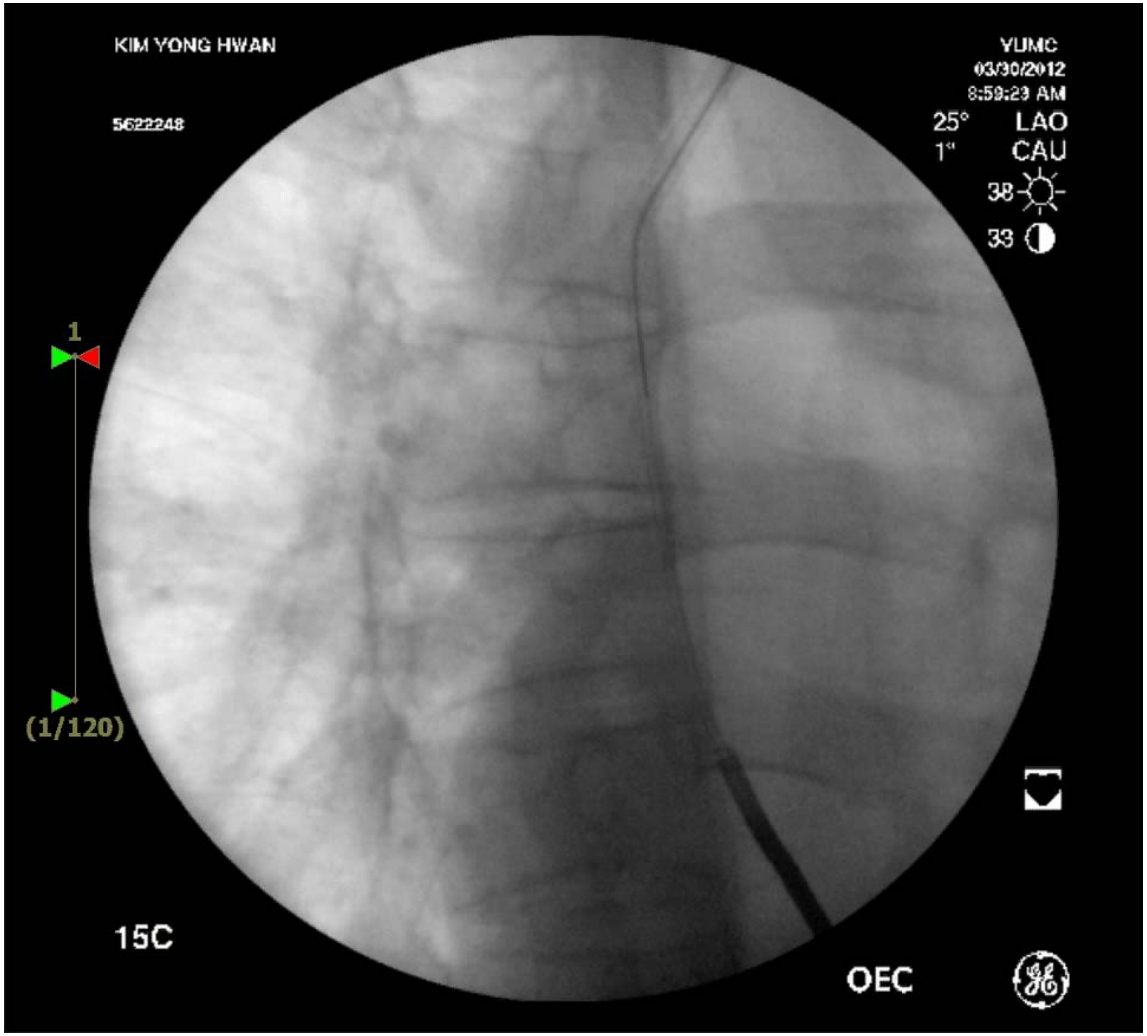
Lead Extraction

정보영

연세대학교 심장내과

M/39, ICD 2.5 yr ago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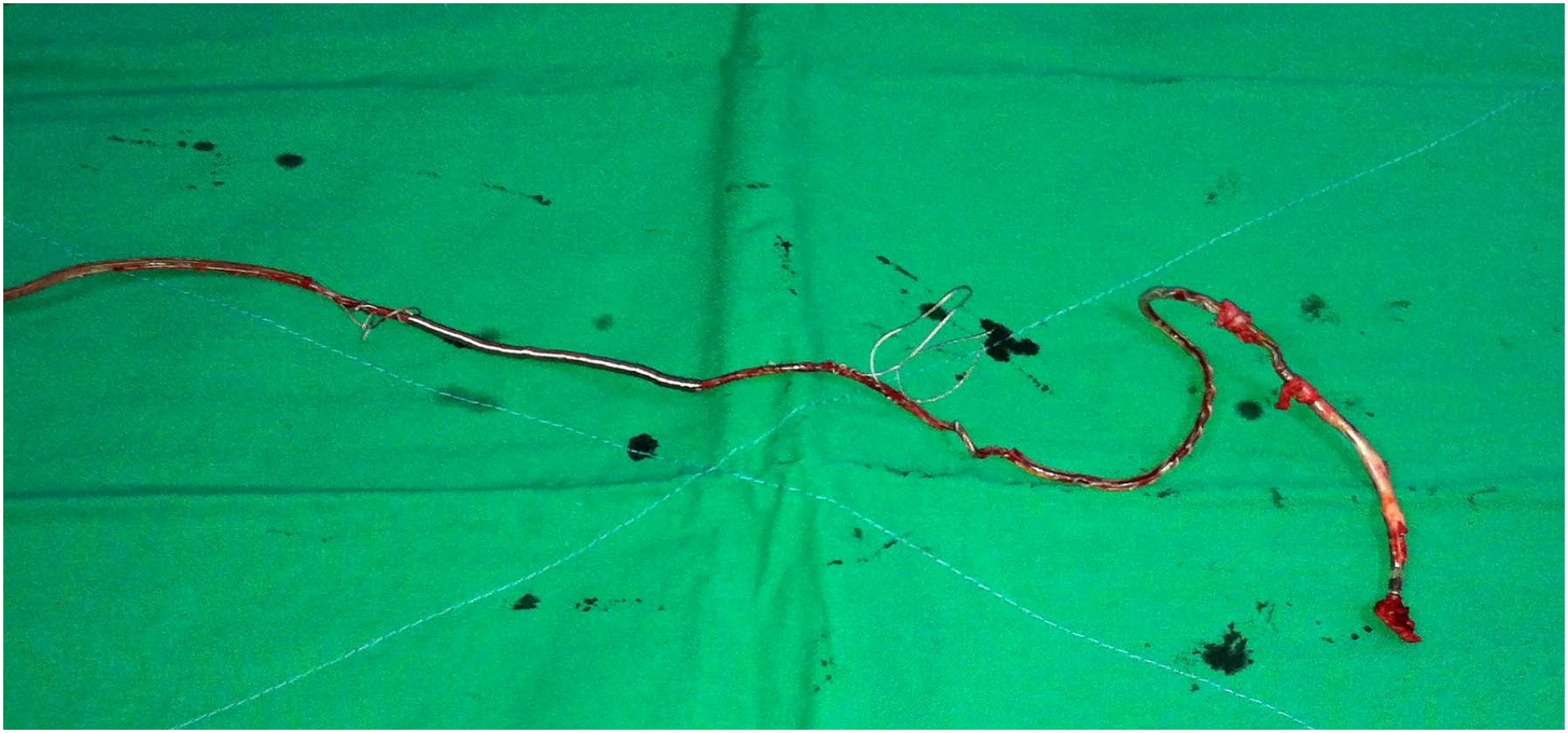
The Chronic Lead



