



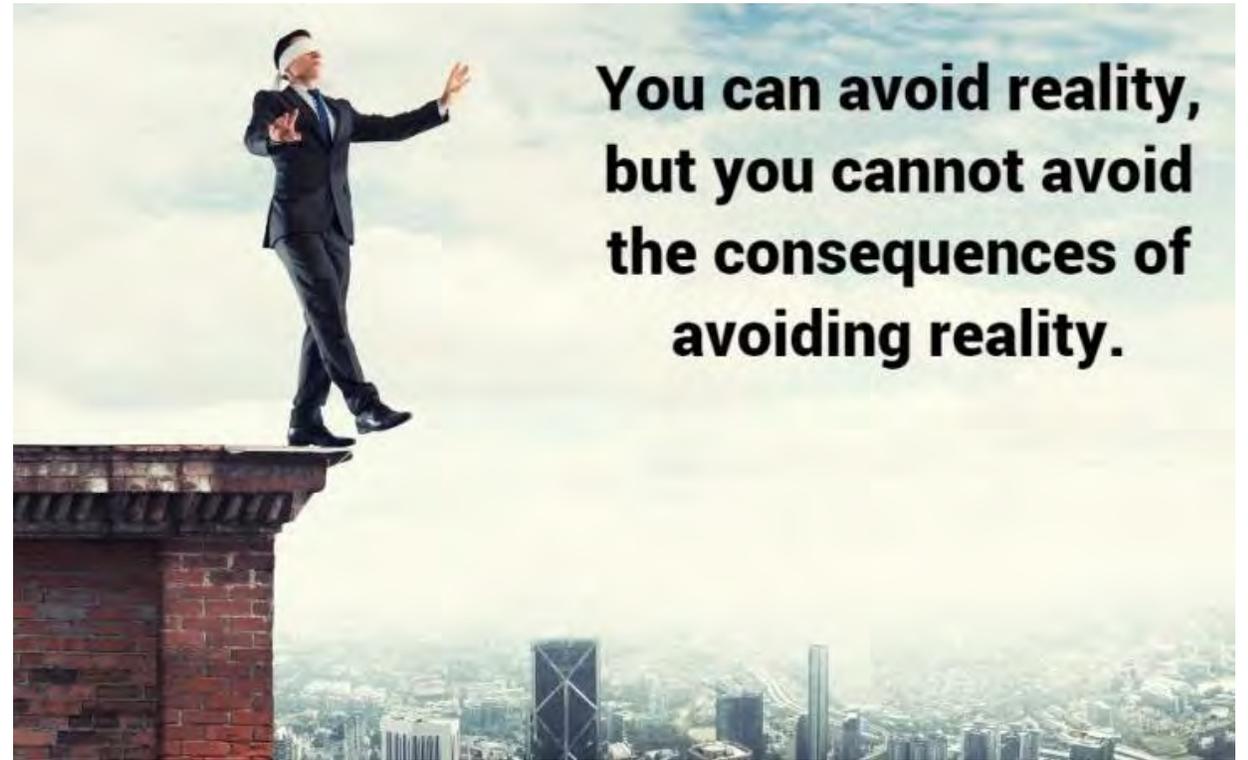
Conduction System Pacing - Lead Extraction -

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Hacettepe University Faculty of Medicine
Department of Cardiology, Ankara, Turkey
13 June 2025

Disclosures

- Proctoring for CSP: Biotronik, Medtronic, Boston Scientific
- Proctoring for TLE: Spectranetics

**As in all CIED
systems, the
TLE is also a
'Reality' for
CSP!**



**You can avoid reality,
but you cannot avoid
the consequences of
avoiding reality.**



- There is scarce data about the TLE in CSP pts!
- No >3 years lead dwell time during TLE for LBBaP leads



- Manual traction has been successful in most patients so far.
- There are too many extraction tools in the box!





**The primary focus of
the TLE Program
should be to
maximize ‘procedure
safety & efficacy’.**

Be Prepared (or Don't Extract!)

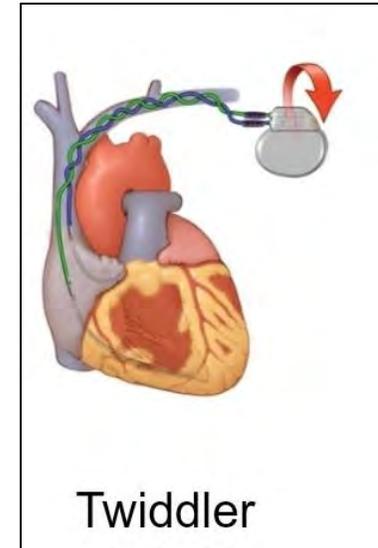
- **Cardiothoracic surgical backup**
- Prep entire chest, abdomen, groin
- Type and cross match
- Femoral access, temporary PM
- Continuous BP monitoring
- Pericardiocentesis/sternotomy trays in room
- Rapid echocardiography available
- **Experience!!!!**
 - **Hacettepe Experience (referral center)**
 - **Between 2009-2025 (mechanical extraction tools)**
 - **n=466 pts, total 784 TLE (530 TightRail™ & 254 Evolution®)**

TLE Indications – 1

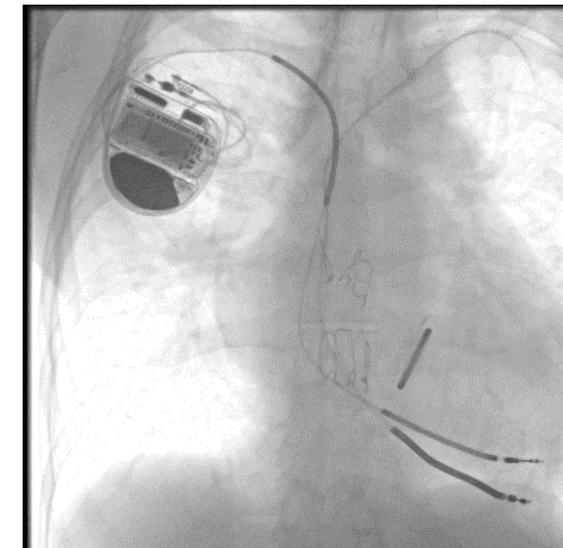


Infection (Local/Systemic)

x7 higher 30-day mortality in antibiotic alone!
Most common indication for TLE!

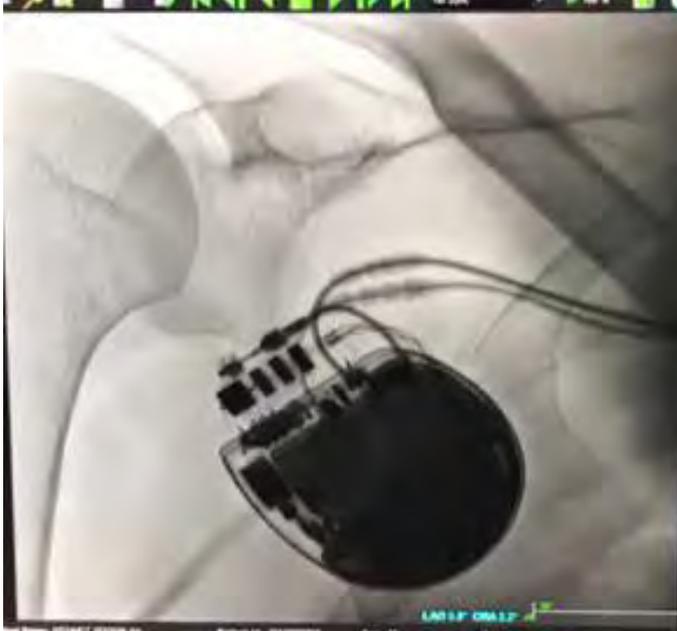


Lead dislodgement



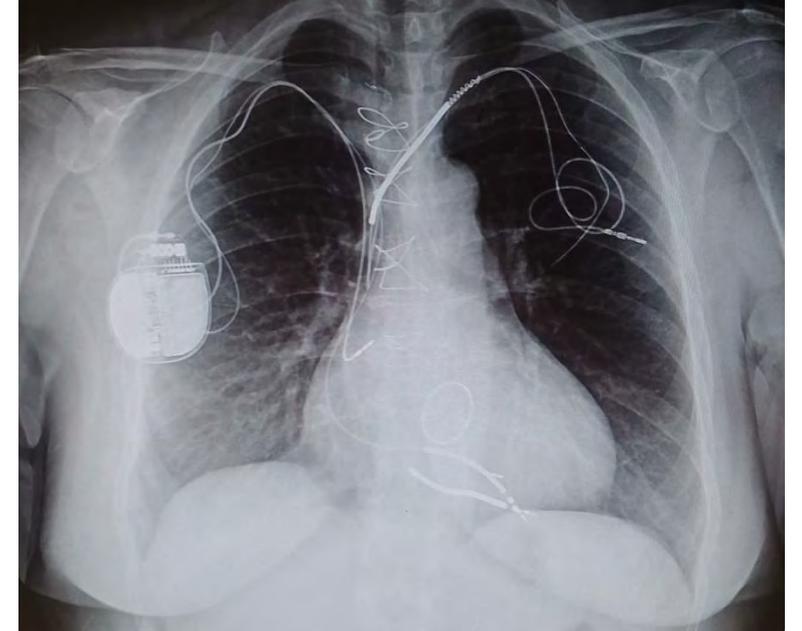
Lead failure (malfxn)

TLE Indications - 2



Venous thrombosis (2-22)

Mostly asymptomatic
Consider TLE in case of upgrade or venoplasty for SVC syndrome



Abandoned leads

Infection, thrombosis, higher risk of deferred
TLE

Khurana et al. *Cardiology in Review* 2025;33: 212–218
Kusumoto et al. *Heart Rhythm* 2017;14:e503–e551
Wilkoff et al. *Heart Rhythm* 2009 Jul;6(7):085-104
Bongiorni et al. *Europace* 2018;20:1217

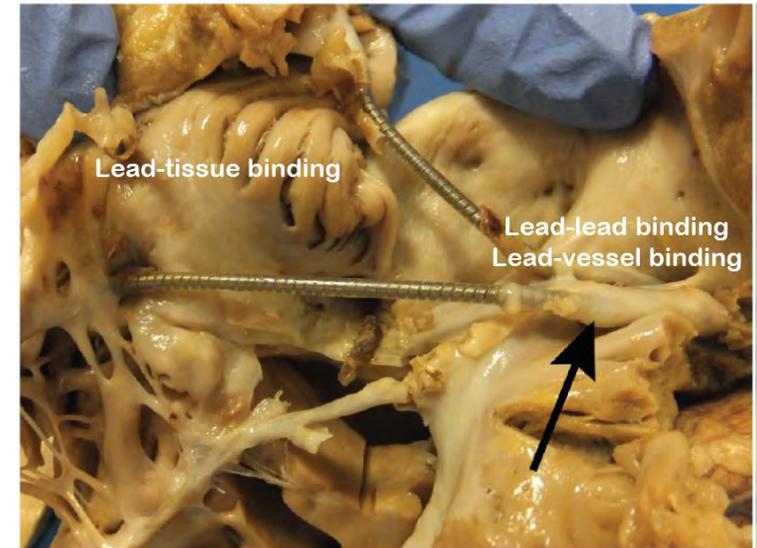
TLE Indications – 3



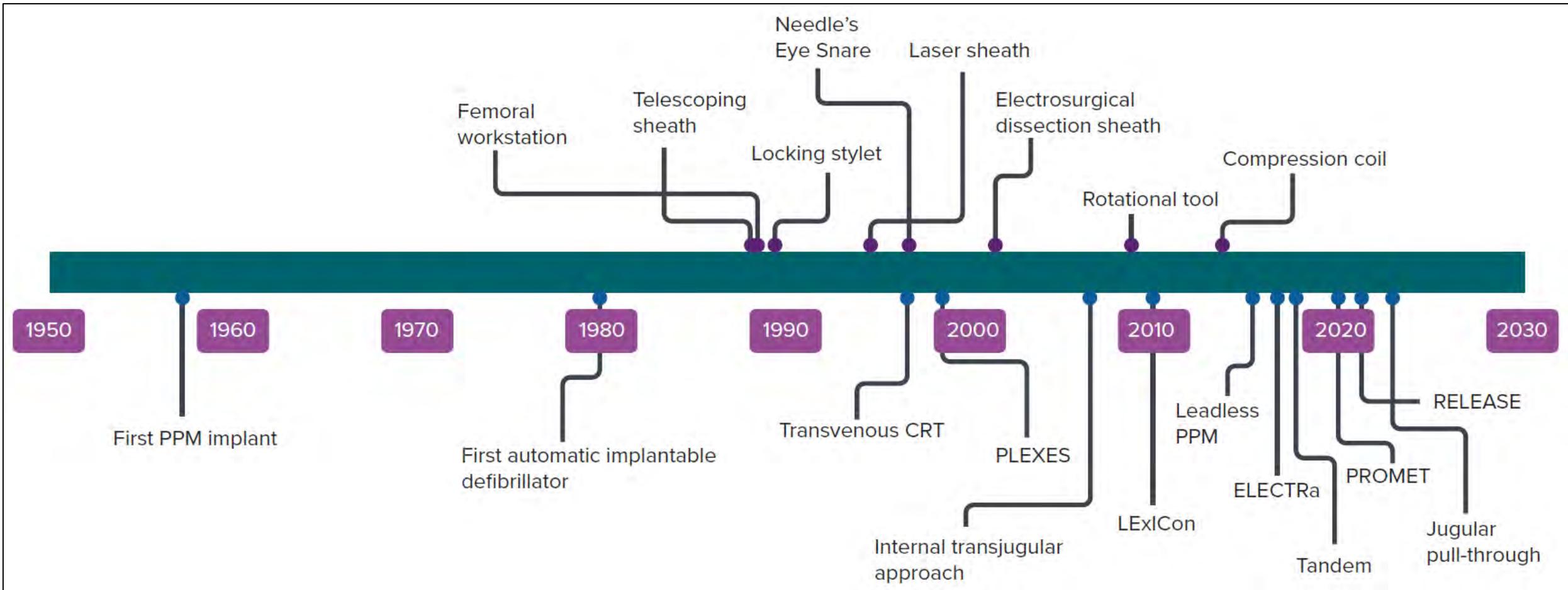
Recalled Leads

Why is It Difficult to Remove CIED Leads?

