

# Lead Extraction State of the Art

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HRC 2010 Birmingham

# Disclosures/Conflict of Interests

None

# Definition of Lead Extraction

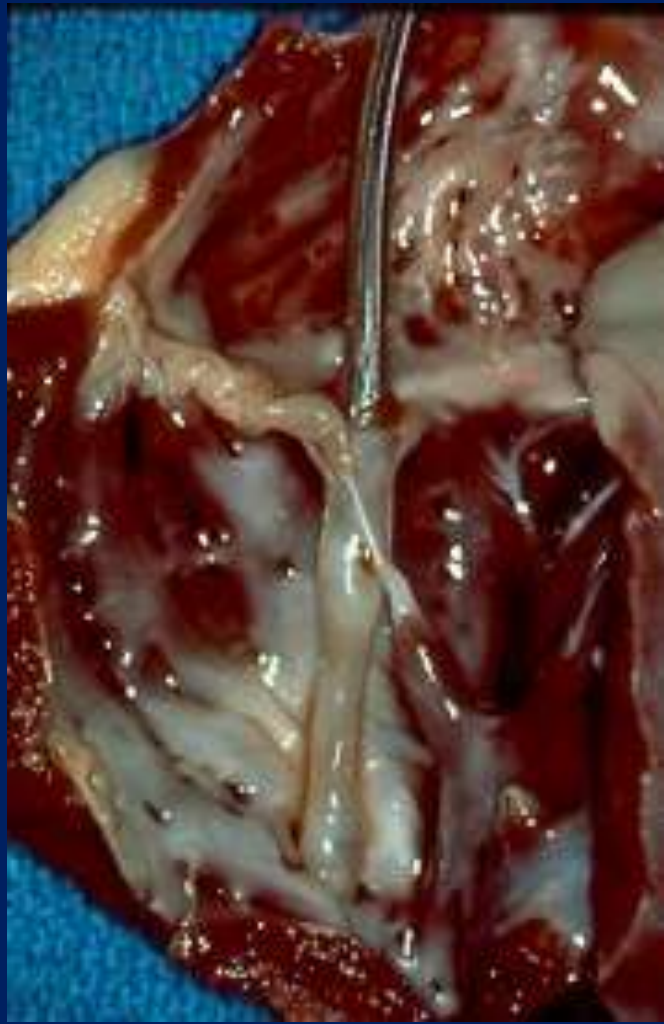
Removal of a lead that has been implanted for more than one year, or a lead regardless of duration of implant requiring the assistance of specialized equipment that is not included as part of the typical implant package.

## Lead Explant

< 1 year + simple traction

HRS Expert Consensus Heart Rhythm Journal July 2009

# Pathophysiology of Chronic Leads



Endothelialisation

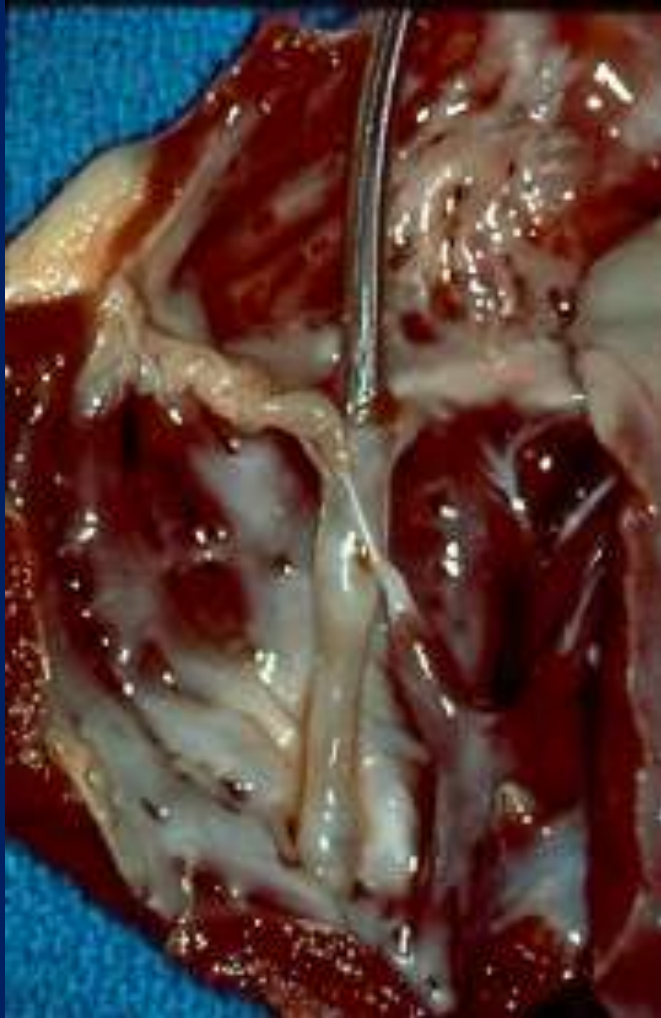


Fibrosis



Calcification

# Pathophysiology of Chronic Leads



## Fibrosis

Fibrotic binding sites

Vein entry

Lead tip

Acute vein angulation

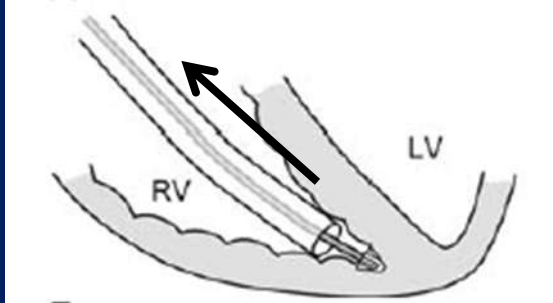
Brachiocephalic-SVC

SVC - Right atrium

Tensile strength

Scar > Vessel = Tear!