Prevalence

- **Lead extraction may be necessary for a variety of reasons.**

USA

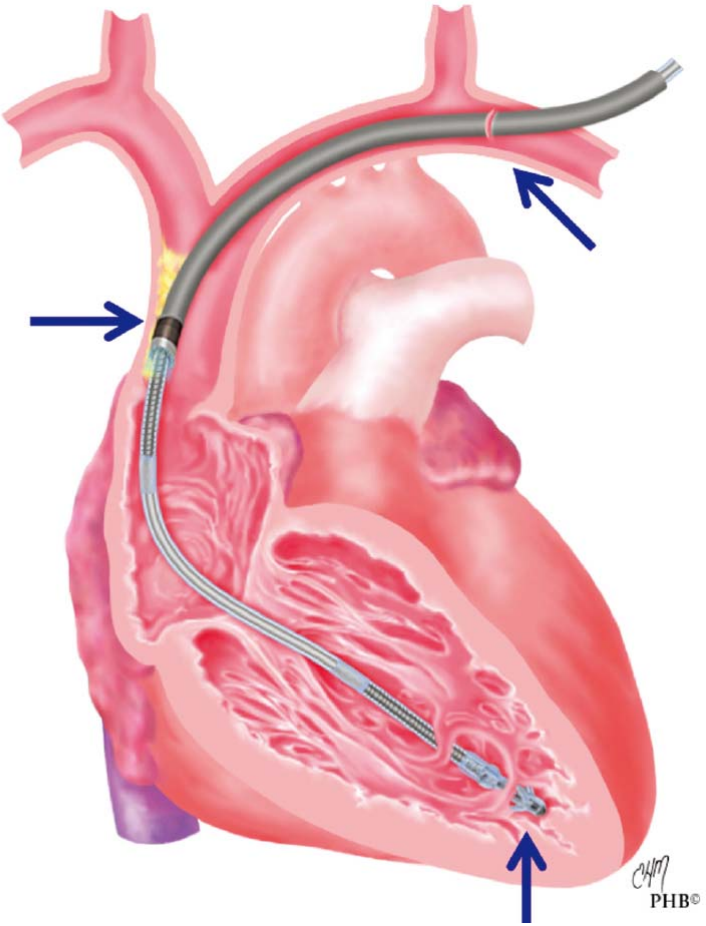
- Implantation; ≈ 400,000 devices/year

- >3 million patients with implanted cardiac devices currently

sugeries

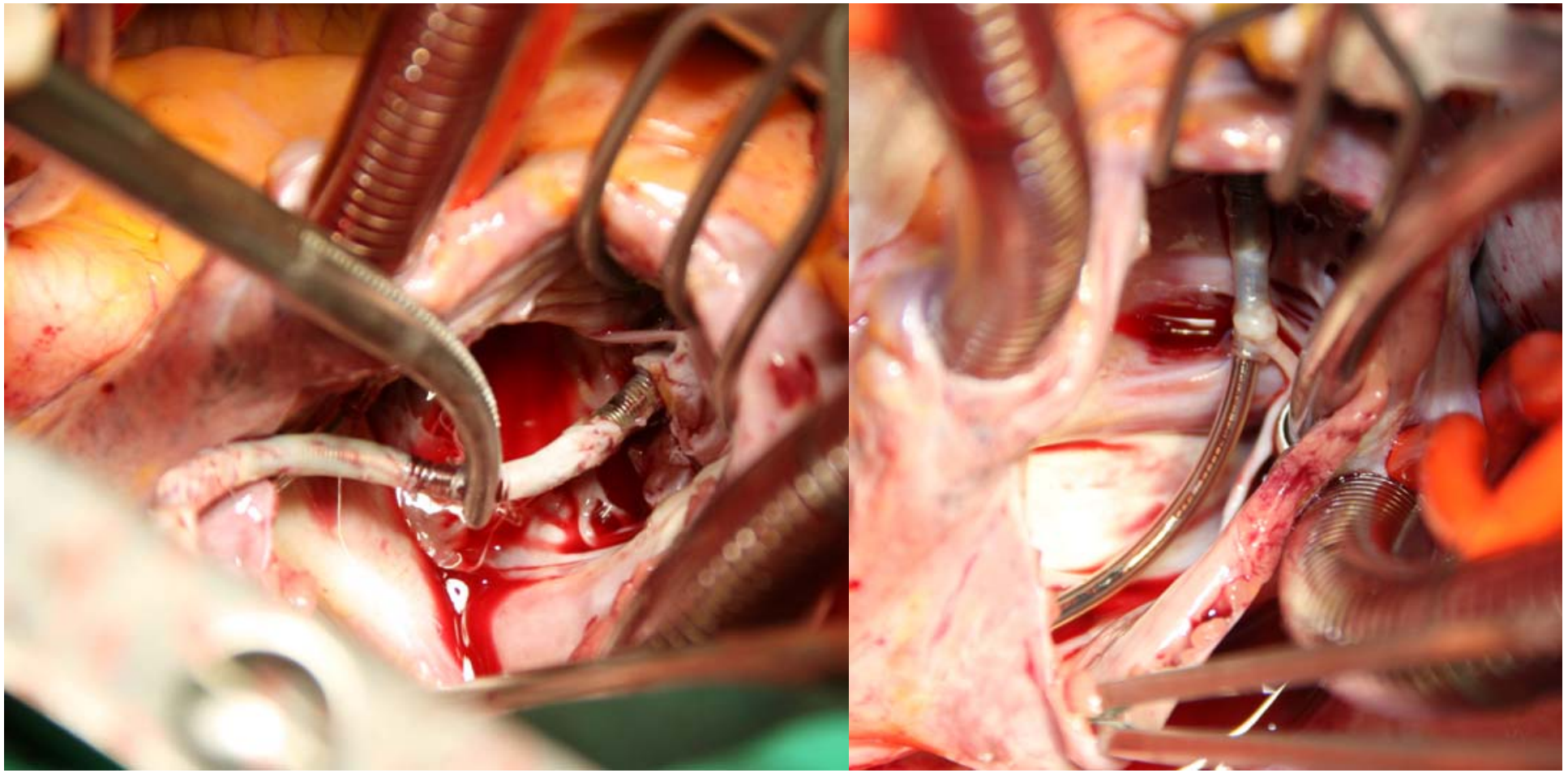
  - **On average, 10% of all leads implanted may require removal**

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 markes the distinction between;**