- Foreign body reaction
- Thrombosis/Fibrosis
- Fibrin sheath within 4-5 days
- Overtime calcification of fibrotic lesions

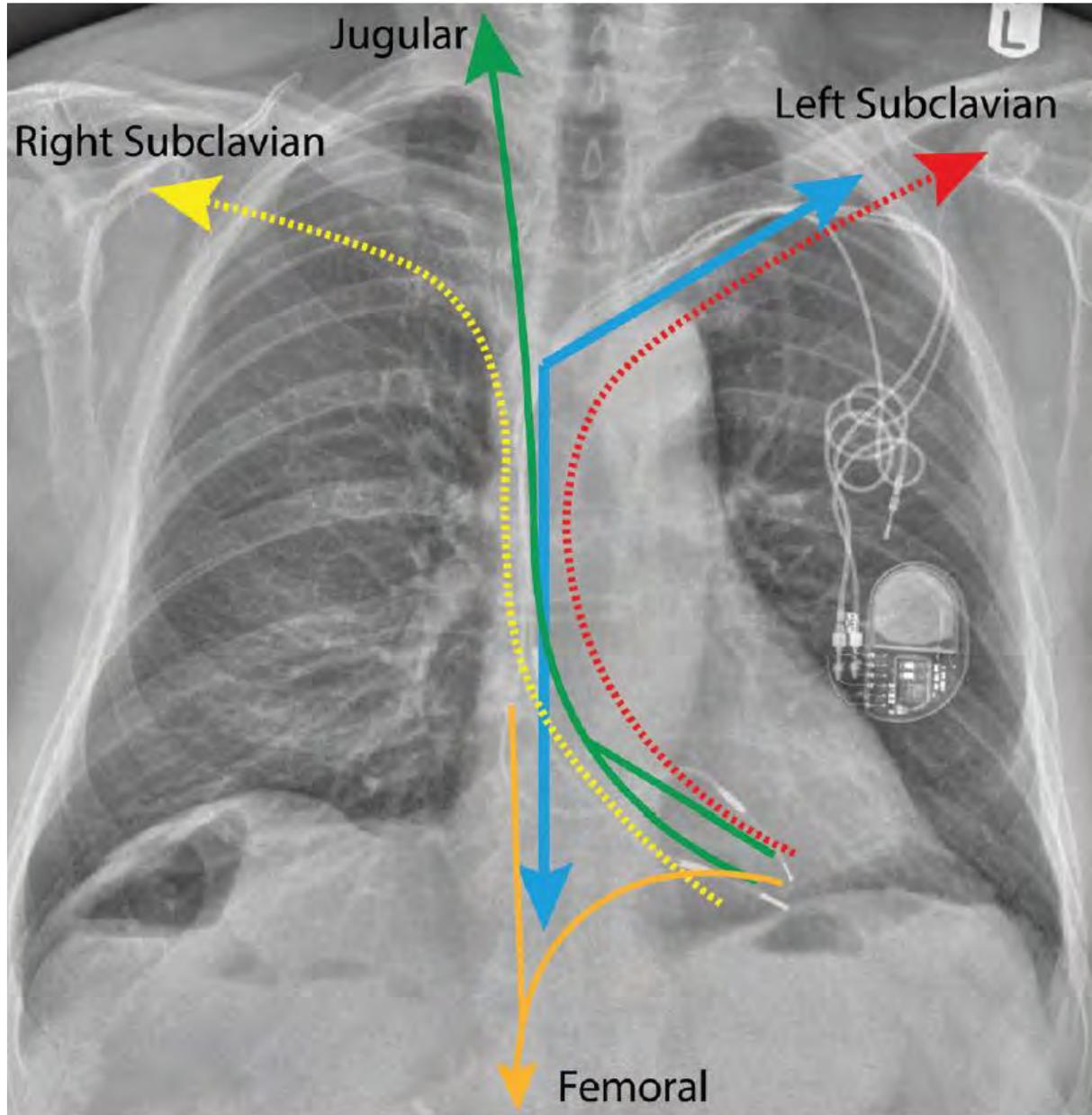


Chronological Evolution of TLE

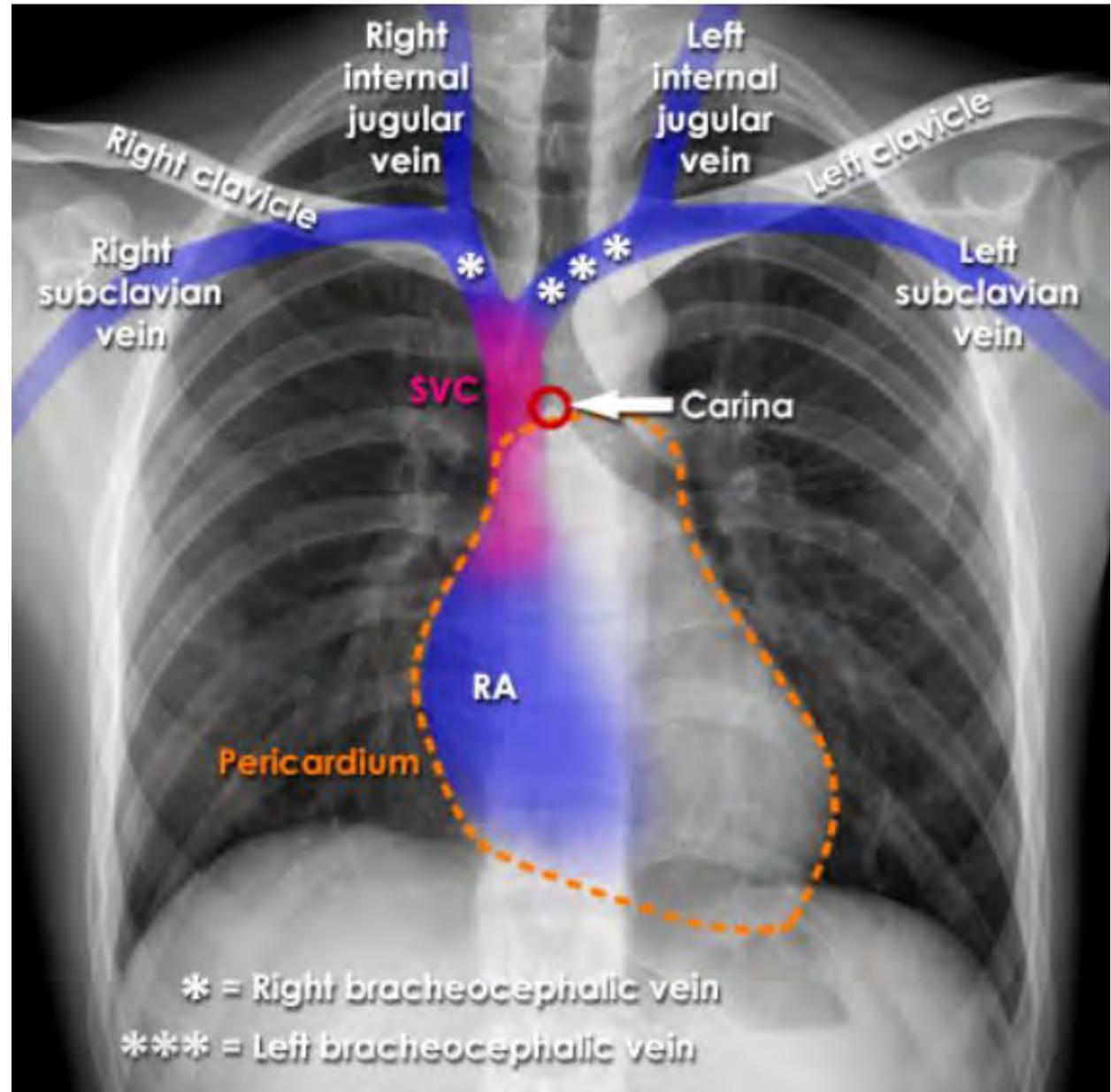


HBP

LBBP

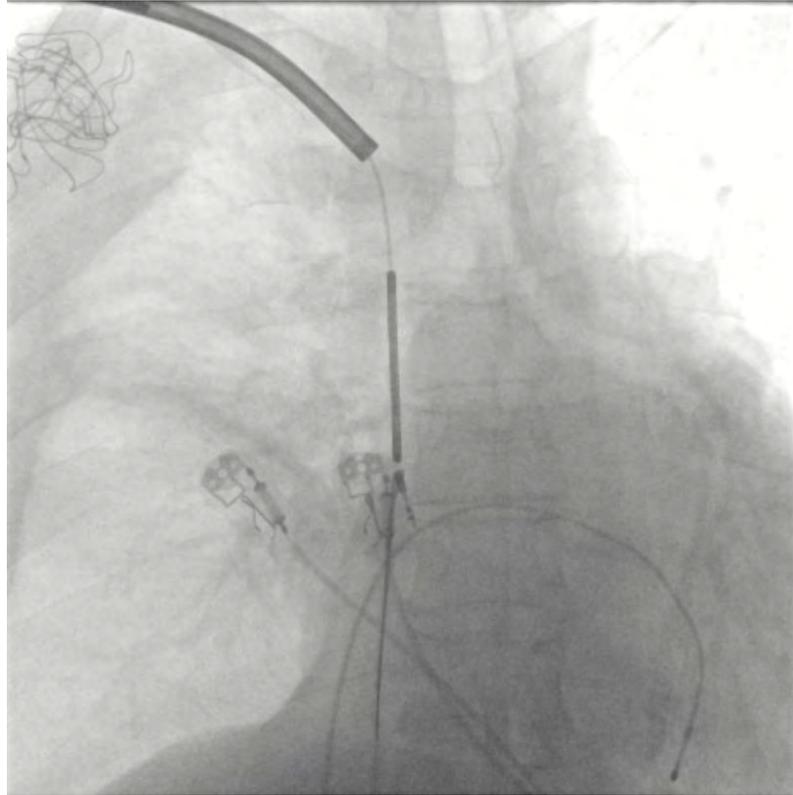
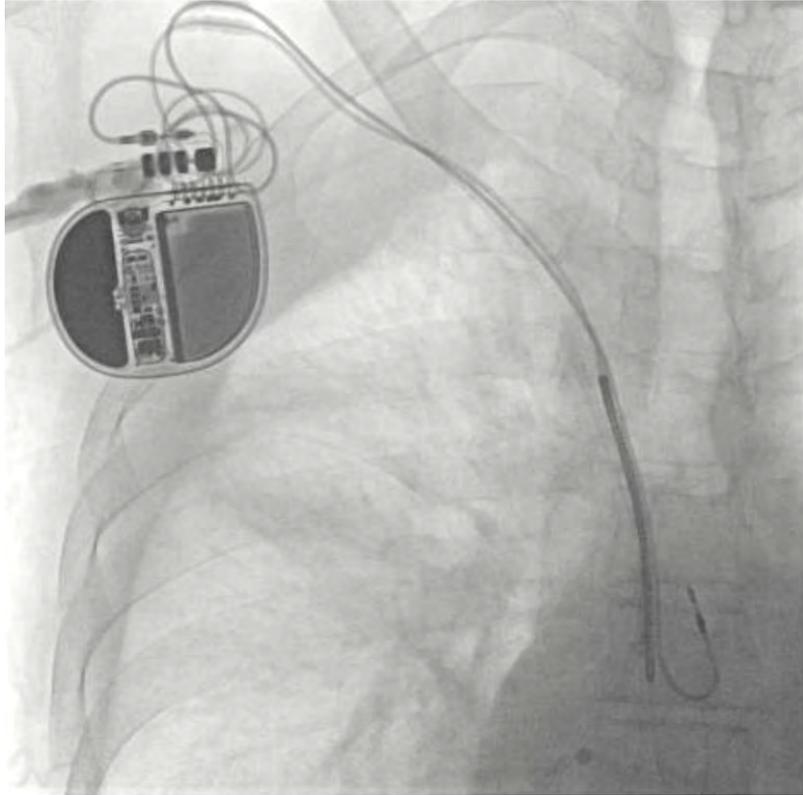


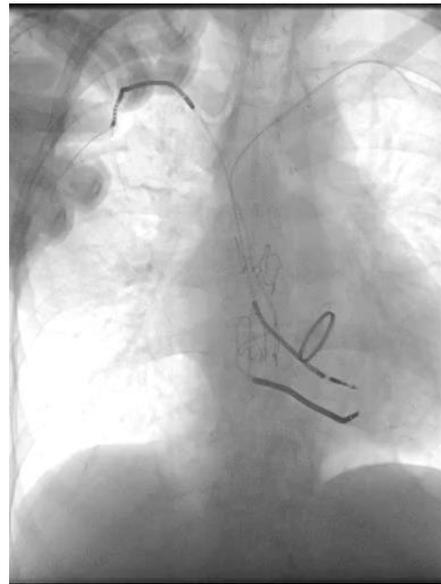
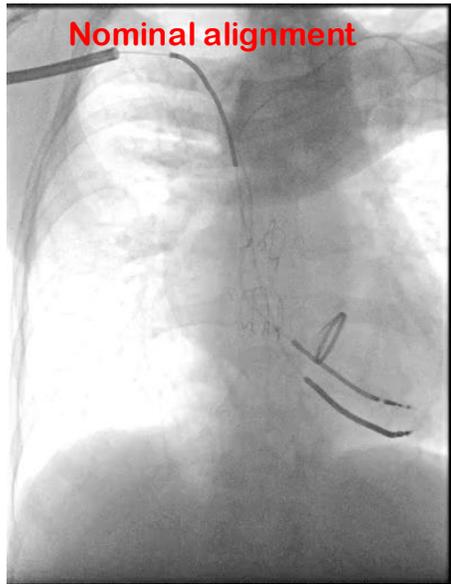
Blue: Tandem Approach (Safer approach!)



