

Results of the Pivotal MODULAR ATP Trial

Petr Neužil : HOT Lines 2025

HRS Late Breaking Clinical Trials: LB-469805-03, 2024



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ORIGINAL ARTICLE



A Modular Communicative Leadless Pacing– Defibrillator System

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EMBLEM™ S-ICD + **EMPOWER™**
A209 and A219 Systems Leadless Pacemaker

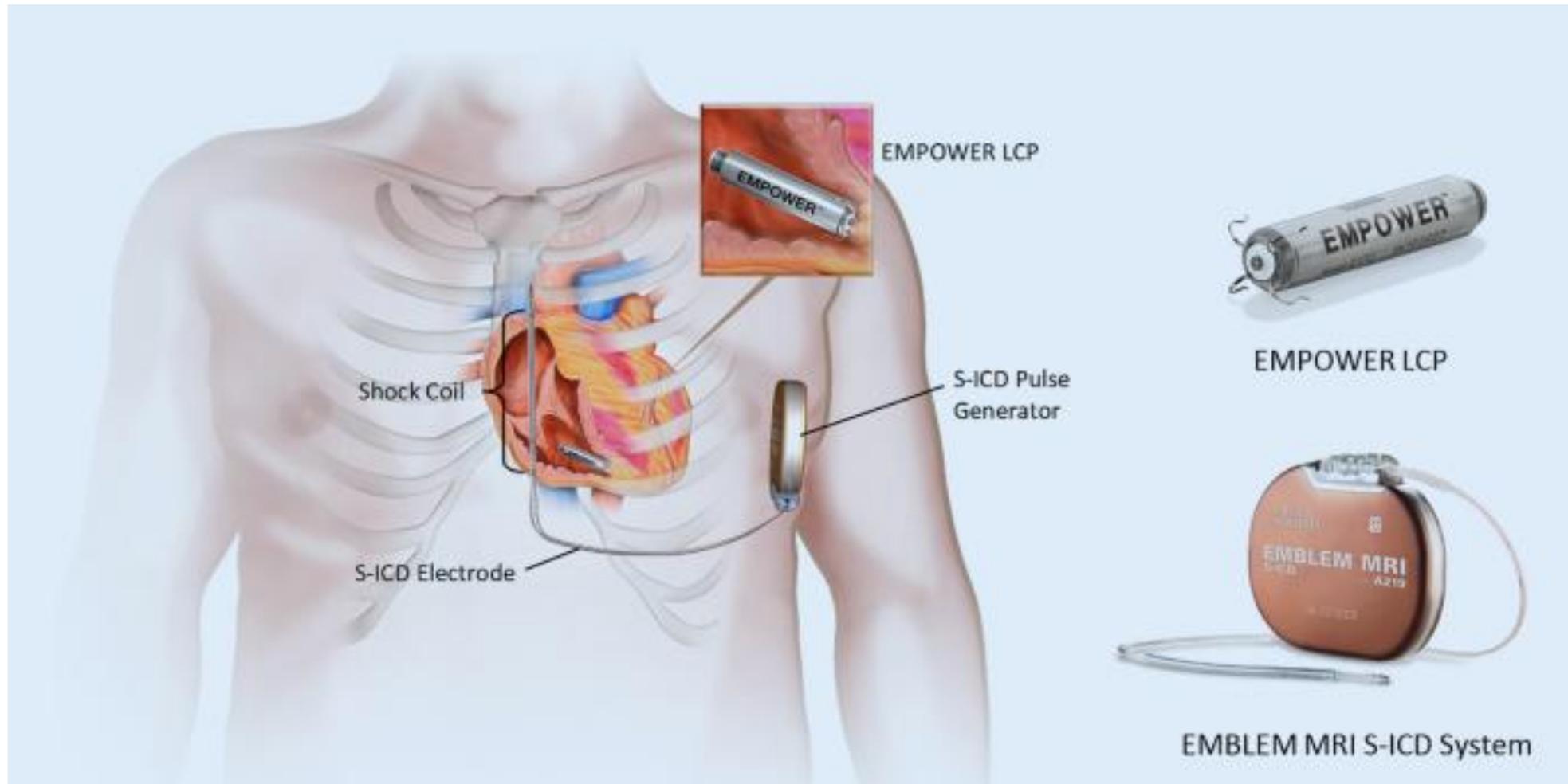


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Pivotal MODULAR ATP Trial



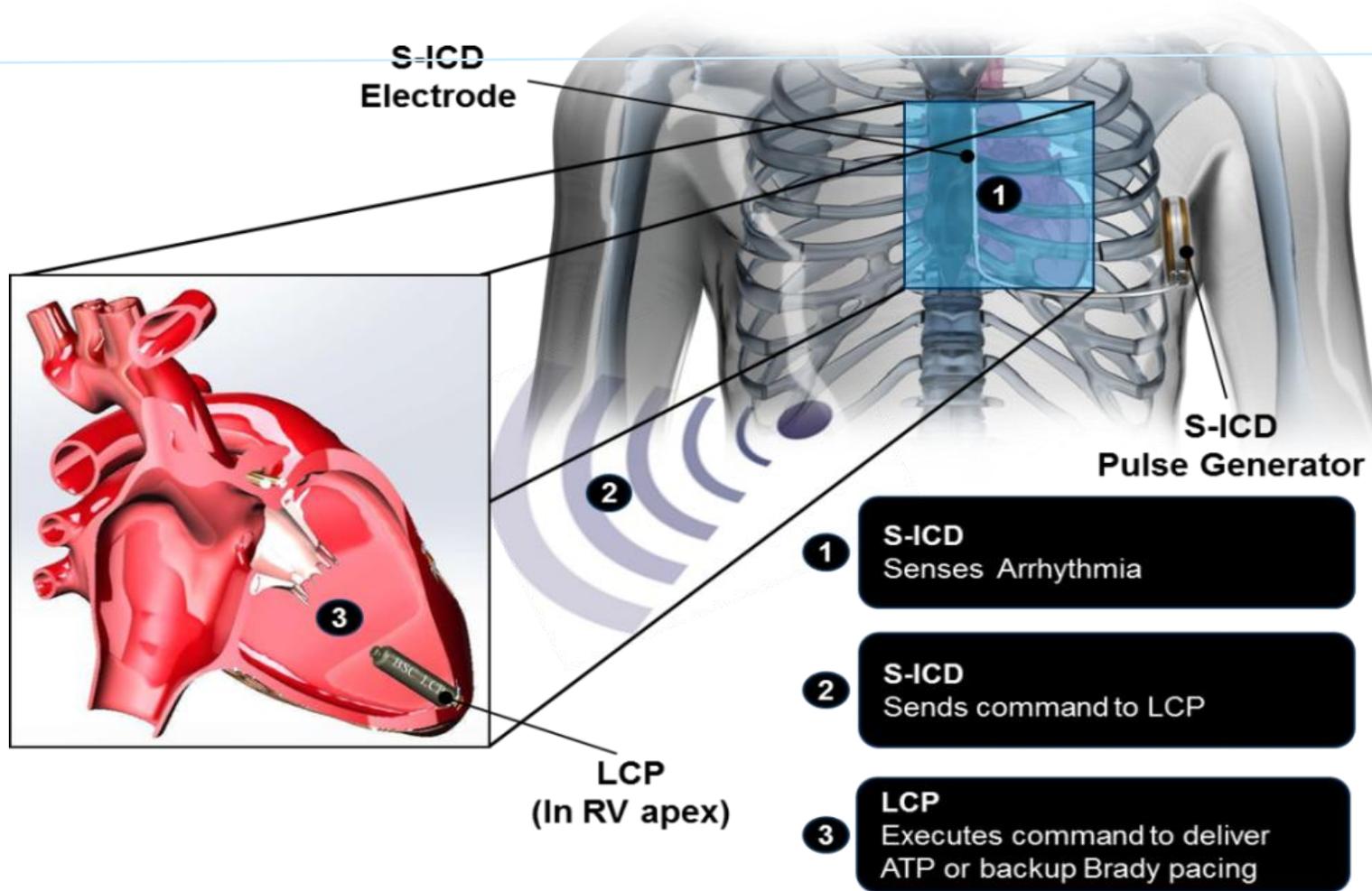
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Leadless & S-ICD

Funkčně integrované