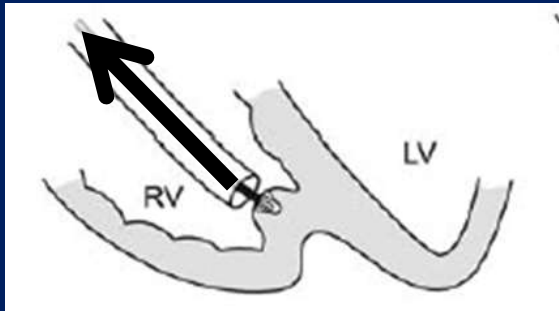
# Problems with Simple Traction



Low success rate

Lead breaks/unravels

Mobile lead segments

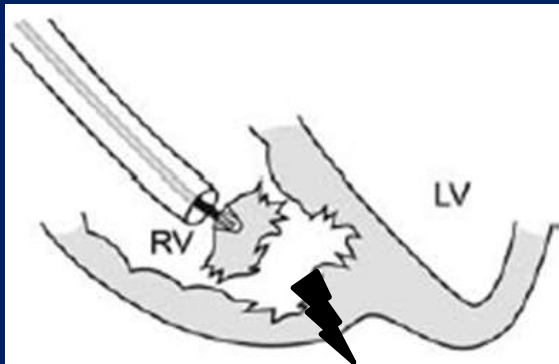


High Complication rate

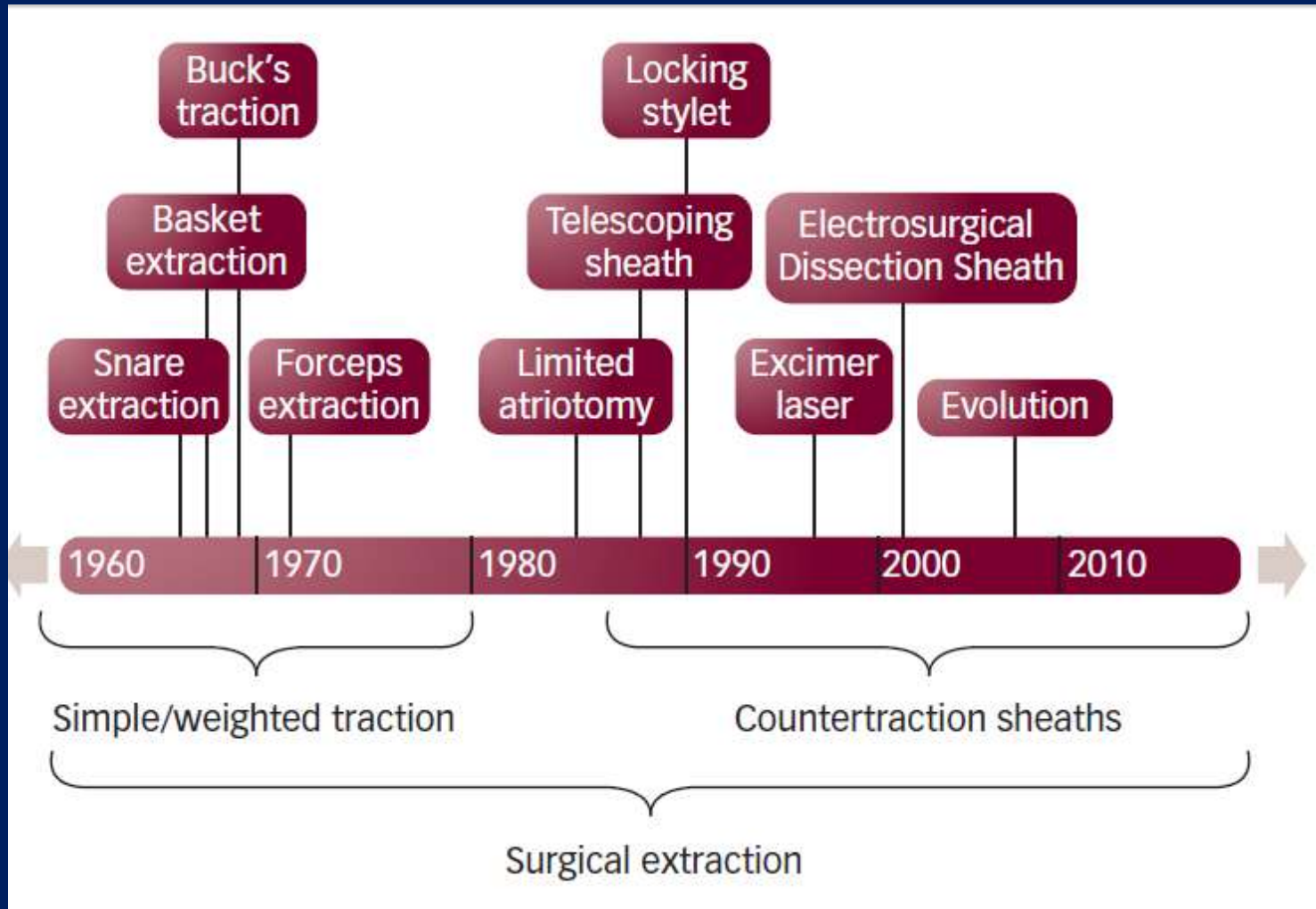
Vascular tears

RV eversion

“Cheese wire” effect