- **Lead explant**
  - **< 1 yr, simple procedure**
- **Lead extraction**
  - **> 1 yr, “specialized” equipment**

Indication

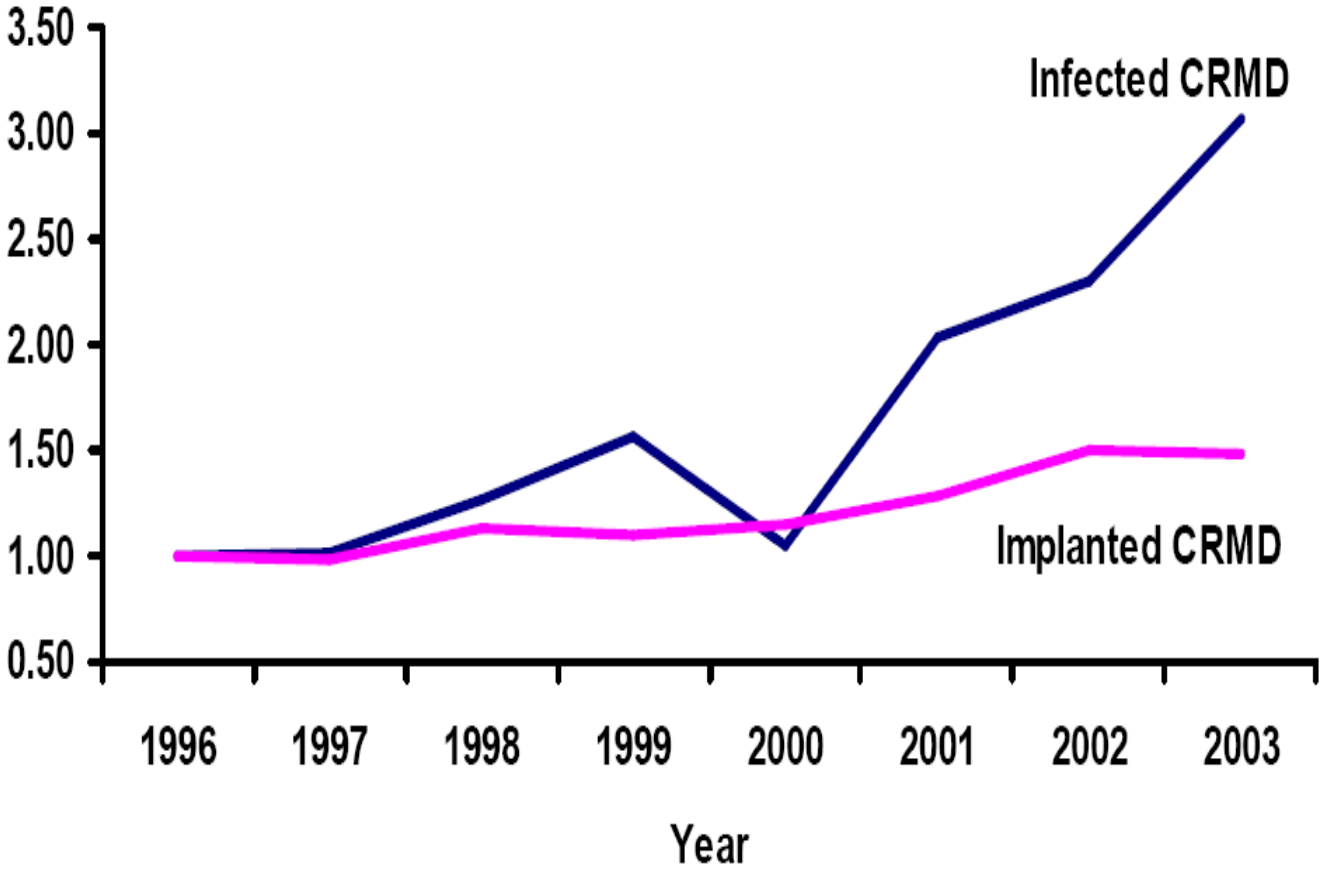
Indication

- Transvenous Lead Extraction -

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

Wilkoff B, et al. Heart rhythm 2009: 1085-1104

Infection


3.50
3.00
2.50
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Infected CRMD
Implanted CRMD
1996
1997
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1999
2000
2001
2002
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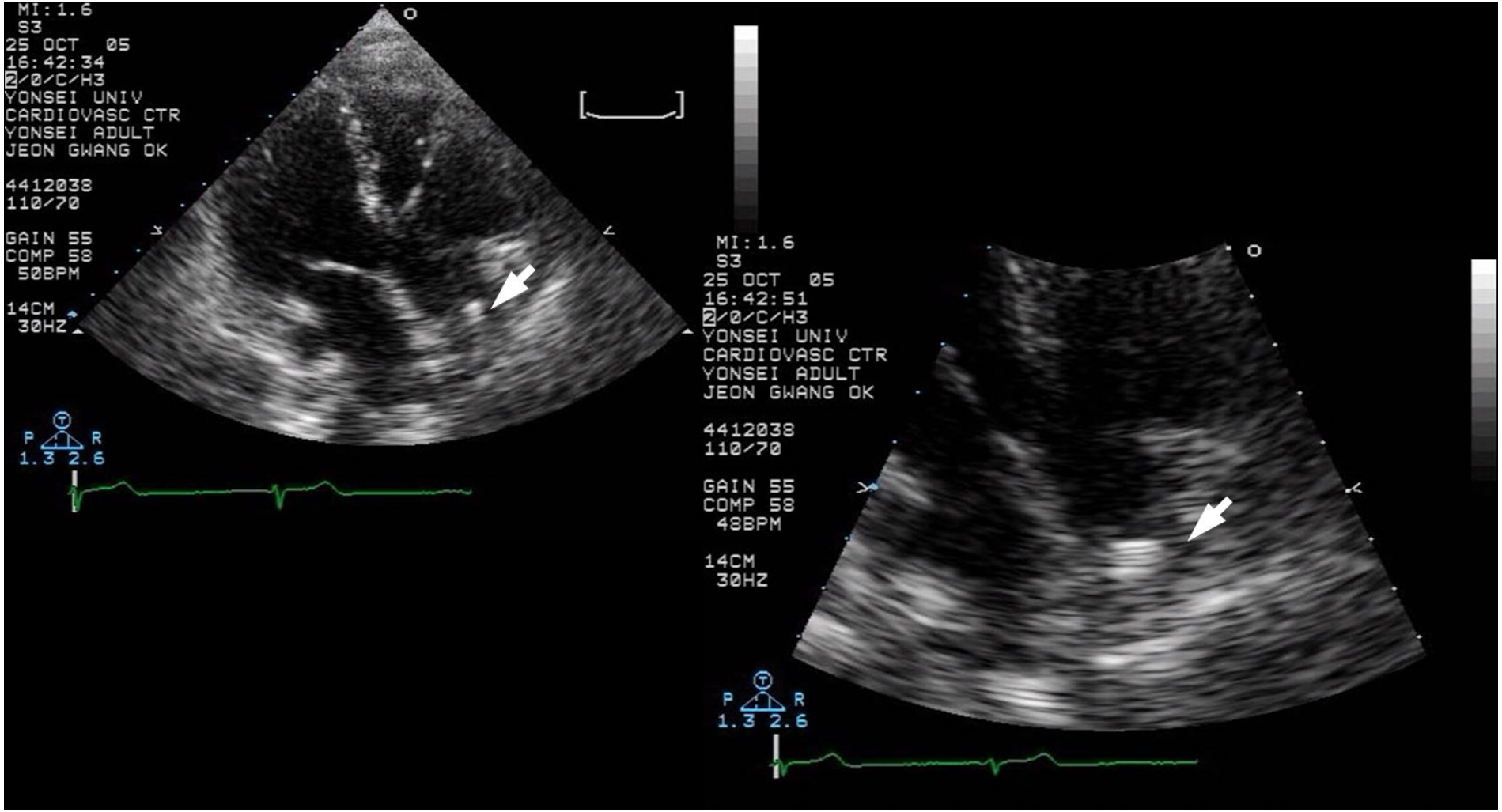
Year

