For physicians that have performed >10 cases, only 2% of leads were not removed.
• Analysis of lead extraction outcomes suggests that the frequency of procedural (radiographic) failure drops dramatically after the first 10-20 procedures have been performed.
• Current procedure related mortality is less than 0.5%, less than 0.2% at experience centers.
세브란스 병원 시술전 준비

• 환자와 보호자에게 시술에 대한 충분한 설명
• Baseline blood test (CBC, SMA, INR,..)
• Blood type, crossmatch
• 혈액 준비 (> 4units)
• Large bore venous access (8Fr sheath)
• Temporary pacing, defibrillation 준비
• ECG, BP monitoring
• pericardiocentesis 준비
• 흉부외과 준비
Lead extraction in Severance Hospital

Number of Patients (n)

Years

2004 2005 2006 2007 2008 2009 2010 2011
Take Home Message

• The number of lead extraction procedures is rising sharply in parallel with ever increasing indications for pacemaker implantation.

• Current procedure related mortality is less than 0.5%, less than 0.2% at experience centers.

• For physicians that have performed >10 cases, only 2% of leads were not removed.

• Long implantation time, lack of operator experience, ICD lead type and female gender are risk factors for complications.
경청해 주셔서 감사합니다!
Risk factors
- Infection & mortality -

• Infection is a complication of CRMD therapy which is associated with significantly increased in-hospital mortality
• Younger age and male gender are independent risk factors for contracting CRMD infection
• Older age, renal failure, and CRMD infection are independent risk factors for mortality among patients with implanted devices