# History of Lead Extraction



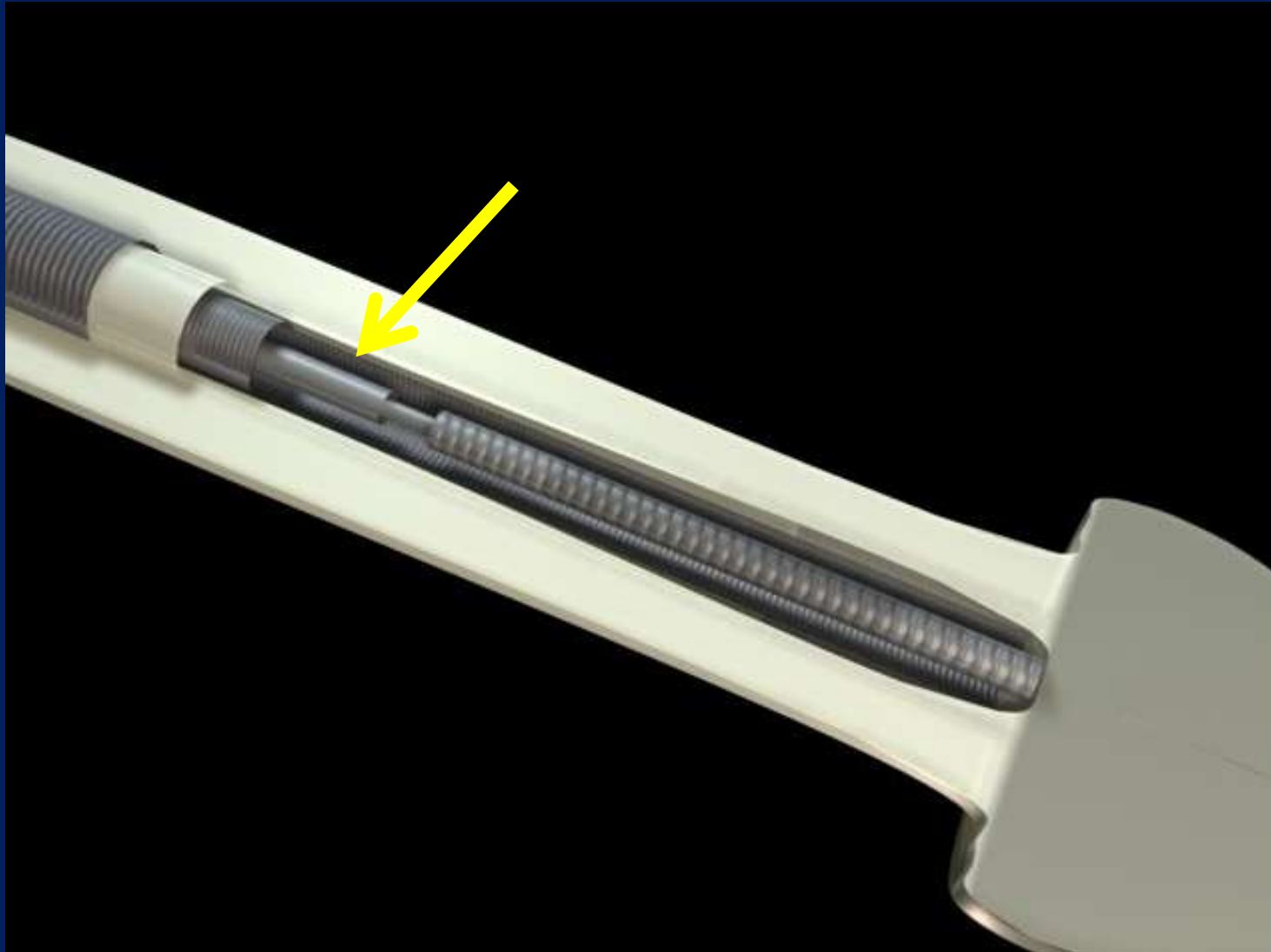
# Traction : Locking Stylet → Lead Tip



# Locking Stylet → Lead Tip



# Locking Stylet → Lead Tip



Locking Stylet → Lead Tip  
(Traction applied at Tip)

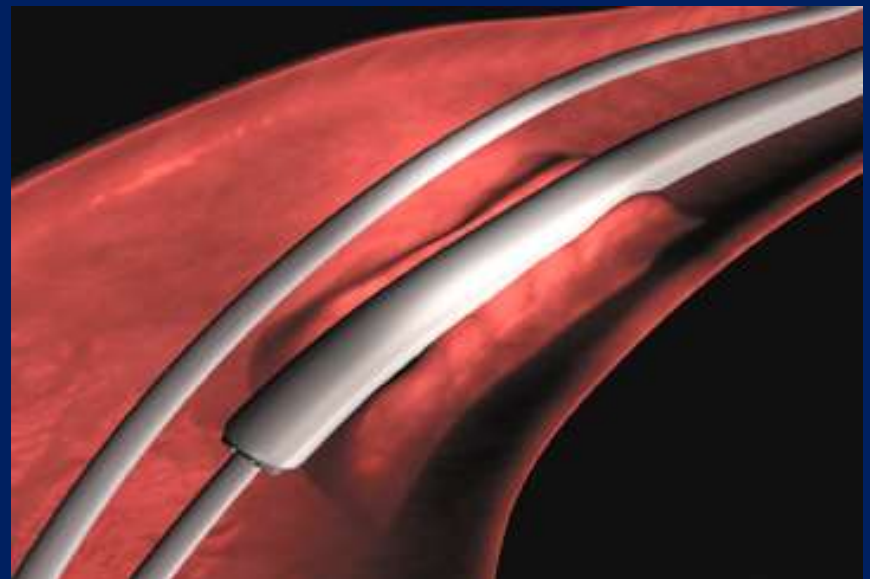
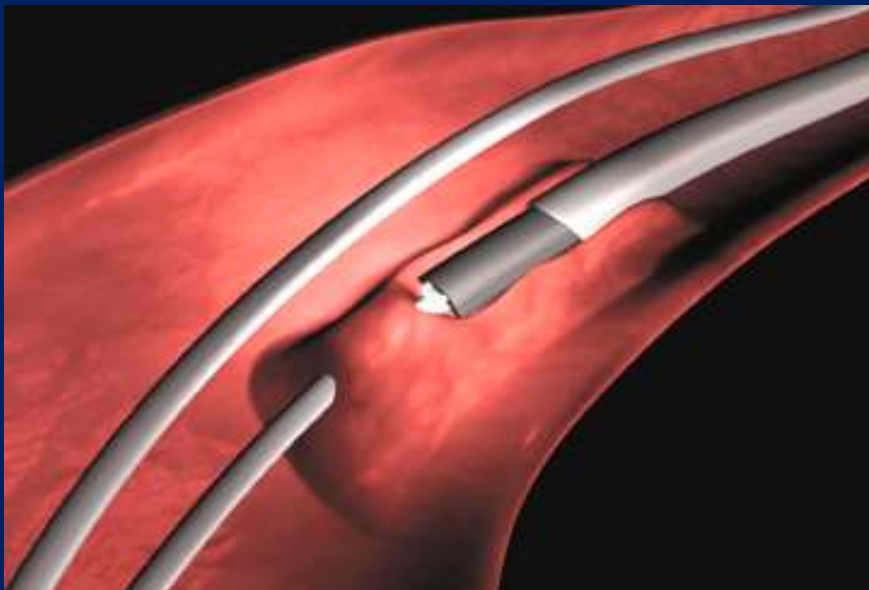
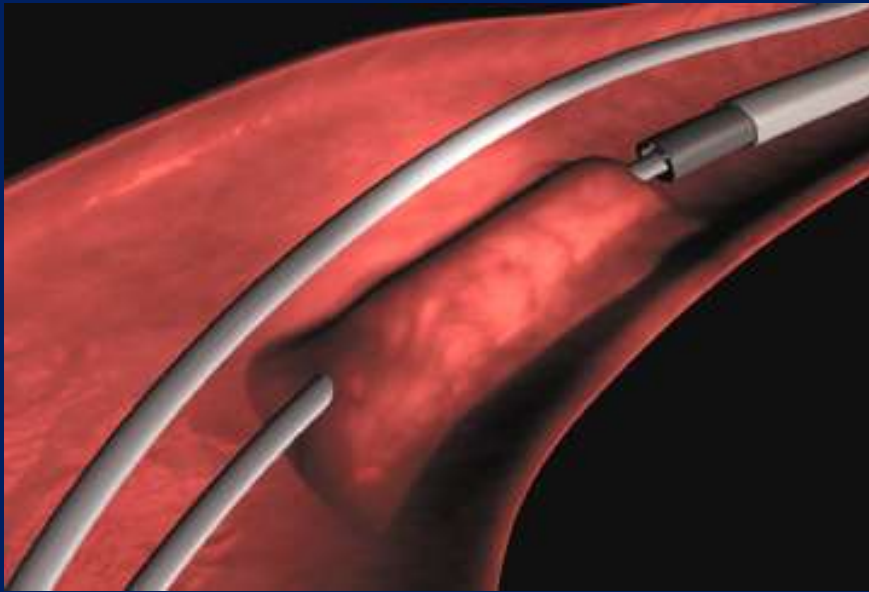