*** Higher risk for vascular injury**

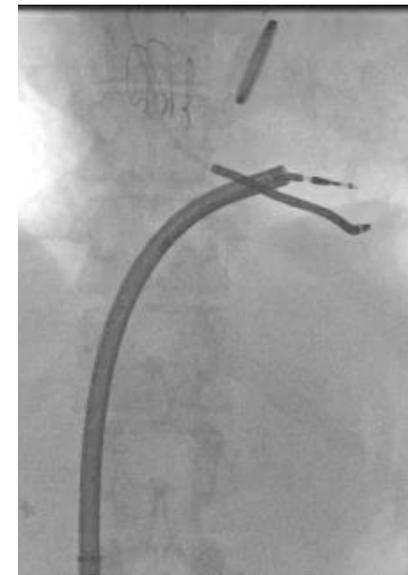
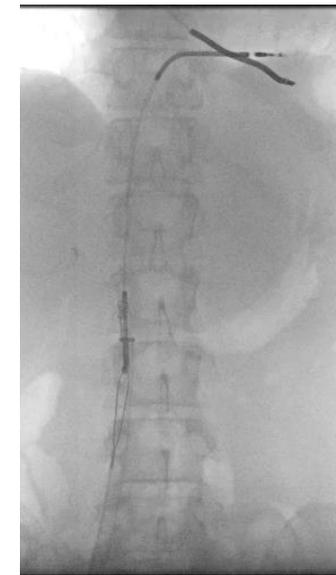
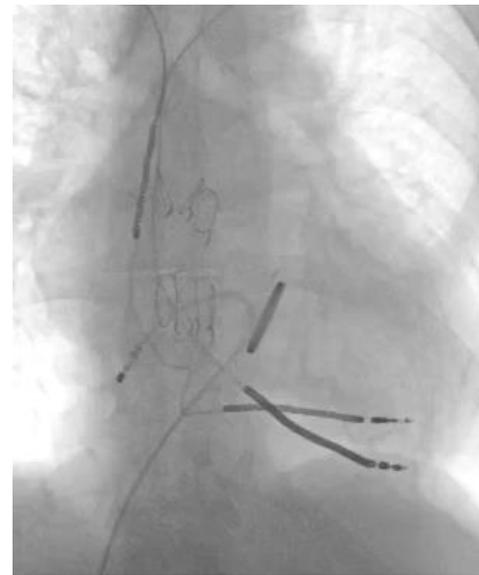
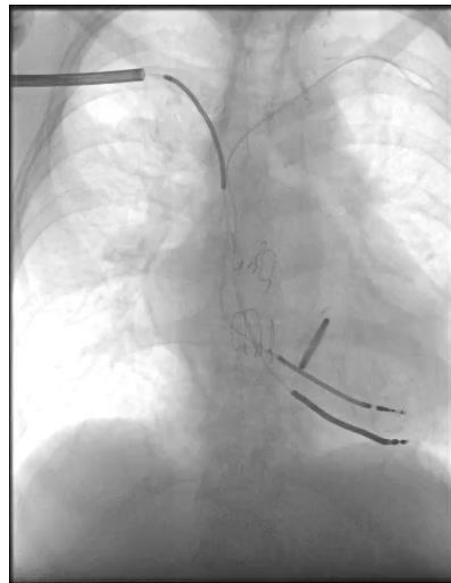
Tandem Approach





Traction + Countertraction + Powered sheath

Modified Bulldog Lead Extender

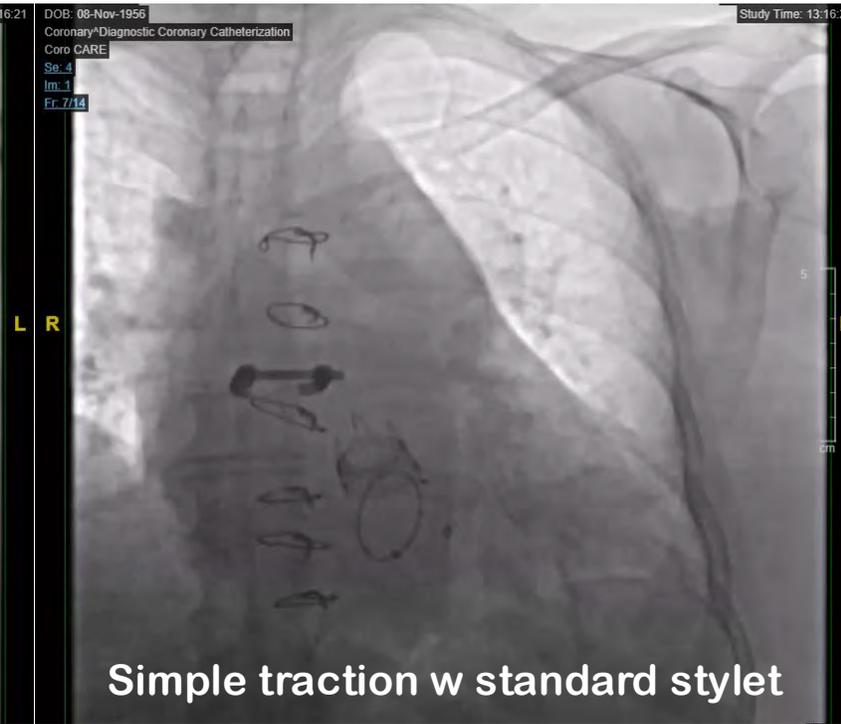
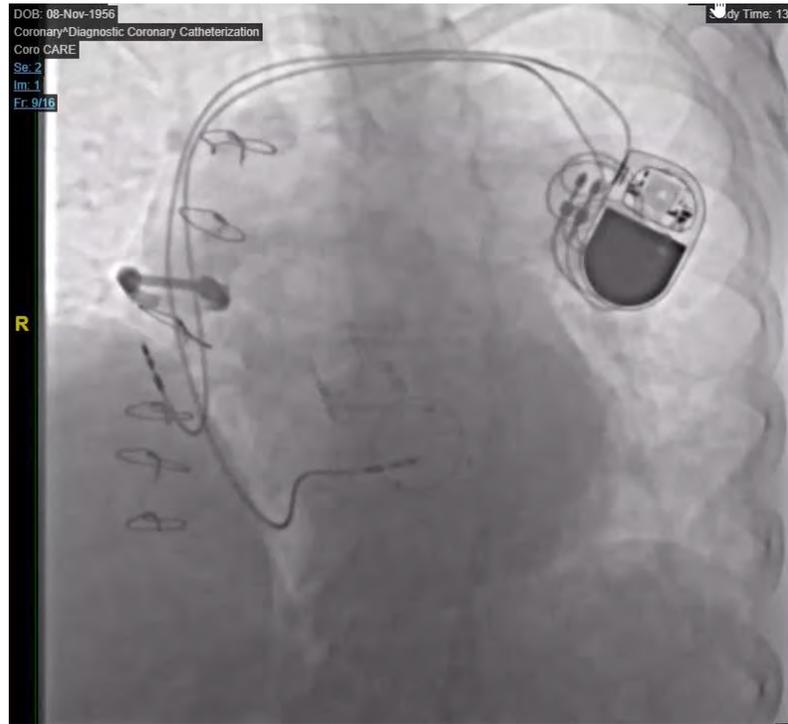
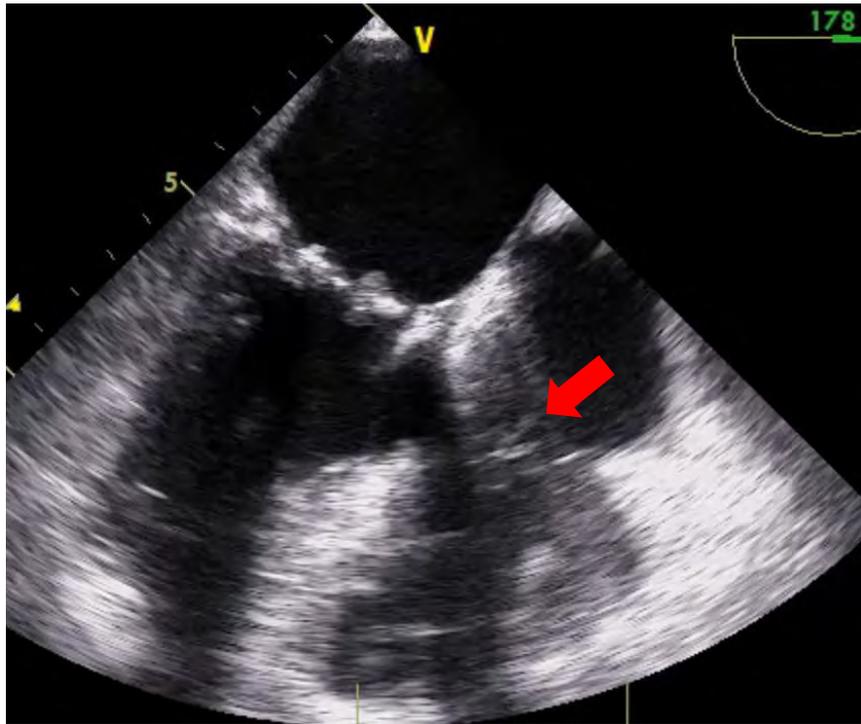


Novel Railroad for Powered Sheath

Femoral Extraction w steerable EP catheter + Gooseneck snare + Powered Sheath

Hacettepe University TLE for CSP Experience

07/2022-06/2025 : 2 / 454 (0.004%) pts



CASE 1

AVR-MVR, AF, Hypothyroidism, DDD-LBBaP PM impl before AVN ablation (05/2024)

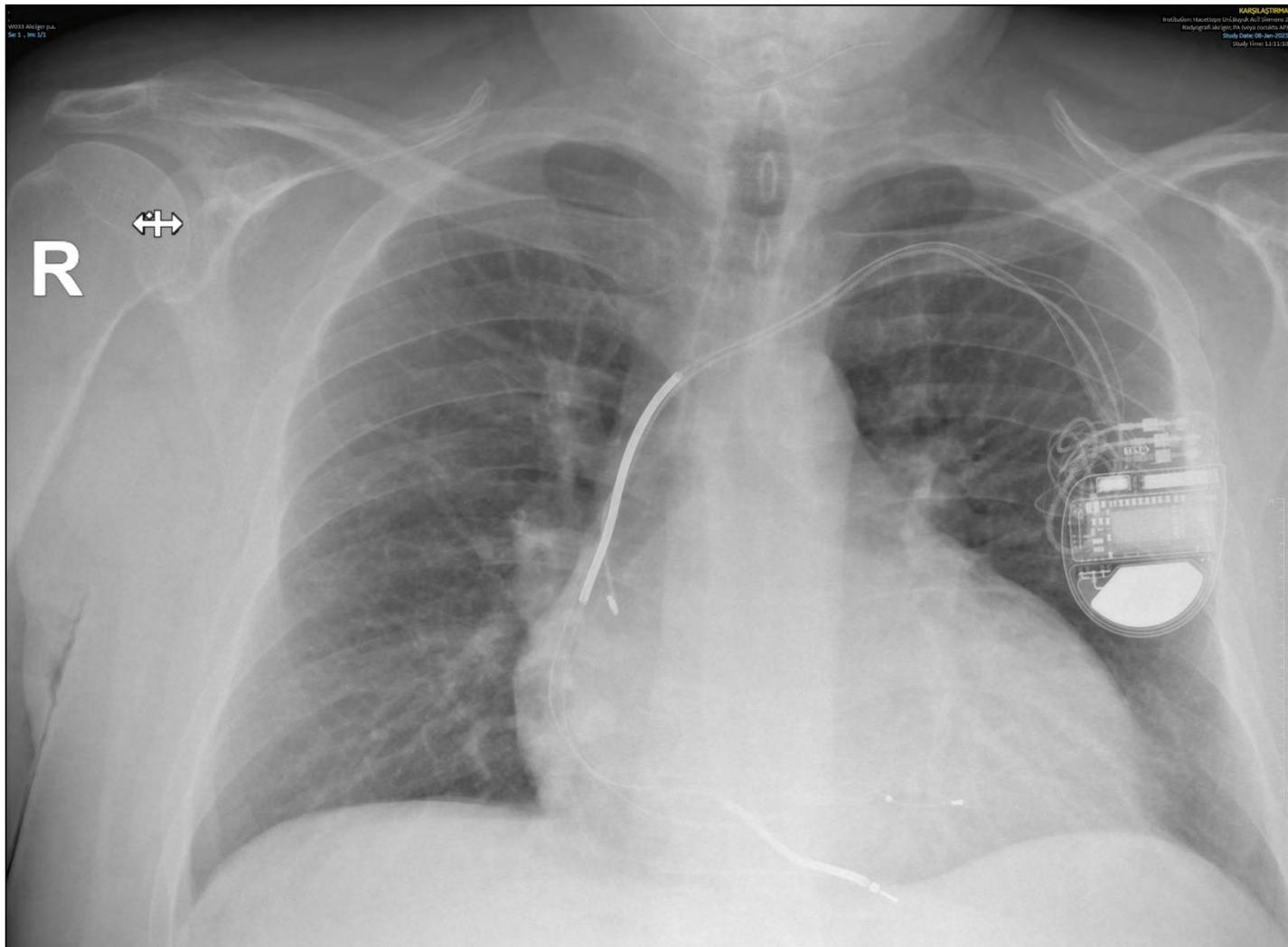
09/2024 Pneumonia+Urosepsis > hospitalization