Pocket Infection

Erosion

Vegetation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JEON GWANG OK
4412038
110/70
GAIN 55
COMP 58
48BPM
14CM
30HZ
P R
1.3 2.6

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 patial explantation results in further morbidity and cost.**

Infection

- Class I
- 1. Complete device and lead removal is recommended in all patients with definite valvular endocarditis (*Level of evidence: B*)
- 2. Complete device and lead removal is recommended in all patients with CIED pocket infection, device erosion, skin ulceration without clinically evident involvement of 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*)

Complete device and lead removal

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 intefere with the operation of implanted cardiac device or the treatment of malignancy

Percutaneous Extraction Techniques

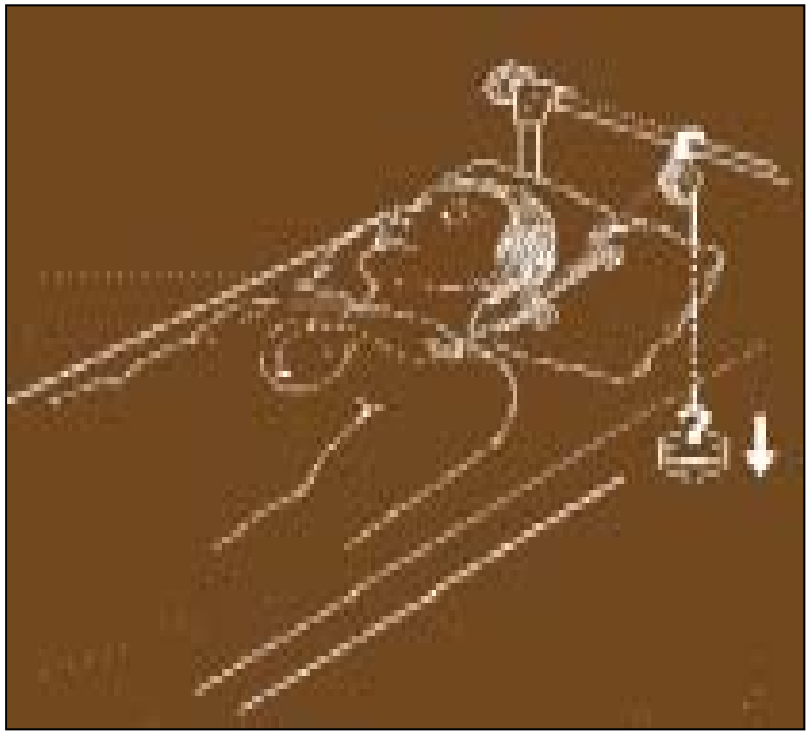
Percutaneous Extraction Techniques

- **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
- Thoracotomy