# Liberator Locking Stylet

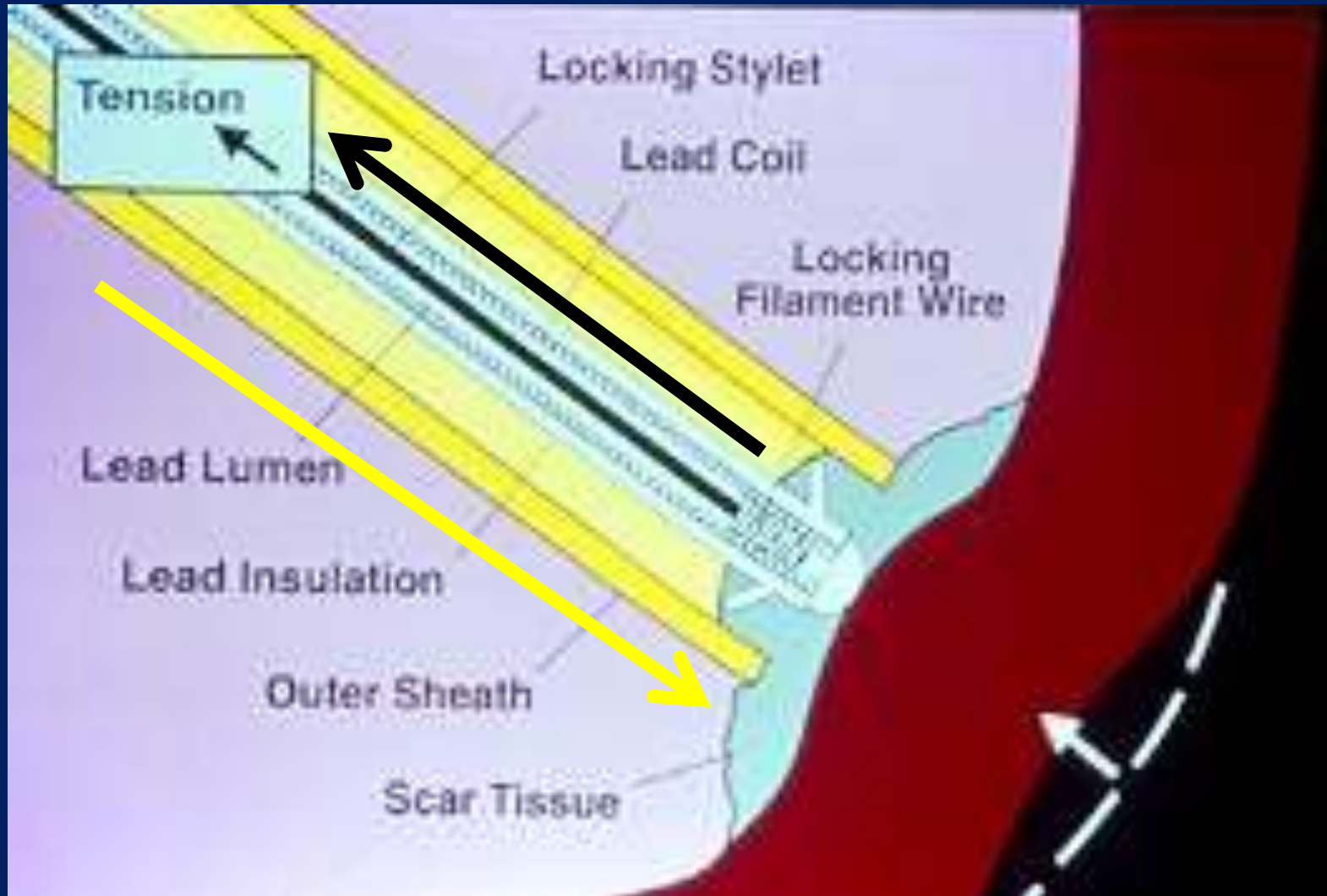


# Telescoping Sheaths

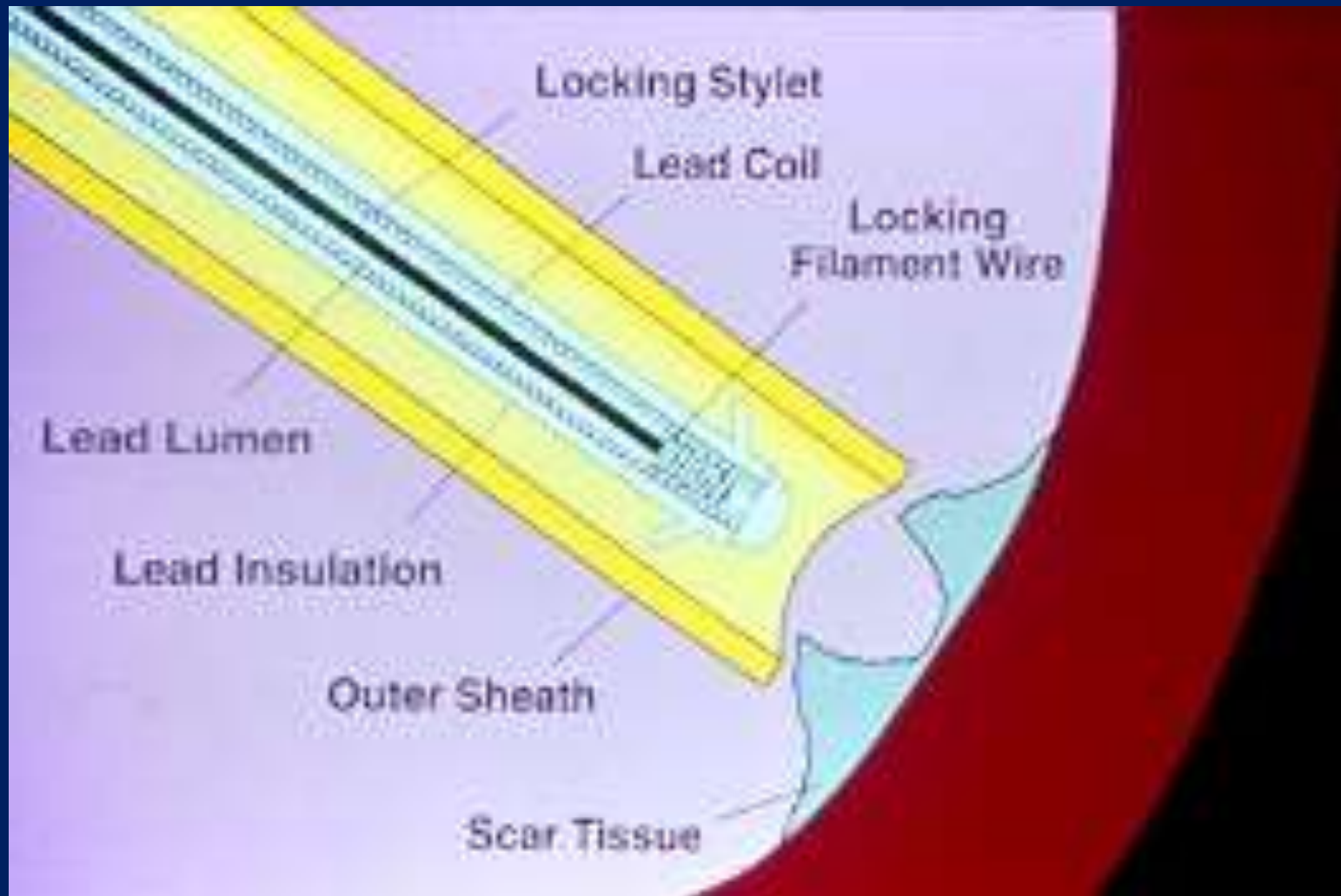
Manual  
Power-Assisted



# Countertraction

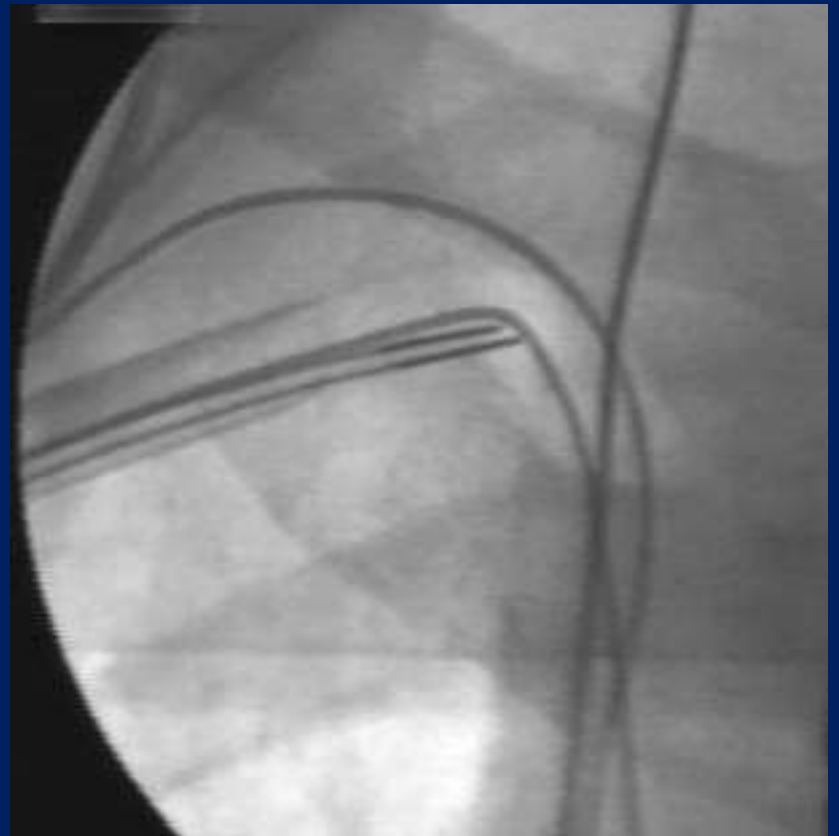


# Countertraction



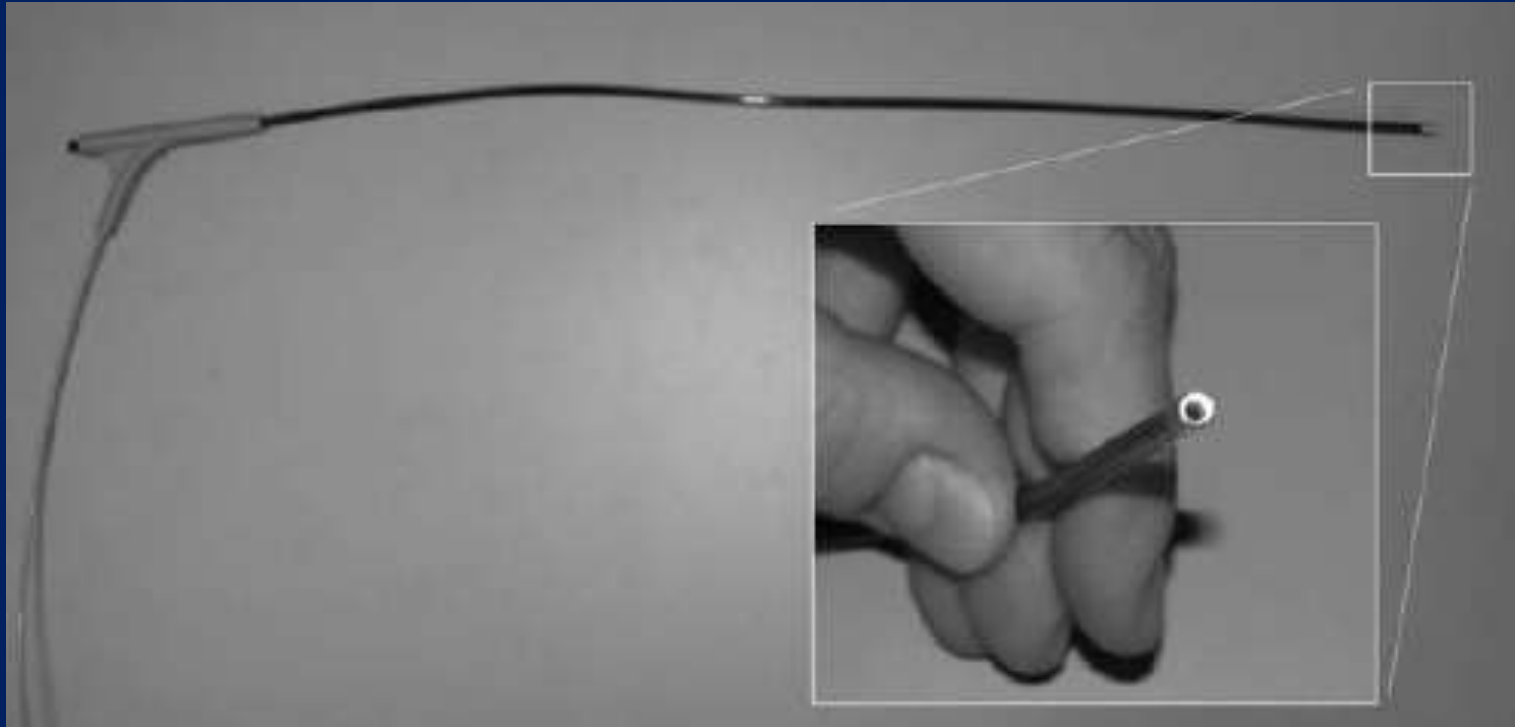
# Power-Assisted Sheaths

Electrosurgical Dissection System (Cook EDS)



# Power-Assisted Sheaths

Eximer Laser Sheath – Spectranetics



# Power-Assisted Sheaths

Rotating Stainless Steel Bladed Tip (Evolution)



EVOLUTION® Mechanical Dilator Sheath Set.