10/2024 low back pain > spondylodiscitis

Blood culture: E faecalis, Urine culture: P aeruginosa

TEE: Mitral prosthetic valve vegetation, lead vegetation

TLE + Antibiotherapy > Re-AVR/MVR



CASE 2

2014 NiCM > CRT-D

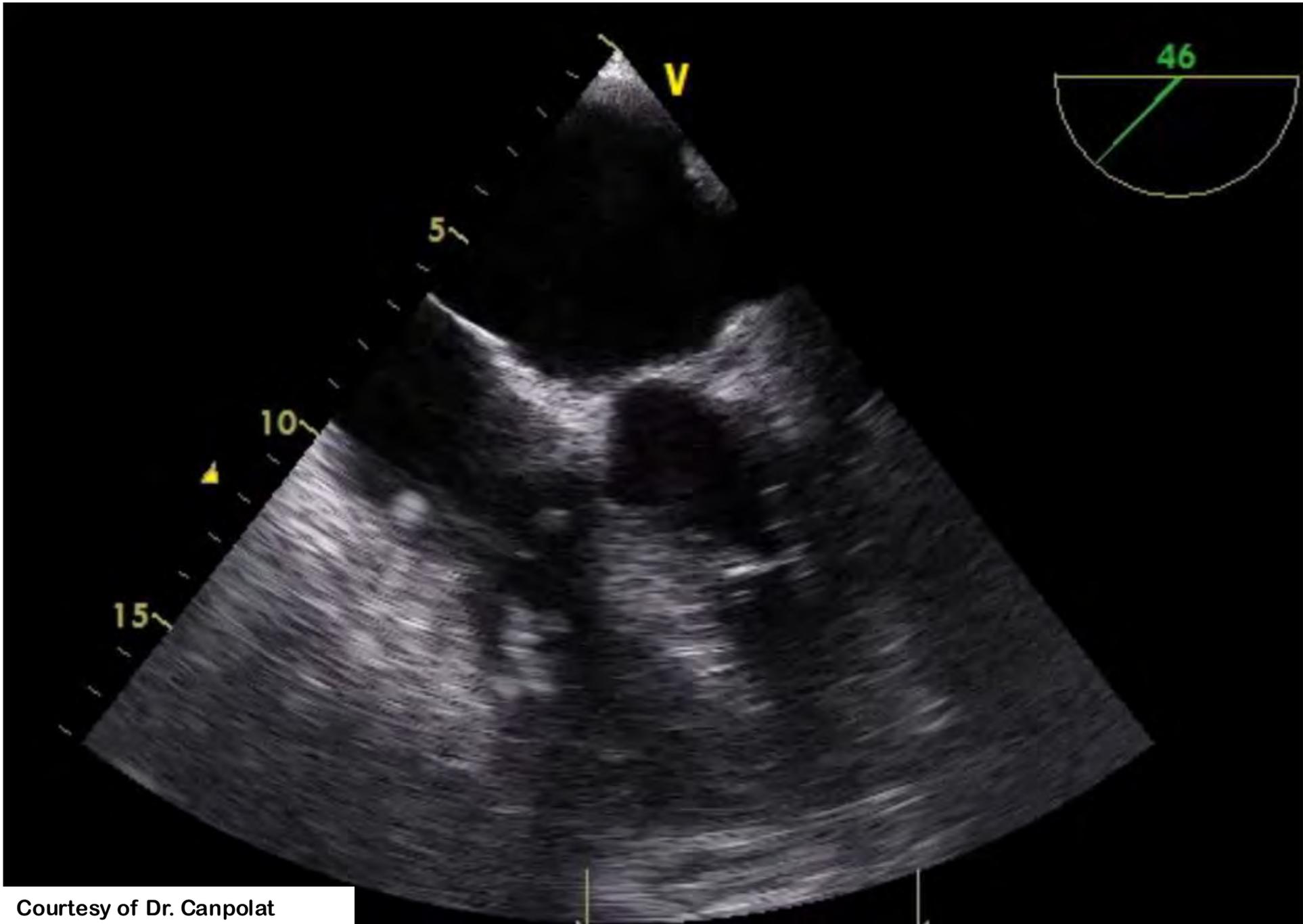
12/2018 Pulse generator replacement

06/2019 Inappropriate shocks > AVN ablation

10/2022 Pulse generator replacement

01/2023 Pocket infection, Blood culture: Negative

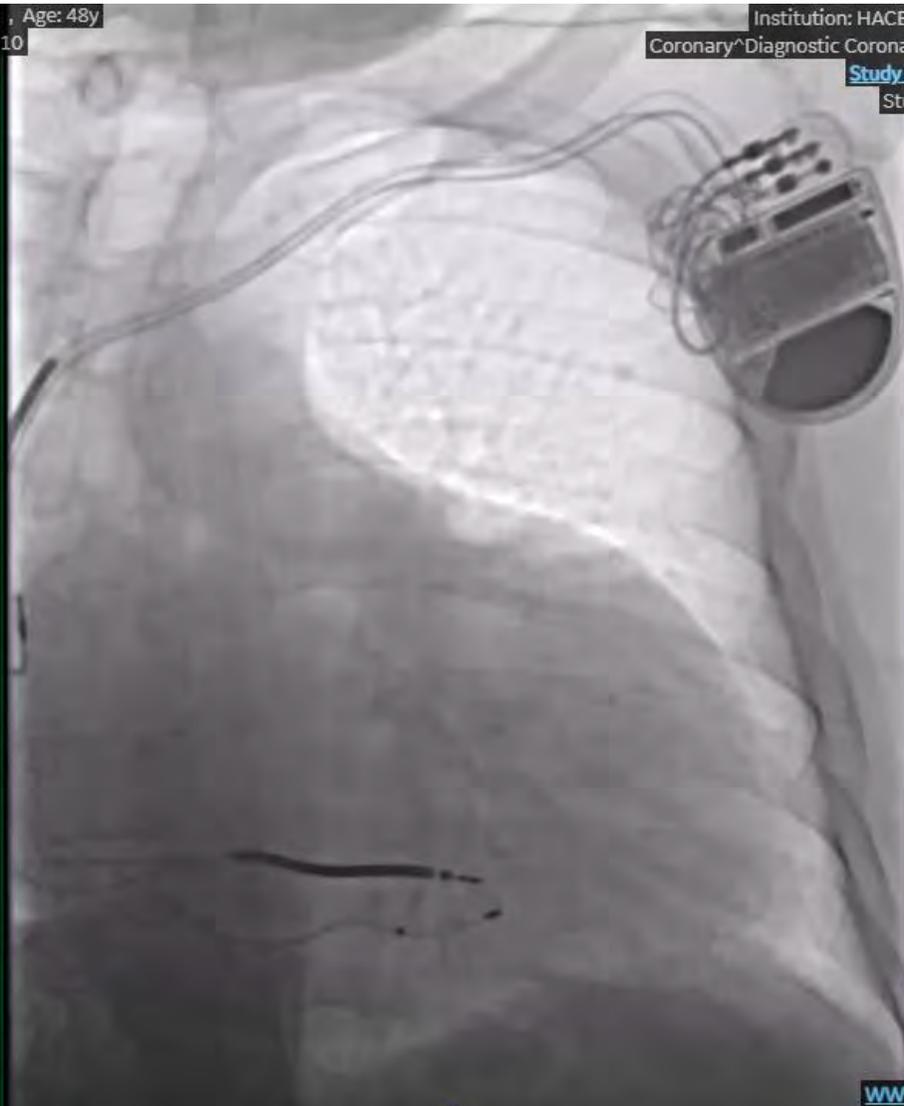
Echo: LVEDD: 83 mm & LVEF: 25% IVS: 9mm



Courtesy of Dr. Canpolat

DOB: 11-Feb-1974 , Age: 48y
Patient ID: 10703210
ACC: 650487706
Coro CARE
Se: 1(1) , Im: 1
Fr: 10/35

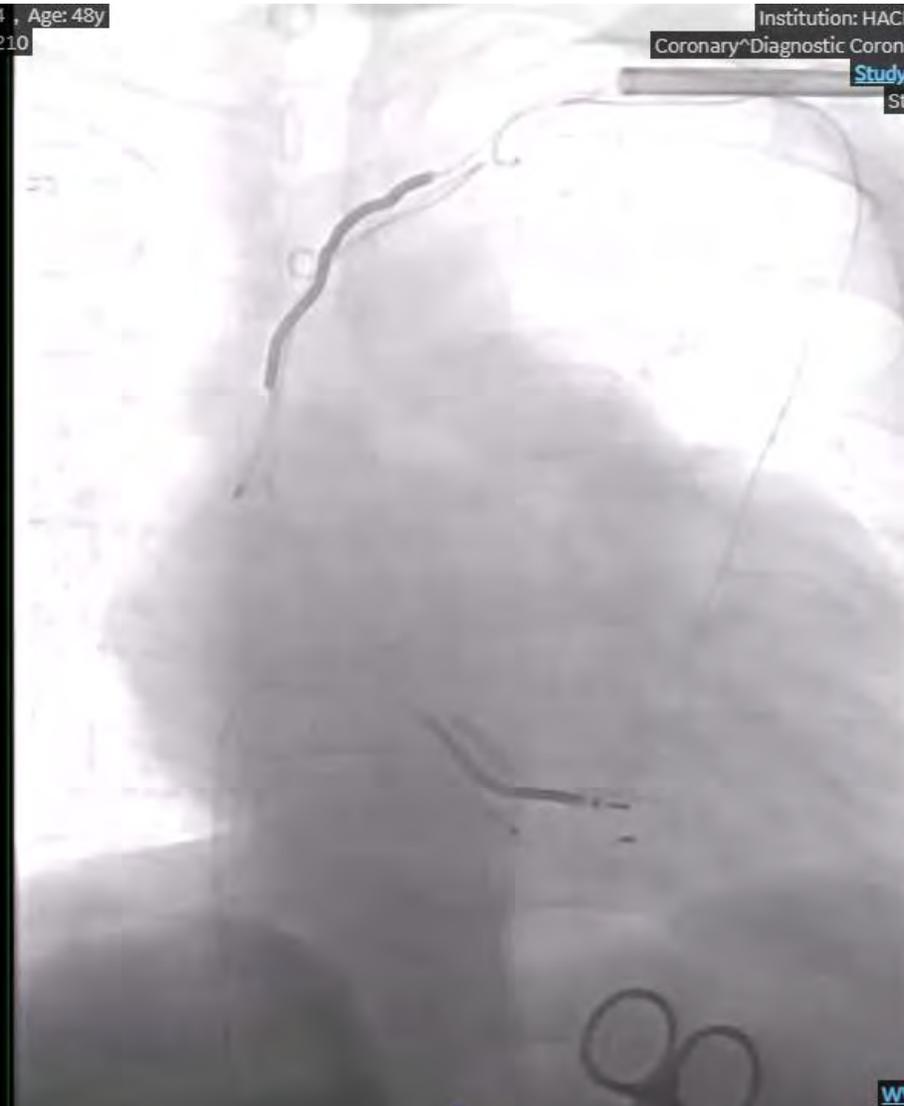
Institution: HACETTEPE UNIVERSTY
Coronary^Diagnostic Coronary Catheterization
Study Date: 09-Jan-2023
Study Time: 12:04:43



WW:131 - WL:104

DOB: 11-Feb-1974 , Age: 48y
Patient ID: 10703210
ACC: 650487706
FL Card
Se: 2(1) , Im: 1
Fr: 134/244

Institution: HACETTEPE UNIVERSTY
Coronary^Diagnostic Coronary Catheterization
Study Date: 09-Jan-2023
Study Time: 12:04:43

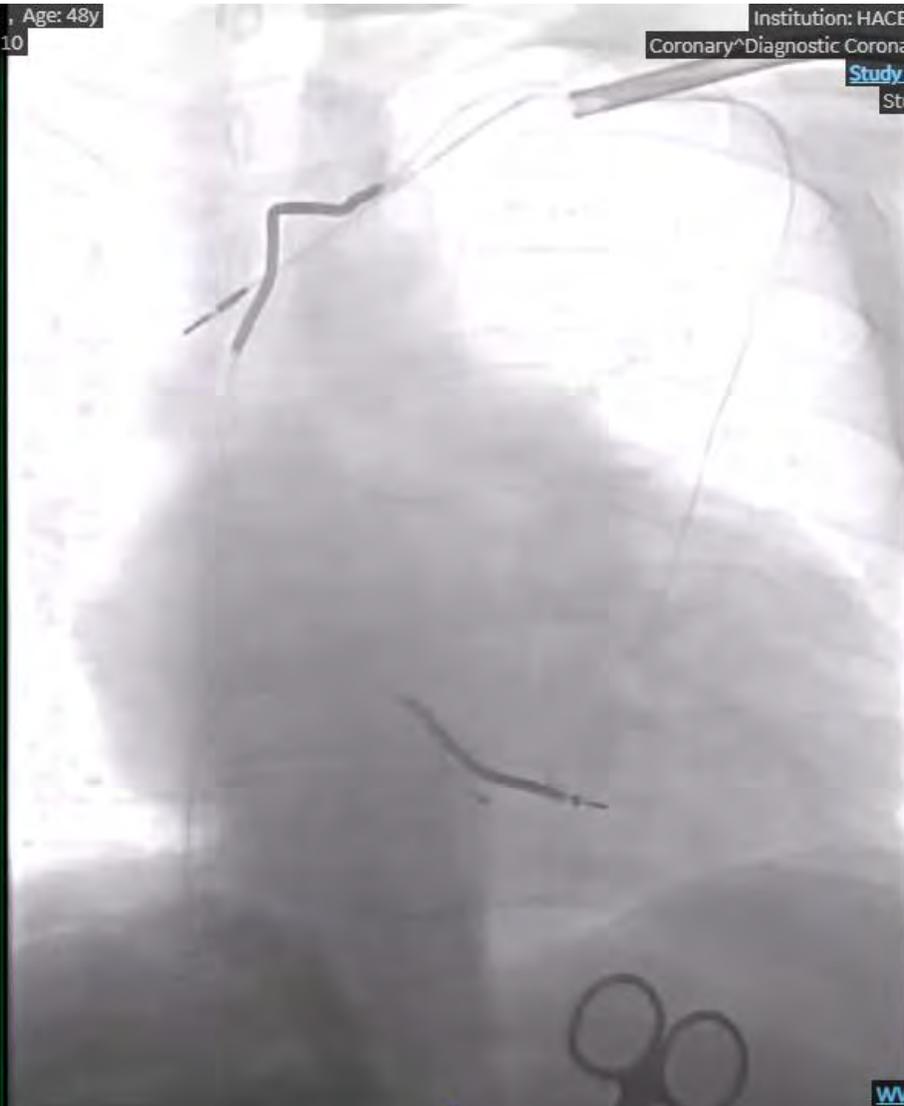


512 x 512

WW:118 - WL:92

DOB: 11-Feb-1974 , Age: 48y
Patient ID: 10703210
ACC: 650487706
FL Card
Se: 3(1) , Im: 1
Fr: 48/163