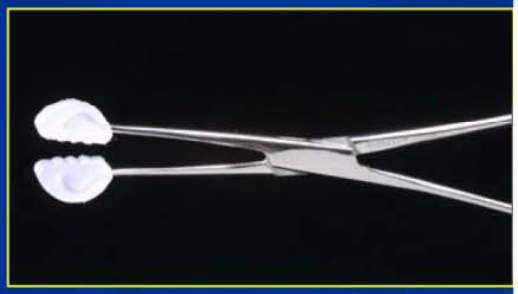
Pulleys & Weights



Lead Extraction™ Accessories

LEAD CLIPPER

COIL EXPANDER



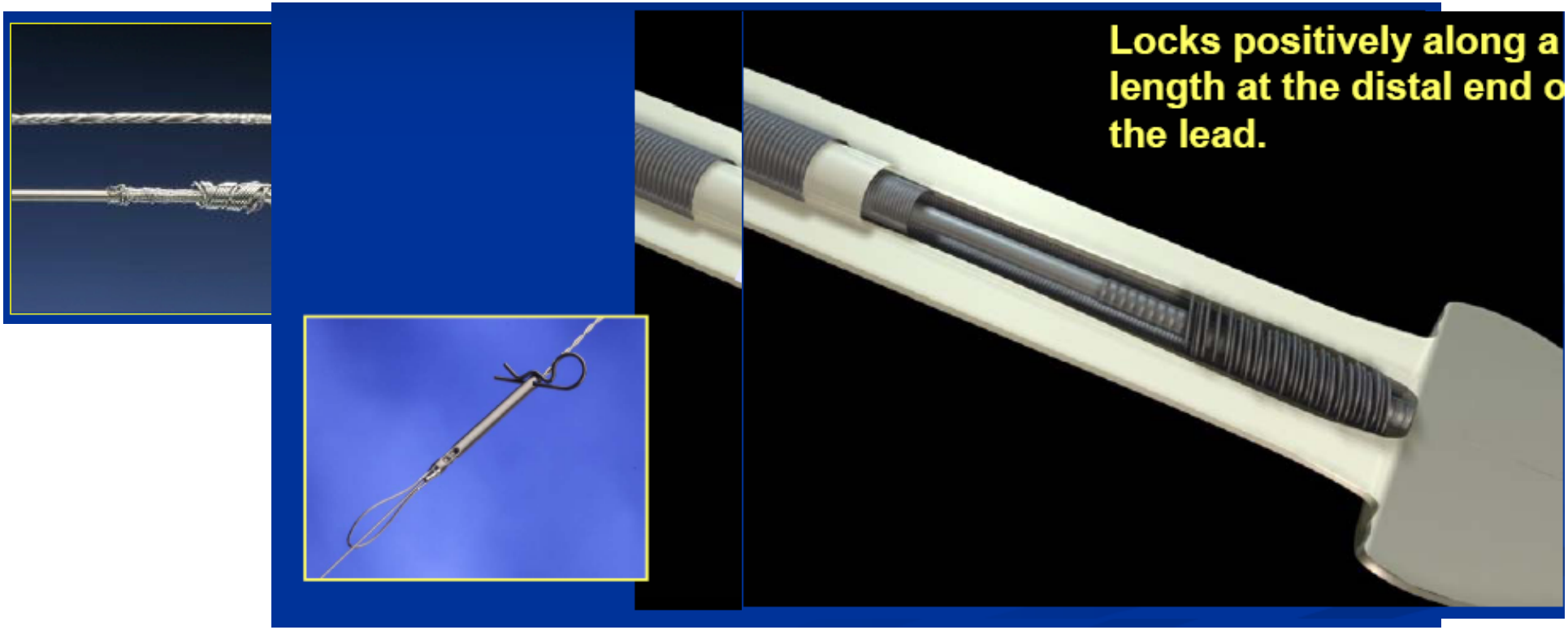
SOF-GRIP HEMOSTAT

PIN VISE

STYLET WIRES

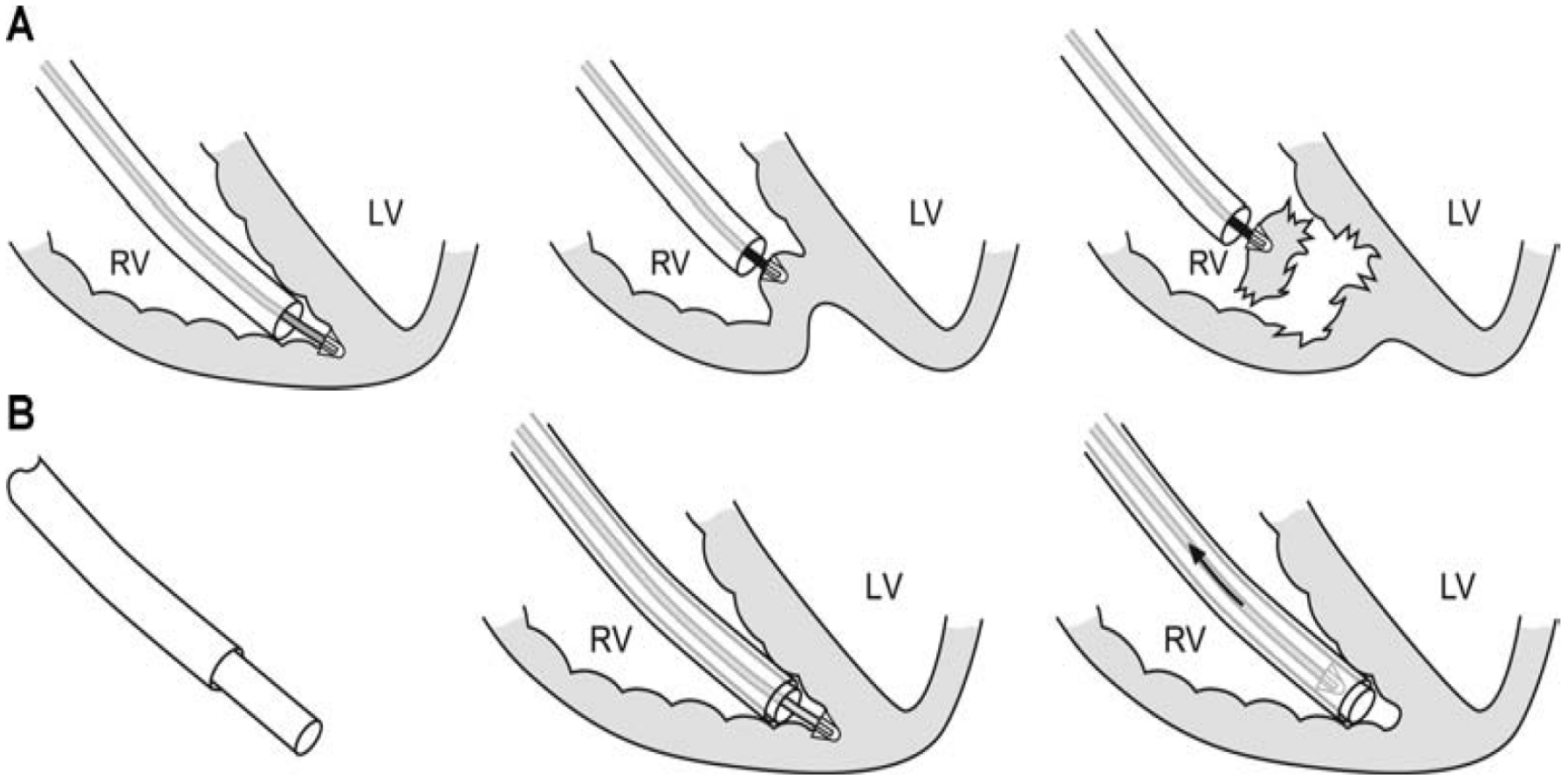
COOK MEDICAL

LEAD EXTRACTION™
LIBERATOR® LOCKING Stylet

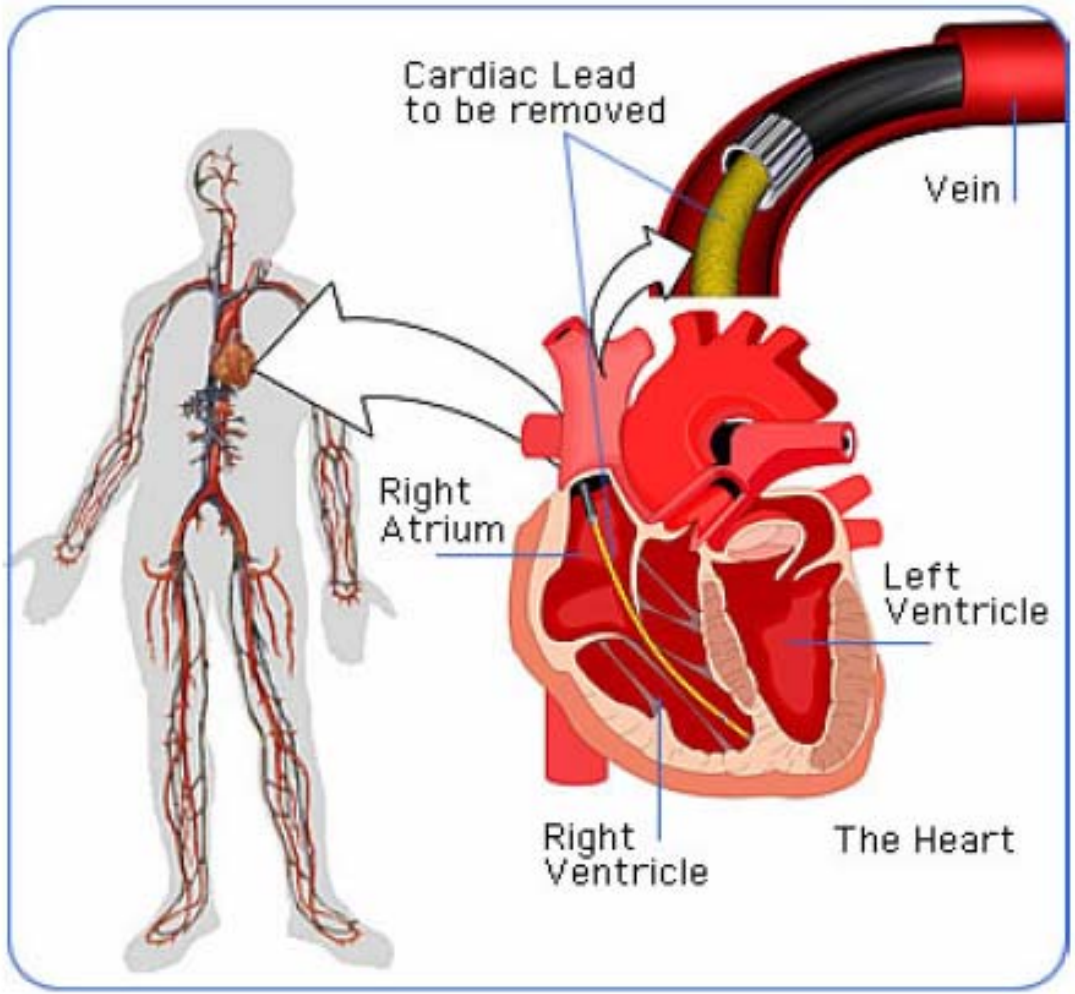


LEAD EXTRACTION™
Manual Mechanical Telescoping dilator Sheath Sets

Counter Traction

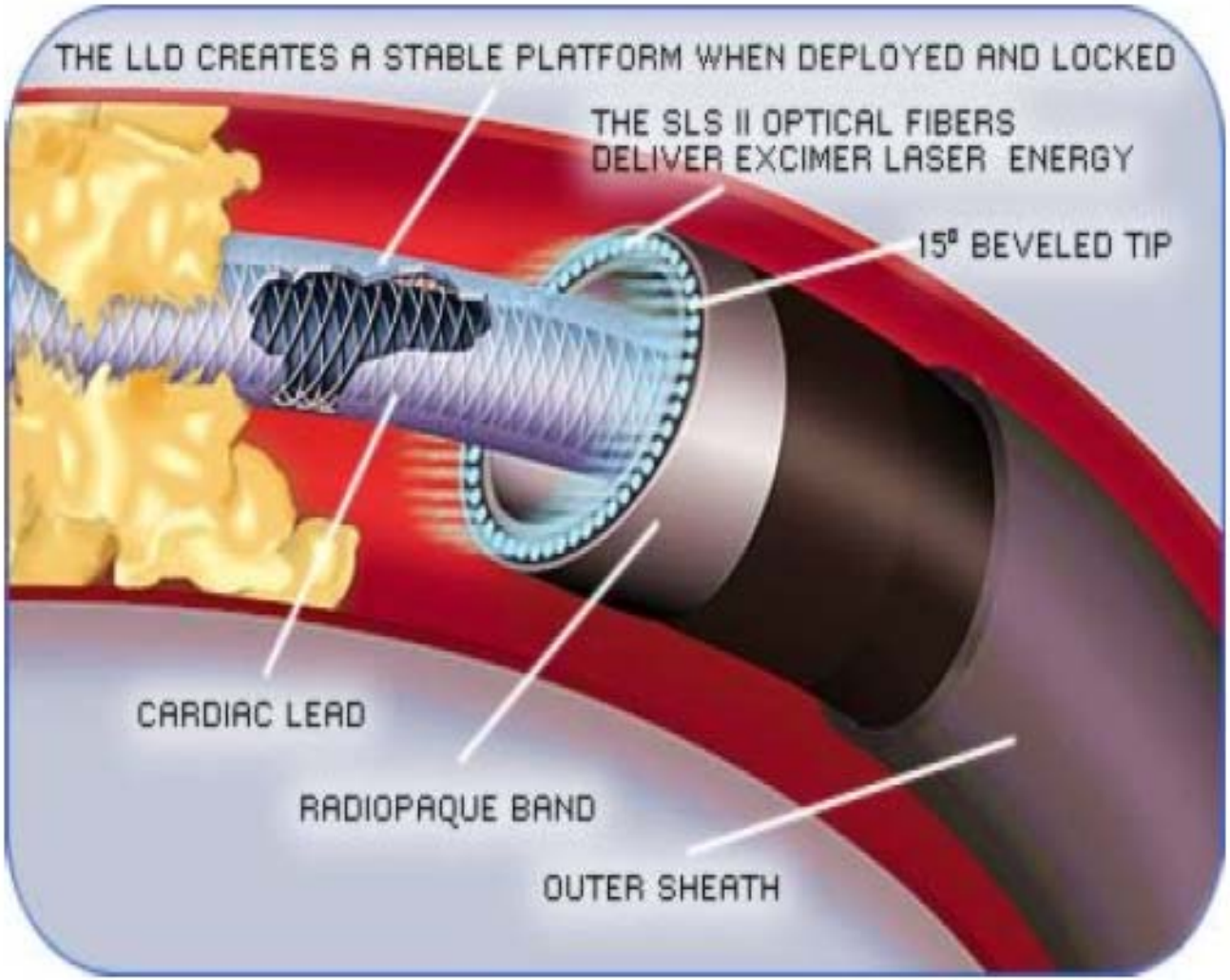


Lead Extraction



Laser Lead Sheath

Lead Extraction – Laser -