# Requirements for Lead Extraction

- Operating theatre/Cath lab/Pacing Lab
  - Emergency availability of GA
  - Rapid access to Cardiac Surgery
    - Within 30 minutes (HRUK)
    - SVC tear – Delays > 5-10min often fatal (HRS)
- Database of Extraction Procedures
  - Success rates
  - Complication rates
- Extraction Tools
  - > 1 method
- Minimum numbers

	HRUK 2010	HRS 2009
Training/Supervised	20	40
CPD /Annual caseload	20 procedures/centre	20 leads/physician

HRUK Standards of Good Practice 2010

HRS Expert Consensus – Heart Rhythm Journal July 2009

# Complications

Classification	Examples
Major Complication	<ol style="list-style-type: none"><li>1. Death</li><li>2. Cardiac avulsion or tear requiring thoracotomy, pericardiocentesis, chest tube, or surgical repair</li><li>3. Vascular avulsion or tear (requiring thoracotomy, pericardiocentesis, chest tube, or surgical repair)</li><li>4. Pulmonary embolism requiring surgical intervention</li><li>5. Respiratory arrest or anesthesia related complication leading to prolongation of hospitalization</li><li>6. Stroke</li></ol>
Minor Complication	<ol style="list-style-type: none"><li>7. Pacing system related infection of a previously non-infected site</li><li>1. Pericardial effusion not requiring pericardiocentesis or surgical intervention</li><li>2. Hemothorax not requiring a chest tube</li><li>3. Hematoma at the surgical site requiring reoperation for drainage</li><li>4. Arm swelling or thrombosis of implant veins resulting in medical intervention</li><li>5. Vascular repair near the implant site or venous entry site</li><li>6. Hemodynamically significant air embolism</li><li>7. Migrated lead fragment without sequelae</li><li>8. Blood transfusion related to blood loss during surgery</li><li>9. Pneumothorax requiring a chest tube</li><li>10. Pulmonary embolism not requiring surgical intervention</li></ol>

Complete Procedural Success

Removal of all targeted leads  
and lead material

HRS Expert Consensus – Heart Rhythm  
Journal July 2009

Clinical Success

Retention of a small portion  
of lead that does not  
negatively impact outcome

# Class 1 Indications for Extraction

## Infection

Lead or valvular endocarditis

Pocket infection

(Device erosion, skin adherence,  
pocket abscess, chronic sinus)

Occult Gram + bacteraemia

## Vascular access

Bilateral occlusion precluding implantation

Unilateral occlusion + opposite side contraindicated

SVC occlusion + symptoms

Retained leads /fragments → life-threatening

Arrhythmia

Thromboembolism

Endocarditis

# Class 2 Indications for Lead Extraction

## Consider Life long consequences?

### Class 2 A

- Abandoned lead + Lead design poses a threat  
(Teletronics Acu-fix J lead)
- Ipsilateral Venous occlusion
- Occult gram negative bacteraemia
- Severe chronic pain

### Class 2 b

- Abandoned lead + Lead design does not poses a threat  
(Sprint Fidelis ICD lead)

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Consider Life long consequences? ←

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## Class 2 b

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(Sprint Fidelis ICD lead)

# Complications

US Extraction Database 1994-1996 (HRS Consensus 2009)

Patients > 2,000      Leads > 3,500

Major complications = 1.4%

< 1% large volume centres (> 300 procedures)

Lexicon Laser extraction, 2004 – 2007 (JACC March 2010)

Patients = 1,449      Leads = 2,405

Complete removal = 96.5%      Death = 4 (0.3%)

Major complications = 1.4%

Single Centre – Brigham and Women's 2000 – 2007 (Heart Rhythm 2008)

Patients = 498      Leads = 975

Complete removal = 97.5%      Death = 0

Major complications = 0.4%      Cardiac Surgery = 1

# Predictors of Major Complications

## Patient Dependent

- Implant duration of oldest lead
- ICD lead
- Female gender
- BMI < 25

## Operator Dependent

- 1<sup>st</sup> 30 cases – Steep ↓ Complications
- Complications plateau @ 400 cases

# University Hospital Of Wales Experience

## 2001 - 2010

- Single Centre, single operator
- Procedures = 70 cases
- Superior approach  $\pm$  Femoral
  - EDS dissecting sheaths 2001
  - Evolution 2009
- General Anaesthesia
- Cardiac operating theatre
- Perfusionist and cardiac surgeon on stand-by
- Same patient prep as bypass operation

# UHW Results 2001-2010

- Major complications = 0
- Complete Procedure success 67/70 = 95.7%
  - Conversion to open procedure = 1
  - Retained proximal lead = 1
  - Retained tip = 1
- Clinical Success 68/70 = 97.1%

## What's Missing?

- Peri-operative mortality?
- Leads extracted?
- Minor complications?

# Case Presentation

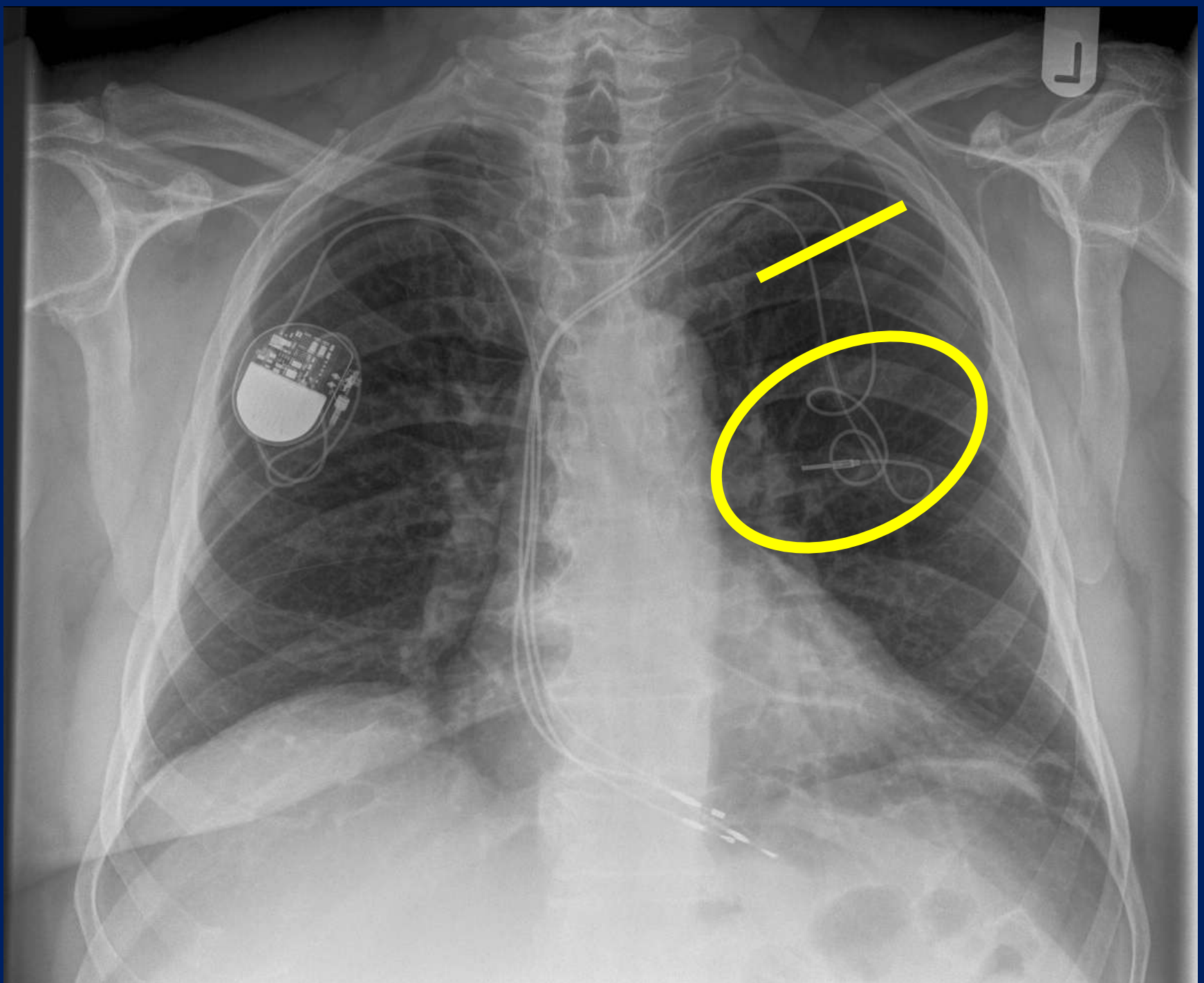
- AG, 68 year old male
- 2004 – Symptomatic 2<sup>o</sup> heart block
  - VVIR via (L) Subclavian vein
- 2006 - # - Lead cut and abandoned
  - New VVIR (L) subclavian vein
- 2008 – Eroded PG
  - Lead capped
  - (L) side abandoned
  - New VVIR on R side
- 2010 - 3 chronic sinuses (R)
  - Eroded lead cap
  - Afebrile, WCC  $6.4 \times 10^9$  /L, CRP < 10mg/l