Institution: HACETTEPE UNIVERSTY
Coronary^Diagnostic Coronary Catheterization
Study Date: 09-Jan-2023
Study Time: 12:04:43



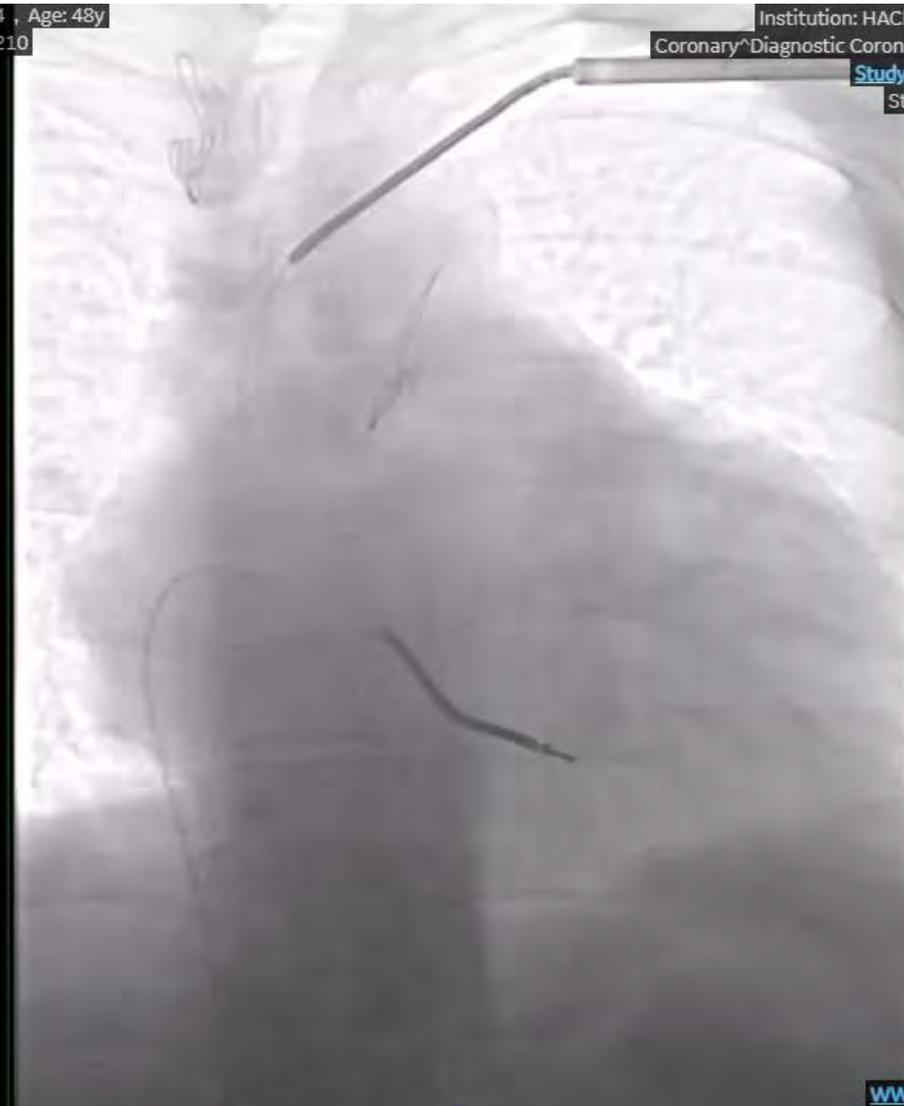
5
L
cm

WW:118 - WL:93

512 x 512

DOB: 11-Feb-1974 , Age: 48y
Patient ID: 10703210
ACC: 650487706
FL Card
Se: 4(1) , Im: 1
Fr: 7/32

Institution: HACETTEPE UNIVERSTY
Coronary^Diagnostic Coronary Catheterization
Study Date: 09-Jan-2023
Study Time: 12:04:43



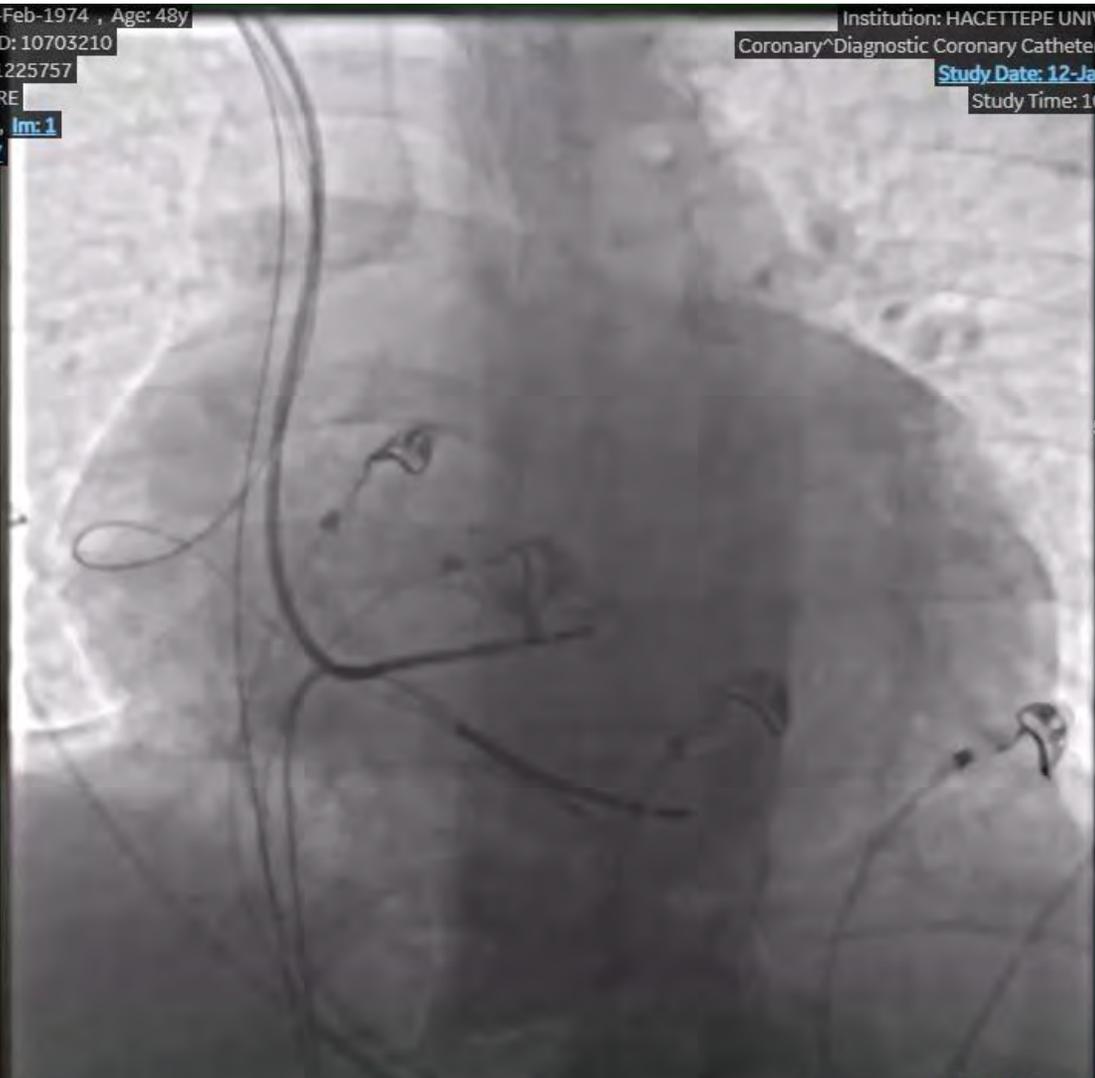
5
L
cm

WW:118 - WL:100

512 x 512

DOB: 11-Feb-1974 , Age: 48y
Patient ID: 10703210
ACC: 651225757
Coro CARE
Se: 4(1) , Im: 1
Fr: 20/27

Institution: HACETTEPE UNIVERSTY
Coronary^Diagnostic Coronary Catheterization
Study Date: 12-Jan-2023
Study Time: 10:33:47



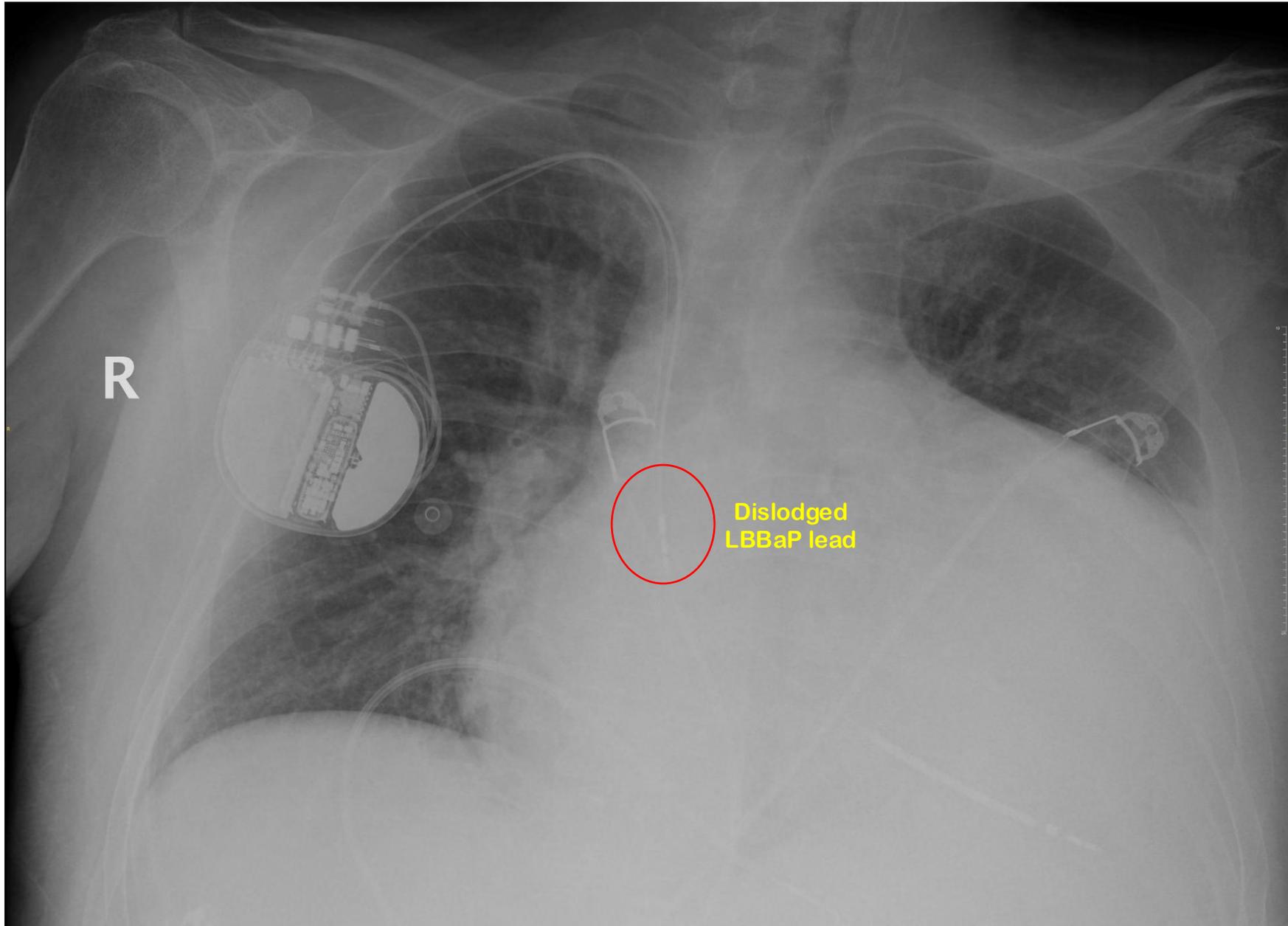
512 x 512 WW:131 - WL:109

DOB: 11-Feb-1974 , Age: 48y
Patient ID: 10703210
ACC: 651225757
Coro CARE
Se: 6(1) , Im: 1
Fr: 22/38