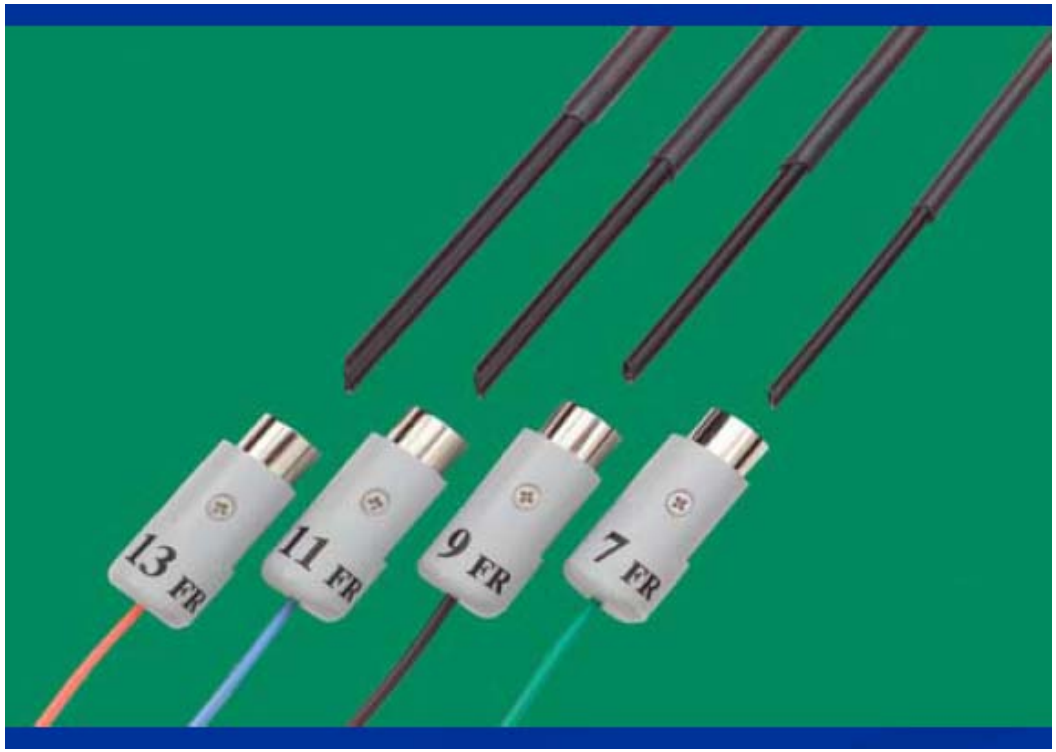


EVOLUTION®
Mechanical Dilator Sheat Set

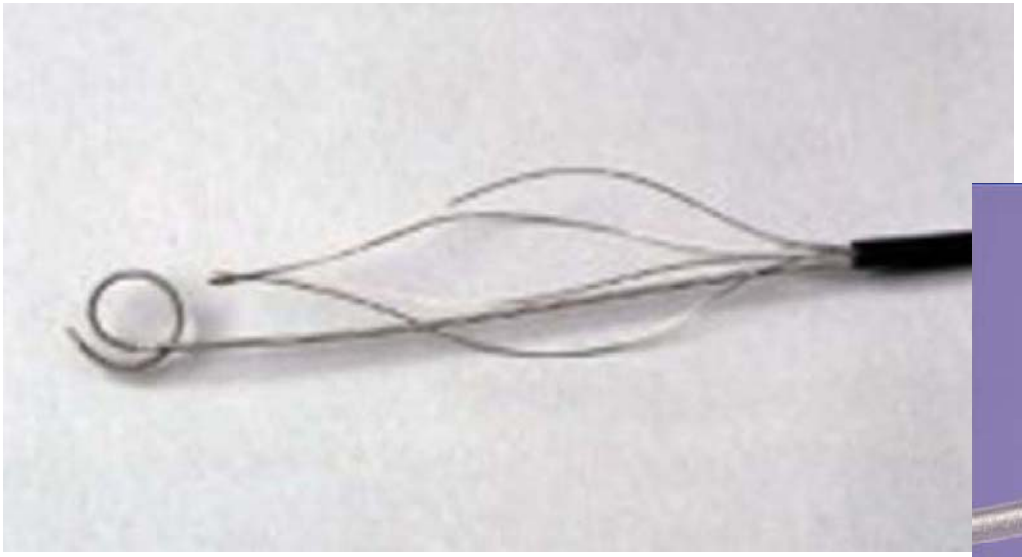
Sheath rotates when the trigger handle is squeezed for maximum operator control

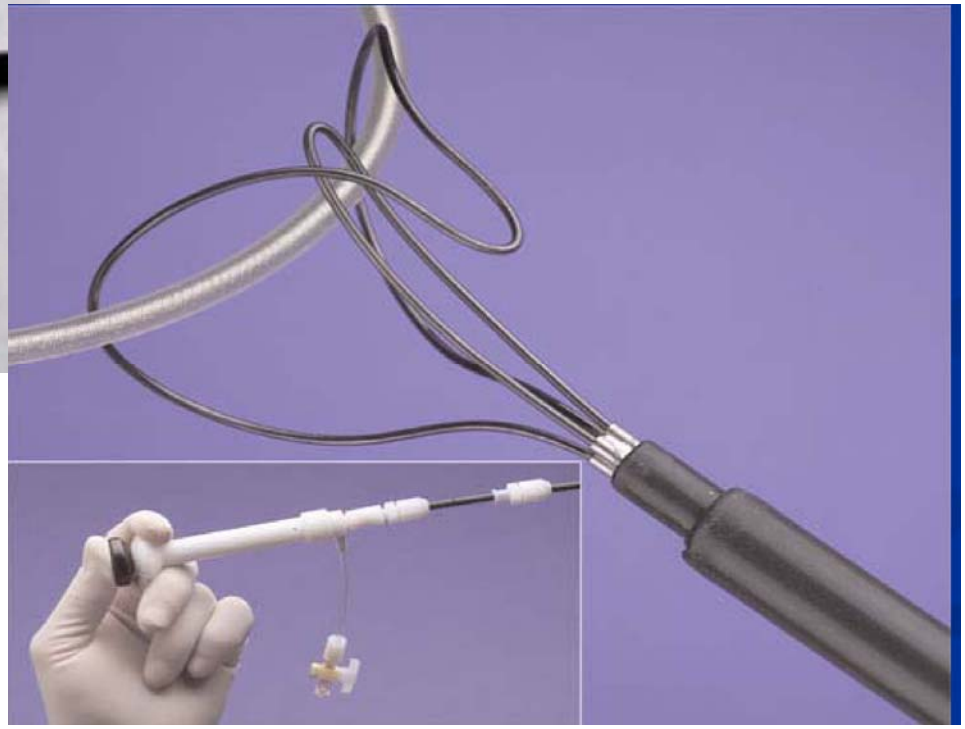
- The patented threaded barrel tip provides succinct passage past fibrous binding sites without the "forward depth of cut" of other powered sheaths
- Available in four sizes that are compatible with both pacing and defibrillator leads: 7, 9, 11 & 13 Fr. (I.D.)