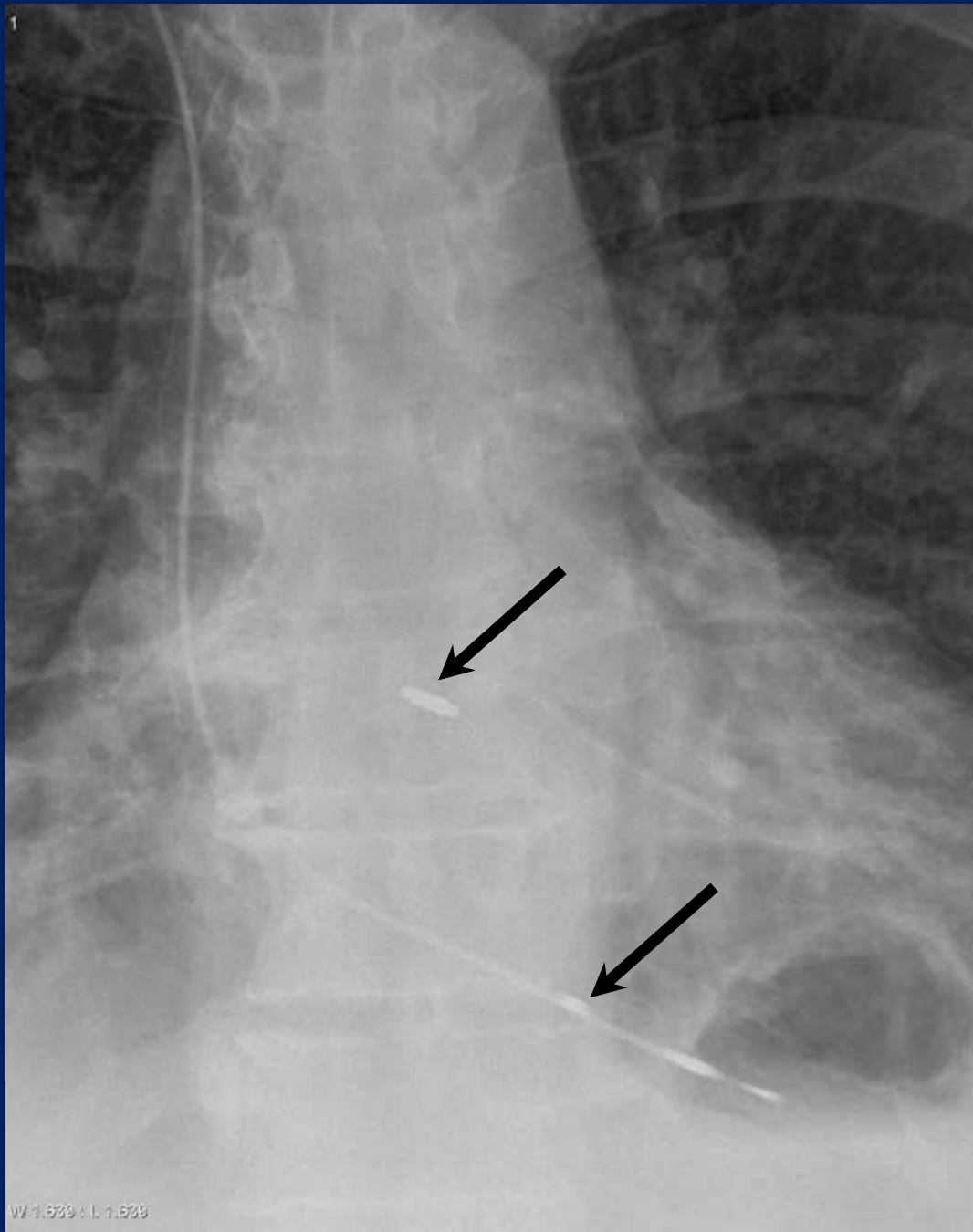
# “State of the Art”