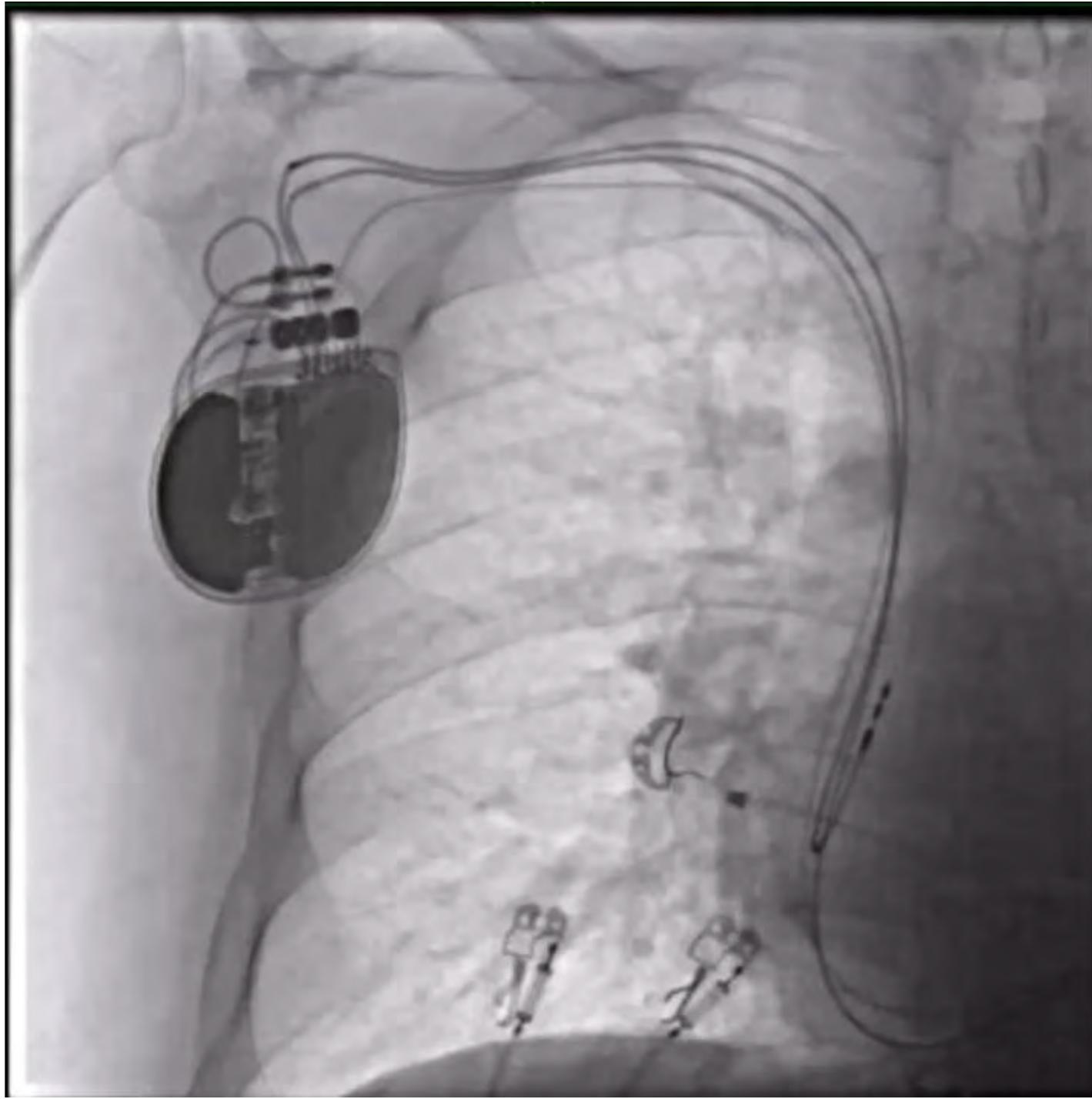
Institution: HACETTEPE UNIVERSTY
Coronary^Diagnostic Coronary Catheterization
Study Date: 12-Jan-2023
Study Time: 10:33:47

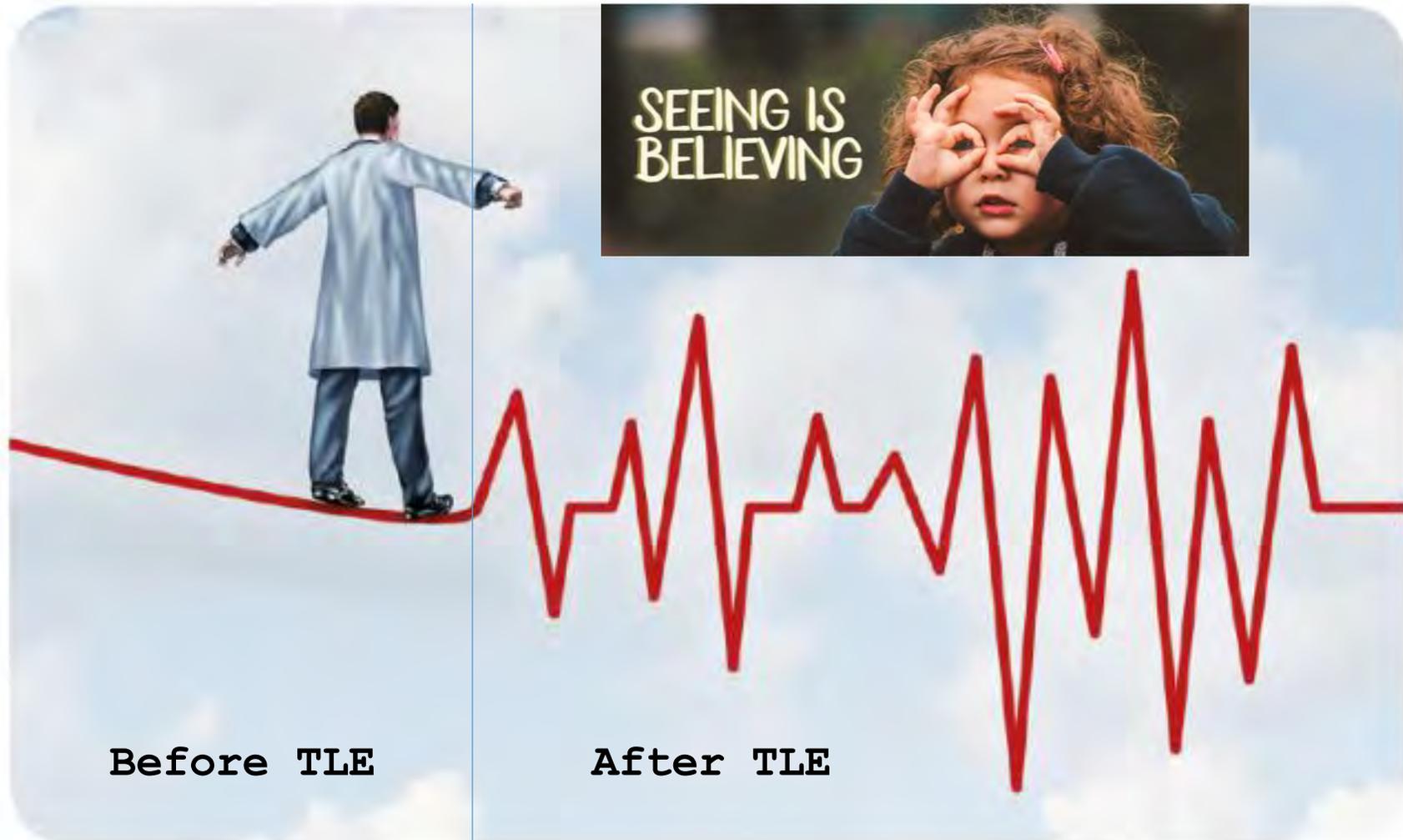


512 x 512 WW:131 - WL:104



After 18 months, the patient admitted with exacerbated acute HF clinic

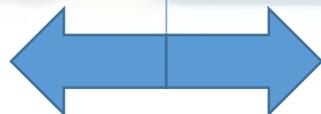




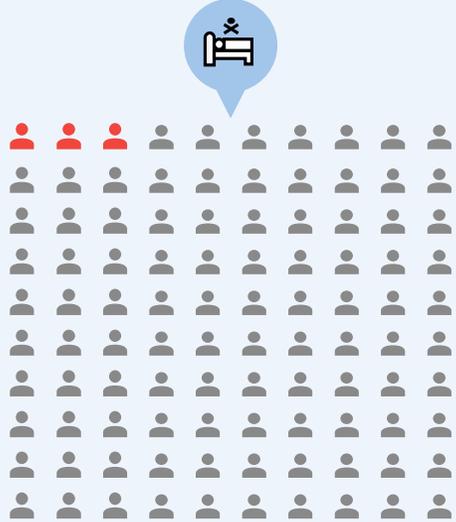
SEEING IS
BELIEVING

Before TLE

After TLE

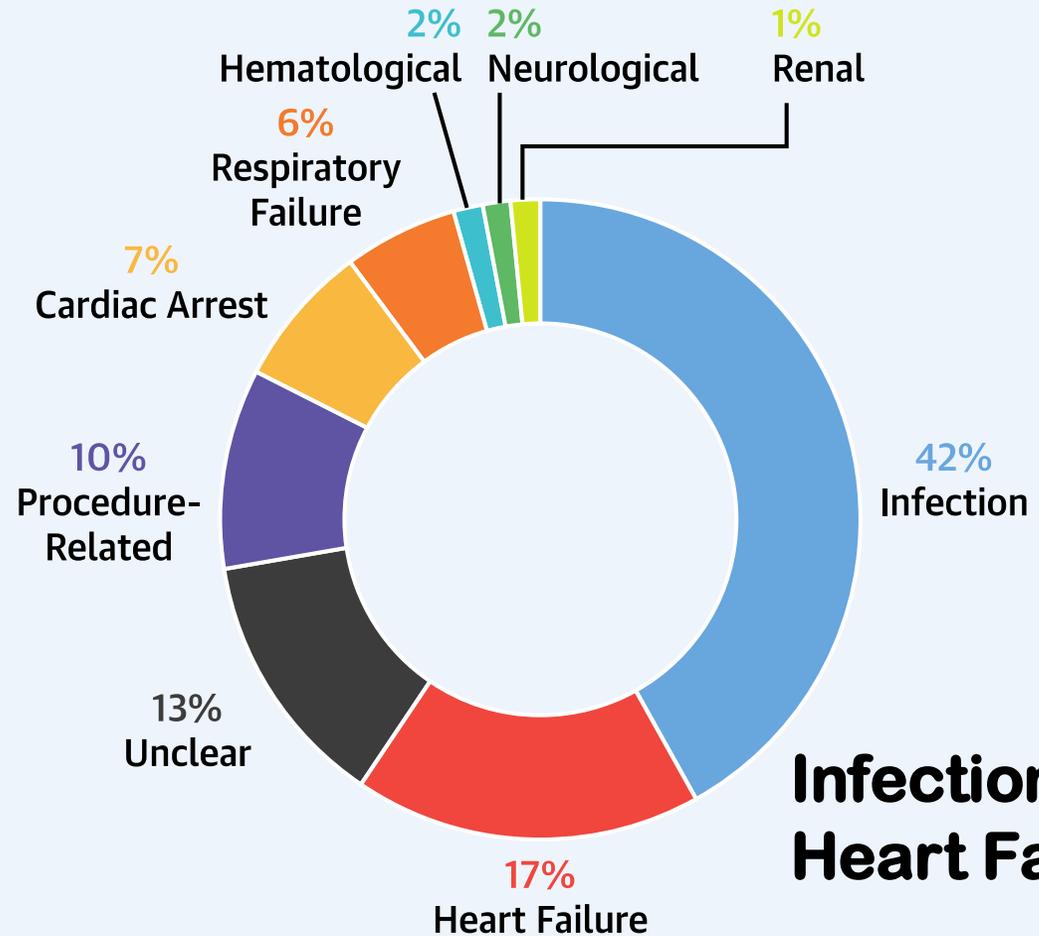


Early Mortality (30 Days)



3%

Causes of Early Mortality



**Infection
Heart Failure** !

x10

Procedure-Related Early Mortality

0.3%

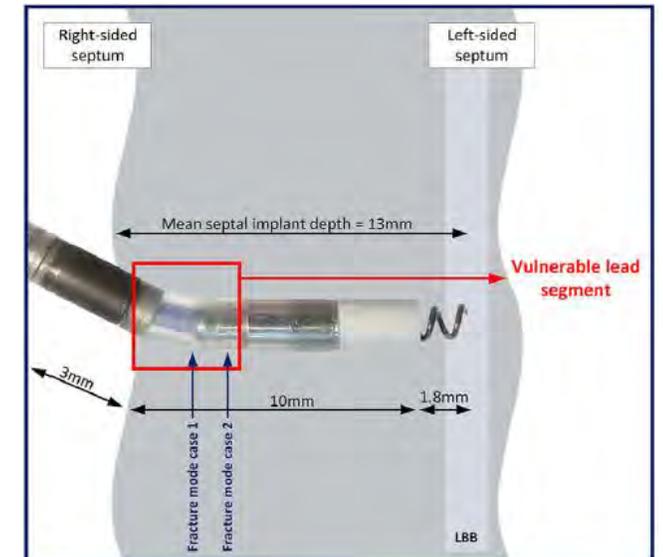
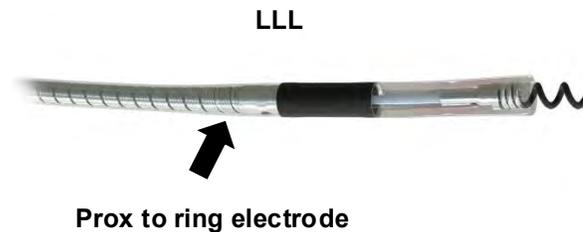
1/3 of the early mortality > after discharge for an index hospitalization