Extraction by RF Energy



Femoral Extraction





Complications

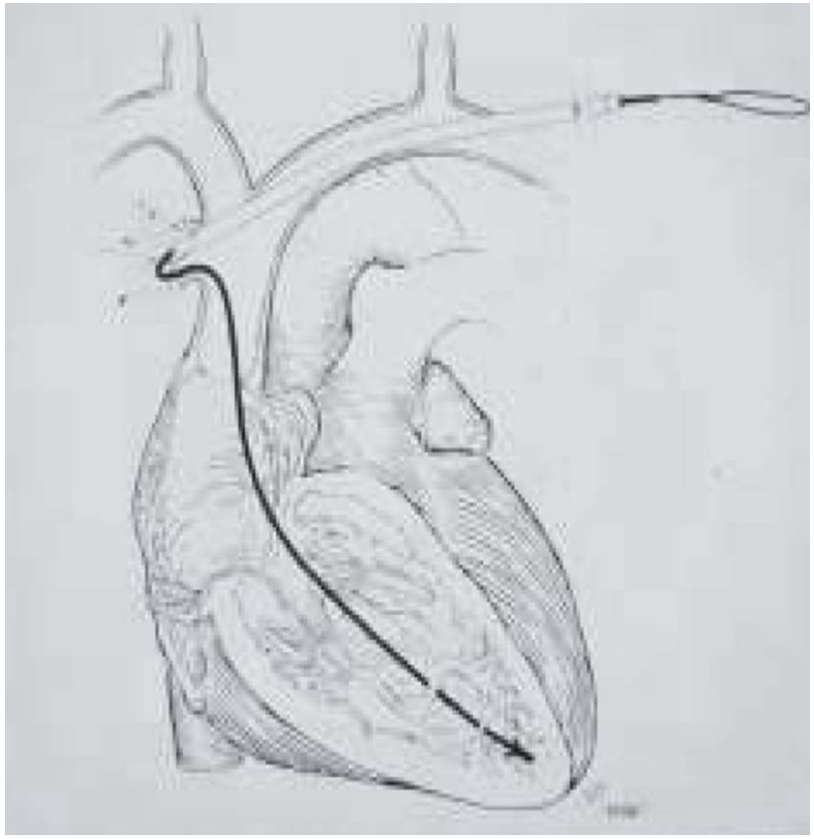
Major Complications

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

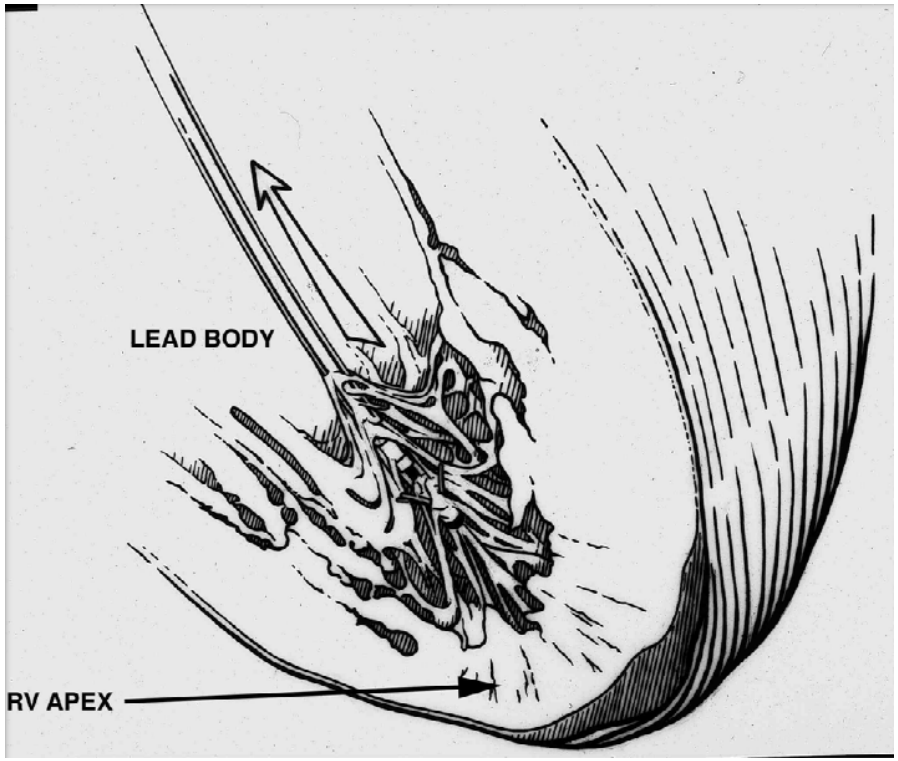
Wilkoff B, et al. Heart rhythm 2009: 1085-1104

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

Wilkoff B, et al. Heart rhythm 2009: 1085-1104

Lead Management Environment: Personnel

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

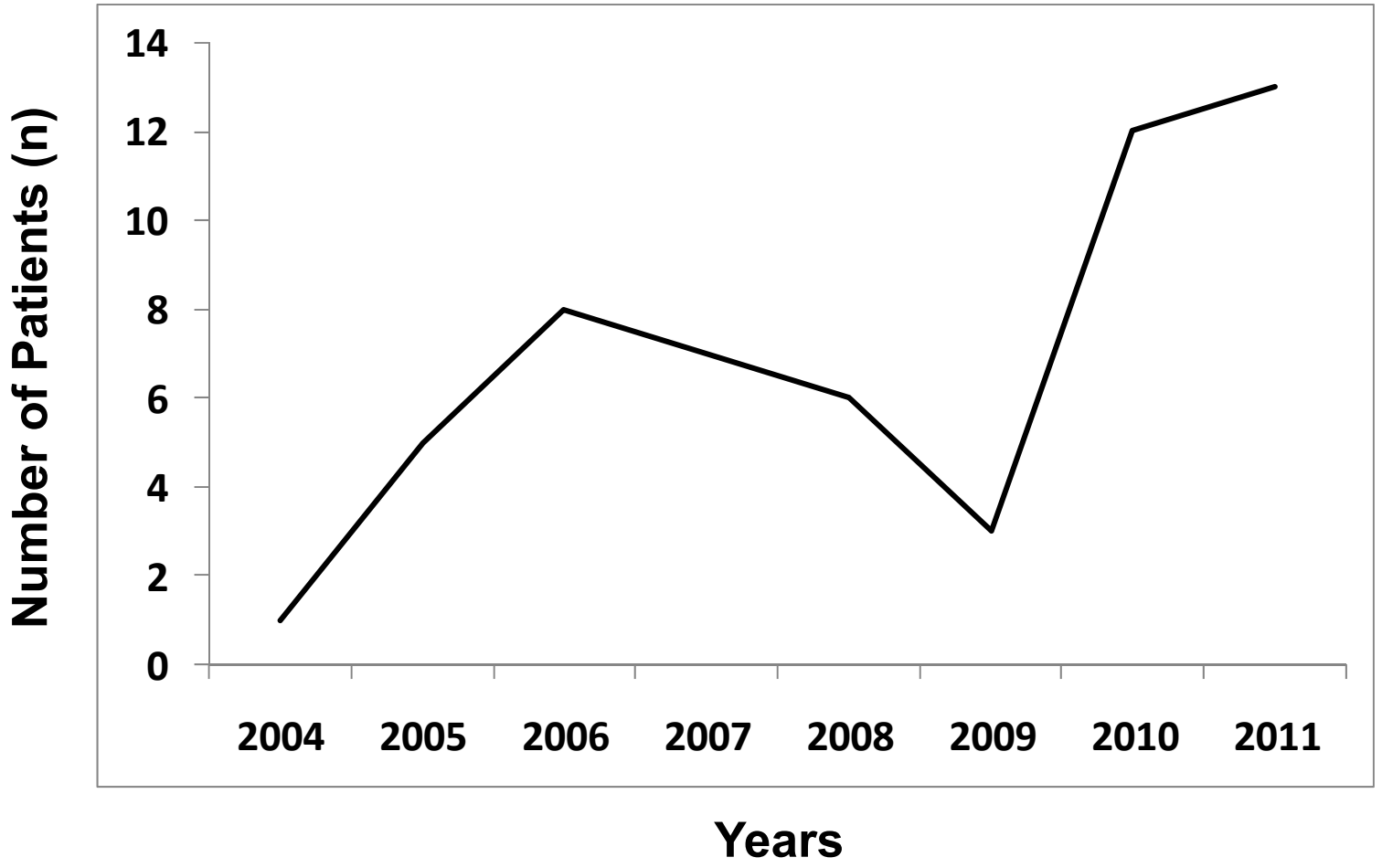
Physician qualifications

- 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, defibrillaion** 준비
- **ECG, BP monitoring**
- **pericardiocentesis** 준비
- 흉부외과 준비

Lead extraction in Severance Hospital



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 inreased 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