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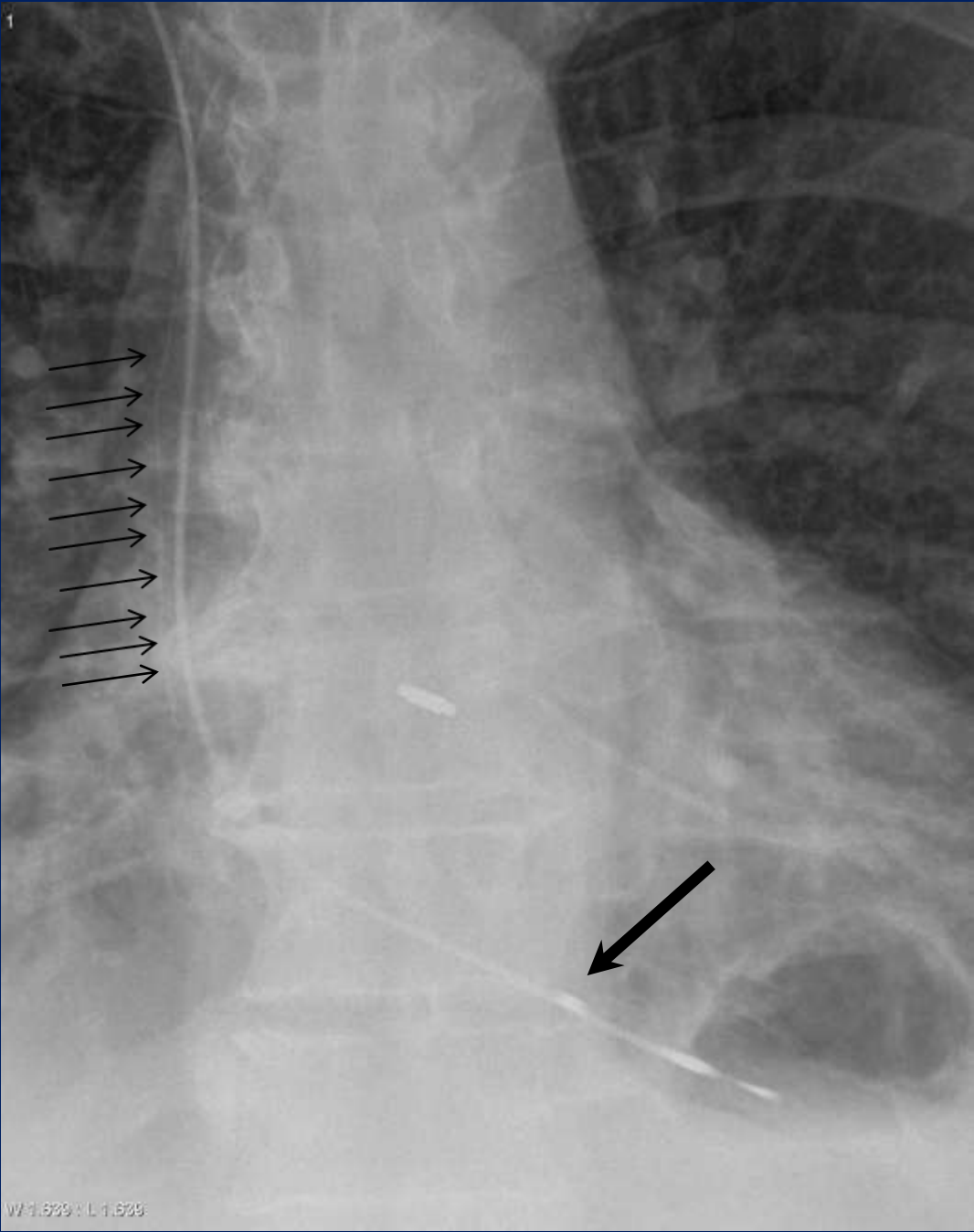


Refer for complete system extraction

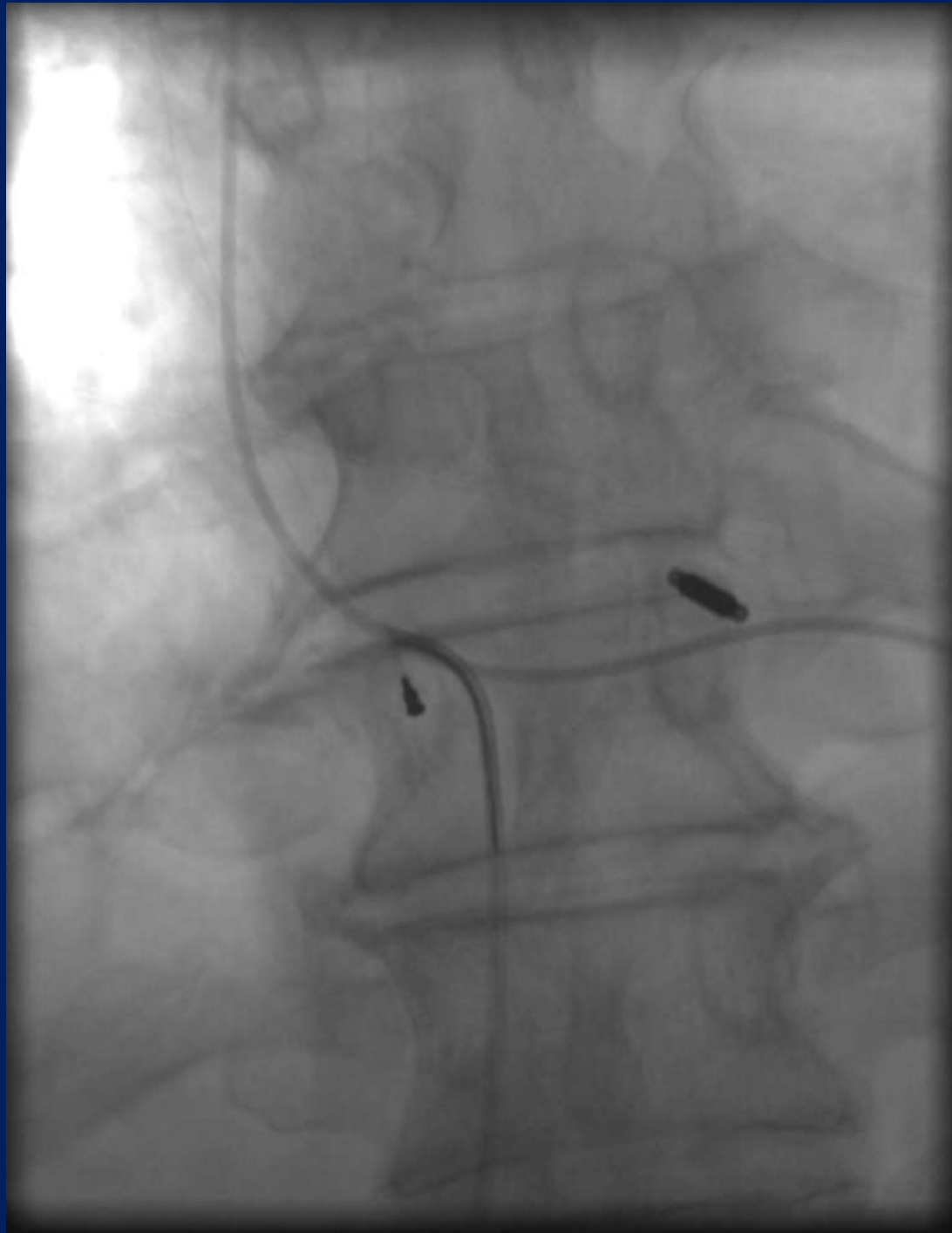




W 1.629 L 1.629







# Prevention is better than Cure!

N = 6319, 35 centres, Infection rate = 0.7%

Variable	Odds ratio
Fever (temperature >37°C)	5.8
Temporary pacing	2.4
Reintervention	11.2
Pulse generator or lead replacement	2.4
No antibiotic prophylaxis	4.2

Klug D et al. 2005 Heart Rhythm Society Scientific Sessions; May 4-7, 2005; New Orleans, LA.

# Think Extraction at Time of Implantation!

- Surgical technique
  - Never tie suture directly onto lead
  - Suture sleeve + stylet support for inner lumen
  - Avoid medial subclavian vein punctures
  - Abandoned leads – Cap, Don't cut.
- Lead prescription
  - Single ICD coil
  - Back filled coil
  - Active fixation lead