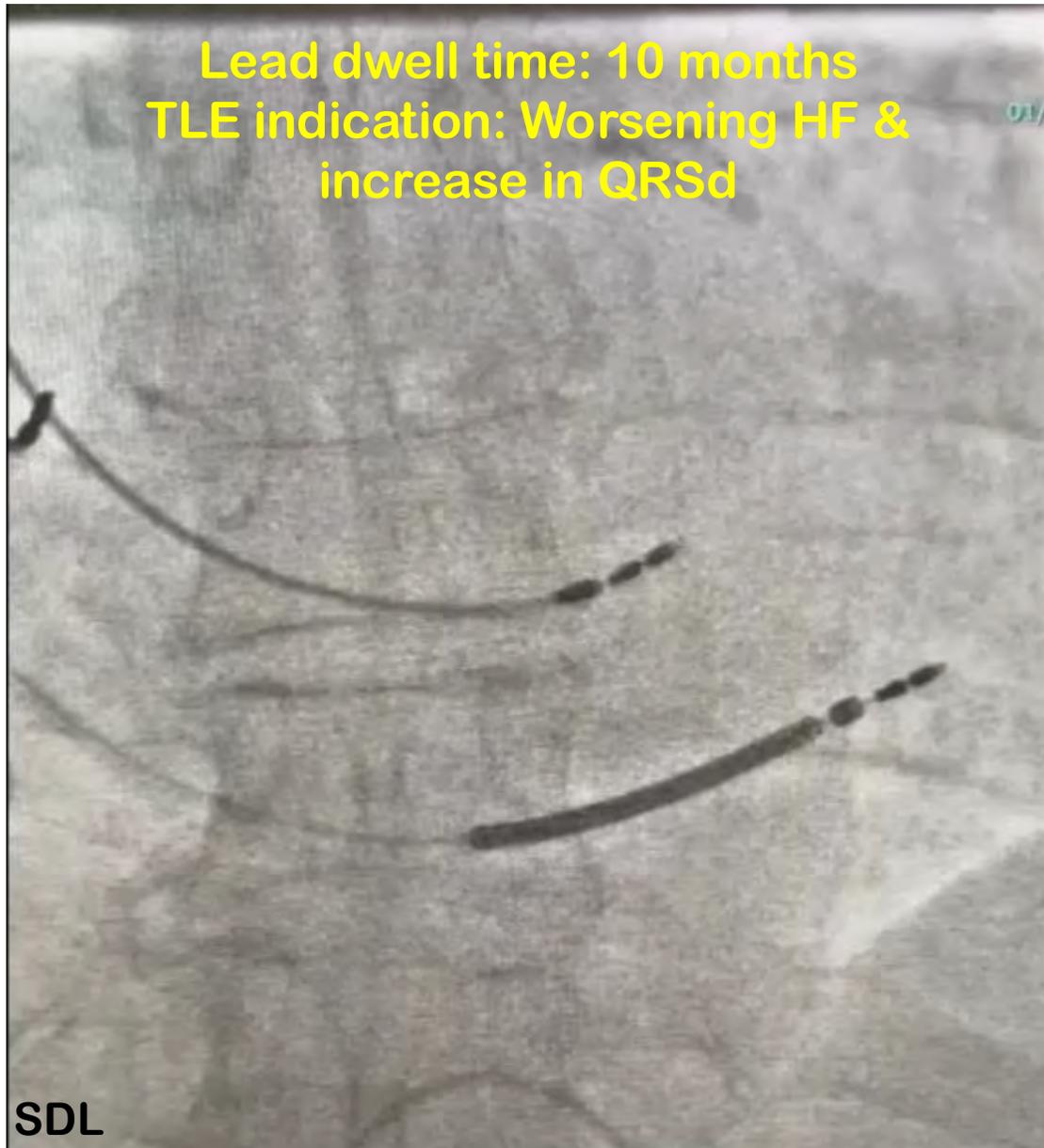
CSP Lead Extraction

Review of Literature & Tips for Procedural Success

Lead Integrity and Failure Evaluation in Left Bundle Branch Area Pacing: The 'LIFE-LBBAP' Study

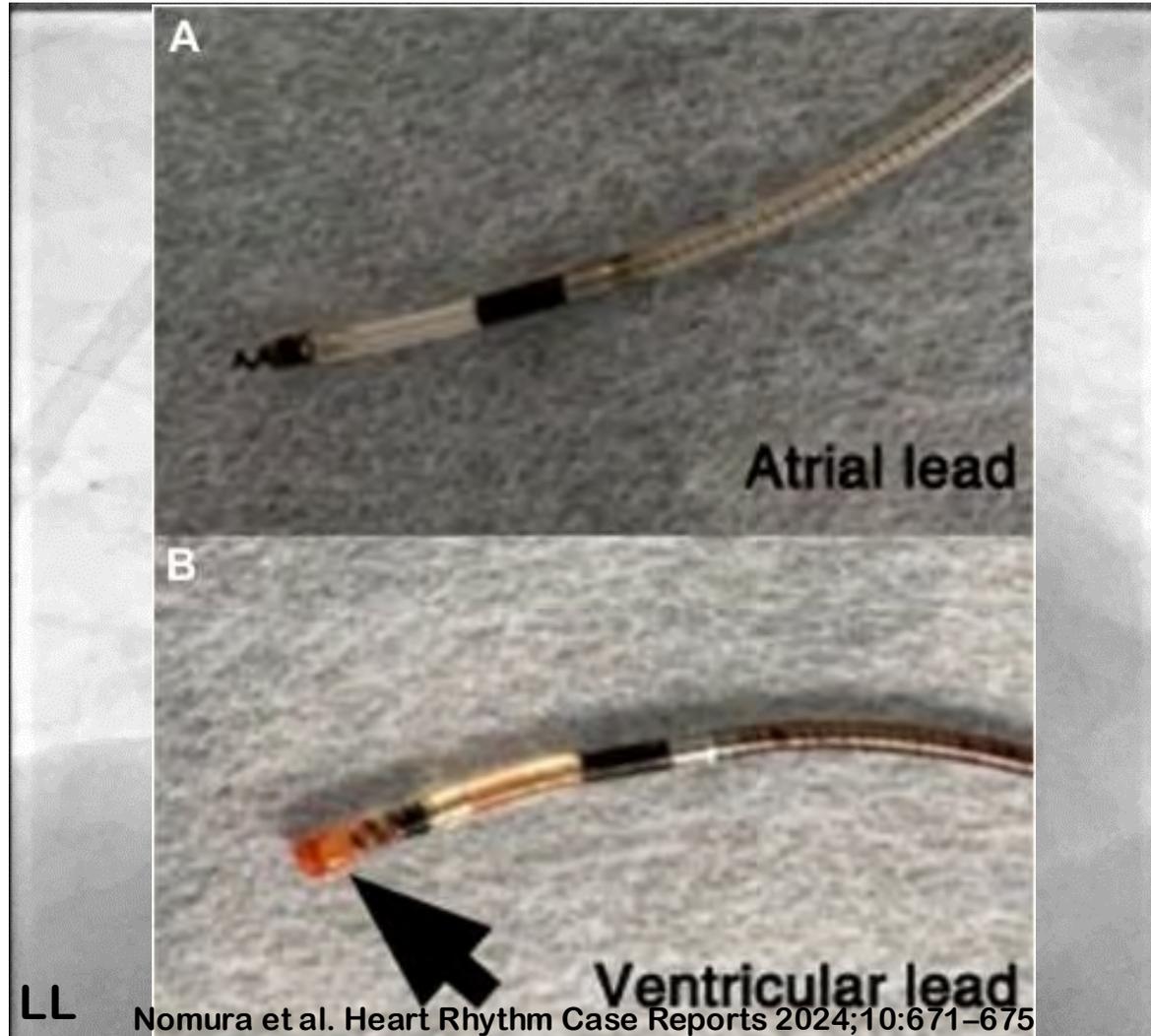
- n: 8,255 pts w LBBP (68% LLL & 32% SDL)
- Median follow-up 16.4 (IQR: 6.4-28.8) months
- Overall lead survival rate 99.7%
- Lead fracture rates: 0.04% in LLL vs. 0.4% in SDL



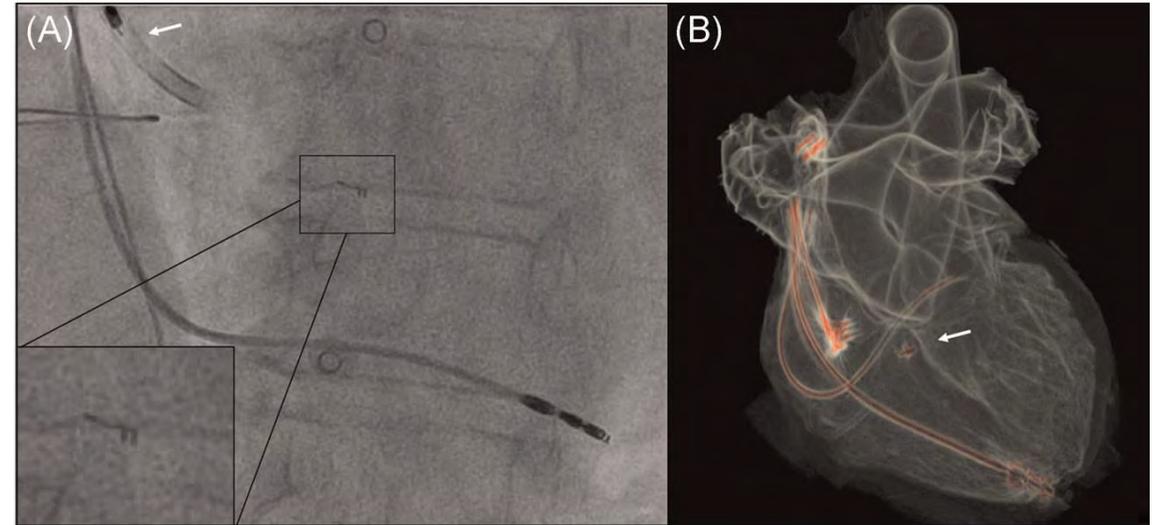


- 4 months old Solia S60 (Biotronik)
- TLE for Twiddler syndrome & no V capture
- Implant vein approach w simple stylet > Failed
- Femoral approach > double-loop snare (Needle's Eye Snare, Cook Medical®)
- No complication

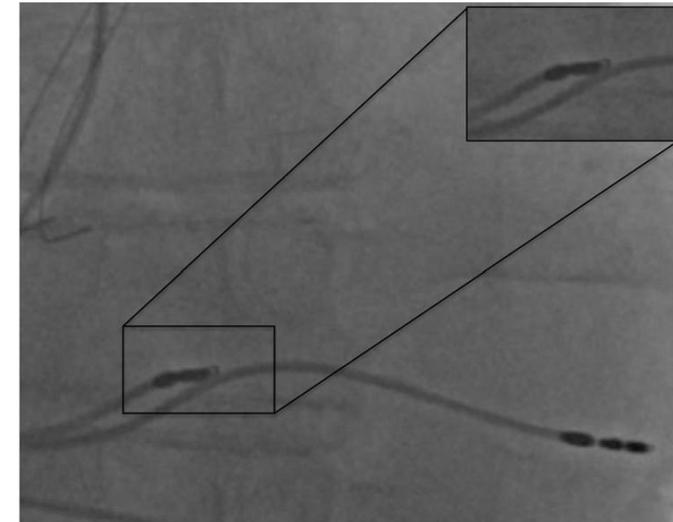
Lead dwell time: 19 months
TLE indication: TV infective endocarditis



Failure in retraction of the lead during
index implantation



SDL



le Polain de Waroux JB et al. J Cardiovasc Electrophysiol. 2021;32:1464–1466

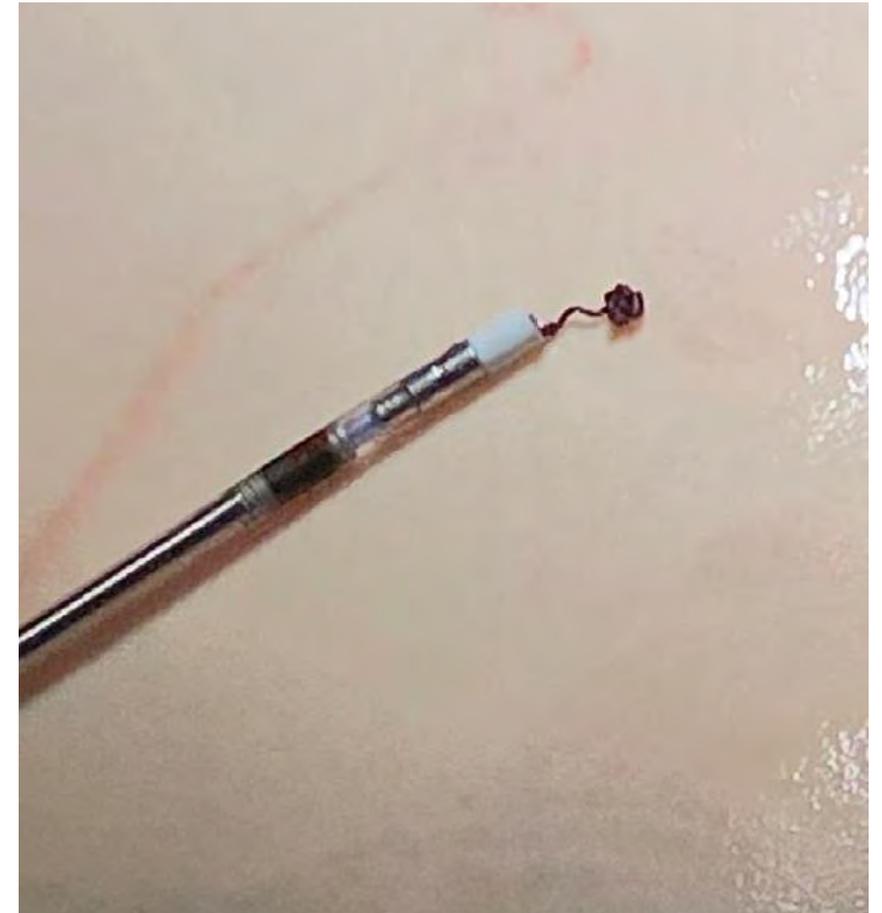
Nomura et al. Heart Rhythm Case Reports 2024;10:671–675

Hayashi et al. J Arrhythmia 2023;39:623-626

A novel method to disengage trapped helix during left bundle branch pacing

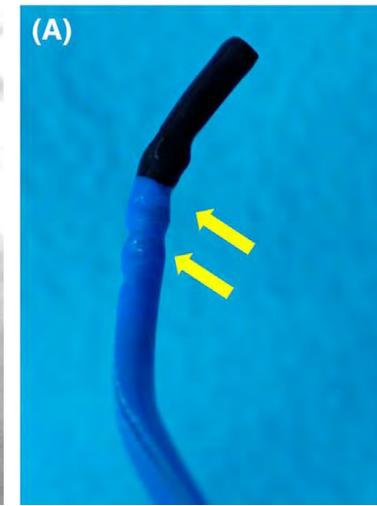
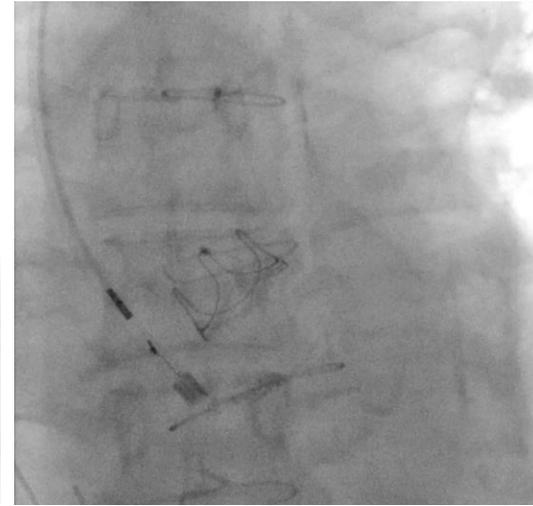
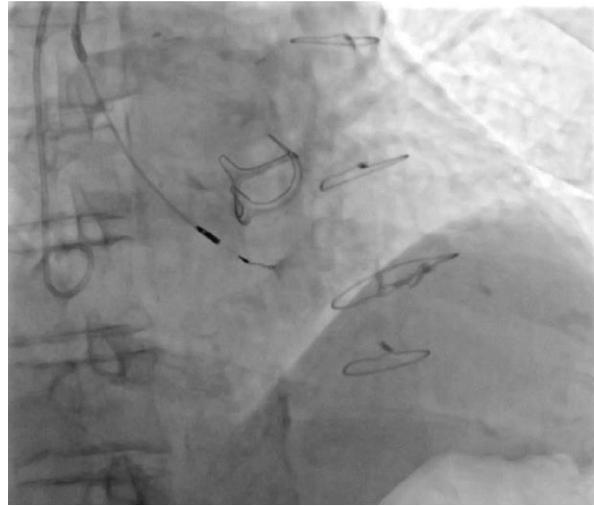
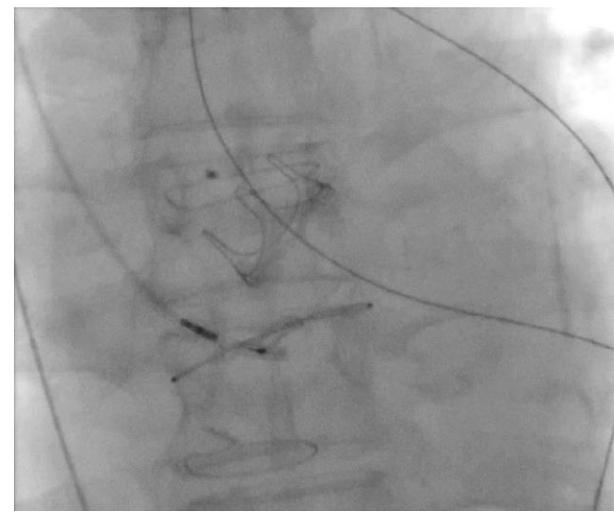


SDL



Unipolar electrocautery > applying energy through the diathermy tip to the distal pacing connector (40W on “cut” with energy delivered for 3 seconds)

A case of difficult removal of lumen-less lead inserted near the tricuspid valve



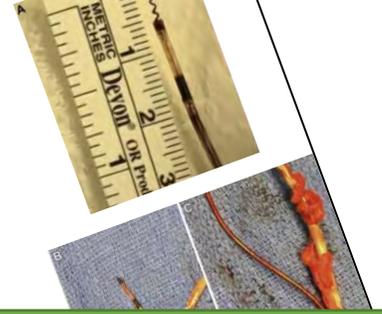
LL

12-Fr laser sheath (GlideLight, Philips)

Extraction of the permanent His bundle pacing lead:
Safety outcomes and feasibility of
reimplantation

- n=30 pts
- **Lumenless**
- Mean lead
- Non-infect
- Infectio
- **Simple**
- Mech
- **100%**
- **86%**

72)months



Extraction of lumenless pacing leads from the
His bundle and left bundle branch area:
outcomes of the high-volume centre

- April 2018 - March 2024
- n=47 (from EXTRACT)
- **Lumenless**

➤ Simple traction has high success rate

➤ Mechanical tools ± snaring > for longer lead dwell time

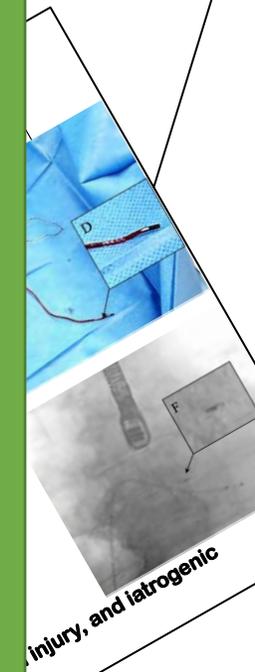
➤ Successful CSP re-implantation rate is high

➤ Potential for myocardial avulsion (LL), conduction system injury, and iatrogenic ventricular septal defects

Transvenous
pacing lead

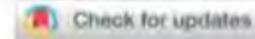
Wagner et al. J Cardio

- 2013 - 20
- n=23 (14
- **12 Lumen**
- Mean lead
- Oldest ex
- Lead failure 7/14
- Infectious 5/14
- **Simple traction: 8/14 (57%)**
- **14/14 (100%) procedural success**
- **CSP re-implantation: 80%**



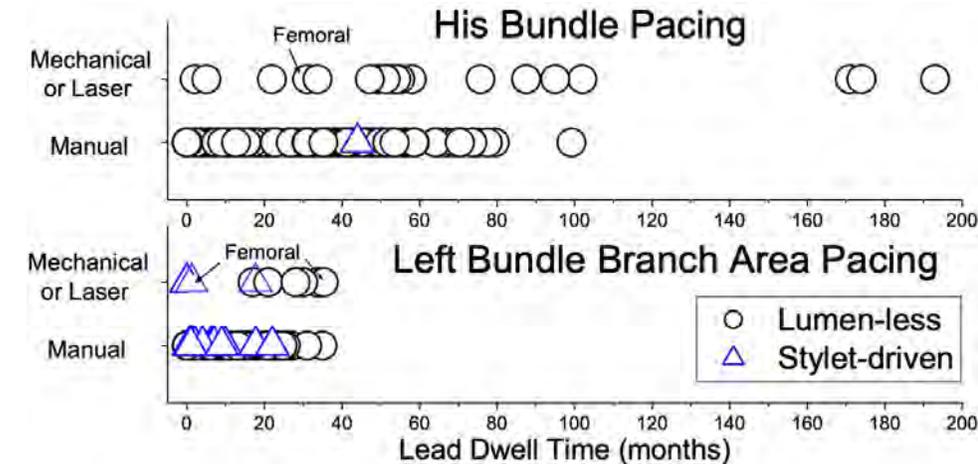
- Mech
- Non-infect
- Infectious 4/6
- Simple traction: 2/6
- Mechanical extraction too
- **5/6 (83%) complete procedural**

Concerns: potential for myocardial avulsion, conduction system injury, and iatrogenic ventricular septal defects



Transvenous extraction of conduction system pacing leads: An international multicenter (TECSPAM) study ^e

- n=341 (221 HBP, 117 LBBaP)
- **321 Lumenless lead, 20 SDL**
- Lead dwell time >6 (6-193) months (n=226)
 - Manual traction: 87%
 - Mechanical tools: 10%
 - Laser: 3%
 - Femoral tool: 3 pts
- Mean lead dwell time: 22±26 (0-193) months
 - Longest dwell time of the LBBAP lead: 35 months
- Lead failure 68% (high threshold/microdislodgement), Infection 19%
- **Manual traction: 91%**
- Mechanical extraction tool: 9%
- **99% (338/341) complete procedural success, 100% clinical success**
- 7 (2.1%) minor complications (severe TR, AV block, retained lead tip)
- CSP re-implantation: 95%



Comparative durability of pacemaker leads in transvenous lead extraction: An evaluation through bench testing

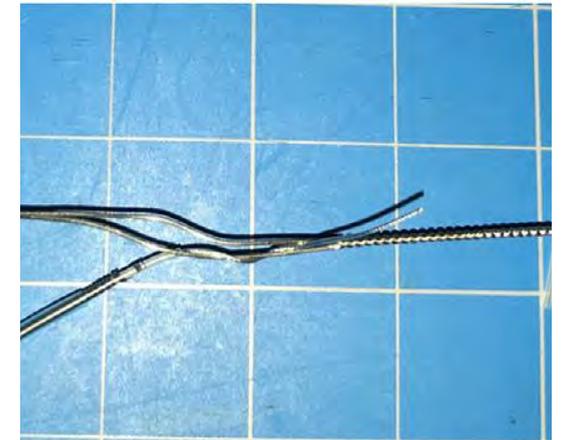
Tendril STS, INGEVITY, INGEVITY1, Solia S, and CapSure Fix

Lead type	Maximum force (kgf)			Recommendation
	T-Rem	T-Ret	Snare	
INGEVITY	1.2	0.7	8.9	Use a snare
INGEVITY+	2.7	3.4	13.2	Retain the terminal
Tendril STS	2.7	5.7	7.8	Use a snare if higher force anticipated Retain the terminal
Solia S	3.4	4.9		Use a snare if higher force anticipated Remove terminal
CapSure Fix	5.9	6.2		Retain terminal if higher force anticipated Remove the terminal

T-Rem = terminal removed; T-Ret = terminal retained.

*****The Solia S lead had the least amount of sliding of the locking stylet of any of the tested leads**

TLE of Lumenless Lead



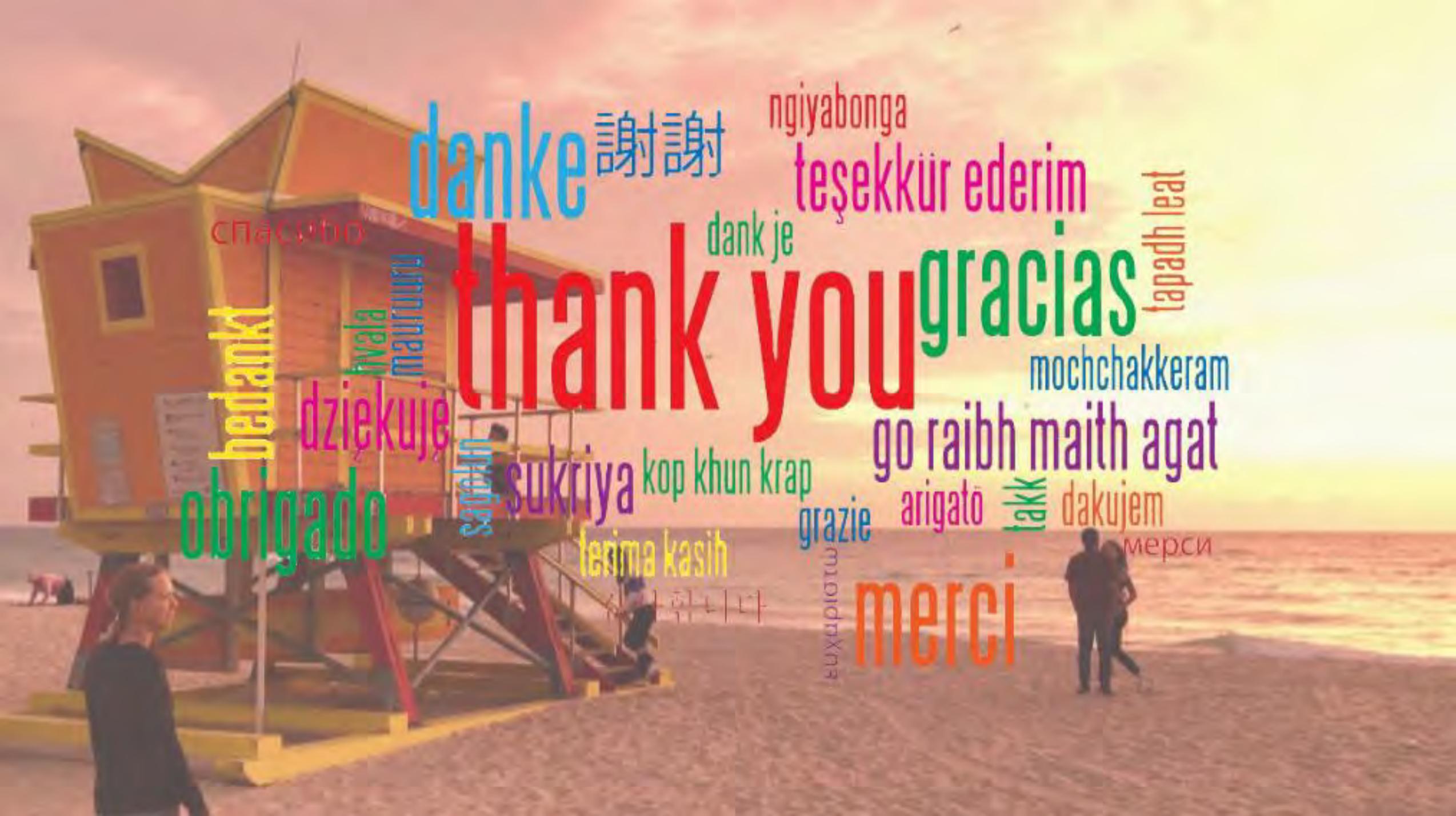
- **BullDog lead extender & One Tie Compression Coil**
- **It is suggested that the Philips TightRail be avoided when the lead angle course is $\geq 90^\circ$ or modify the angle with snaring**

Take home messages...

- Still, TLE has high morbidity & mortality!
- **TLE team** is necessary!
 - Cardiology, CV surgeon, Anesthesiology, Infectious disease
- **Define your A, B, C plans during the TLE for CSP!**
 - Knowing each LBBaP lead design & behavior during TLE
 - Ready for all alternative techniques with different tools
 - Extract conventional leads first to improve adherence and avoid increased strain on the lumenless lead
- **Preprocedural risk scoring & preparedness for all complications!**
- **Preprocedural determination of re-implantation process!**







danke 謝謝

ngiyabonga

teşekkür ederim

спасибо

dank je

thank you gracias

tapadh leat

bedankt

hvala
maururu

mochchakkeram

dziękuję

go raibh maith agat

obrigado

sajoban

sukriya

kop khun krap

grazie

arigato

takk

dakujem

merci

terima kasih

고맙습니다

ευχαριστώ

merci