Leadless brady & ATP & S-ICD

Implantable Devices



EMPOWER™ Modular Pacing System
EMBLEM™ Family of S-ICDs

EMPOWER™ Details

32.1 mm x 6 mm
0.8 cc

Active fixation talons
Tether / Snare port



EMPOWER™ Delivery and Retrieval



Preloaded delivery
catheter with
extendable inner
catheter



Dedicated
retrieval system with single
& tri-loop snares



Dedicated delivery and retrieval catheters

Programmiers

Model 3200 S-ICD Programmer



Next Generation
BSC 3300 LATITUDE
Programming System



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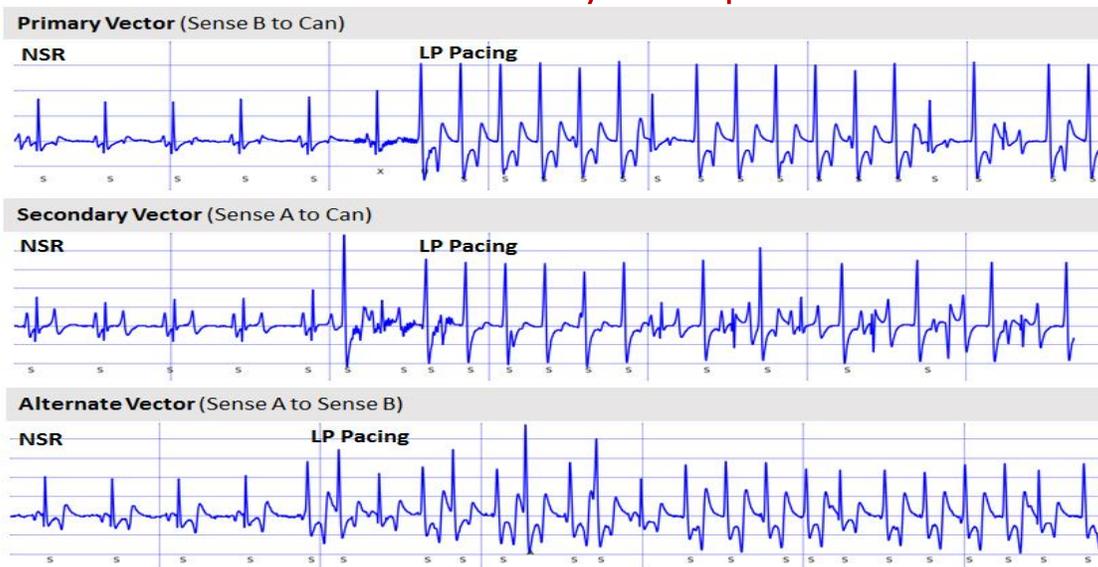
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Komunikace Leadless ATP & S-ICD:

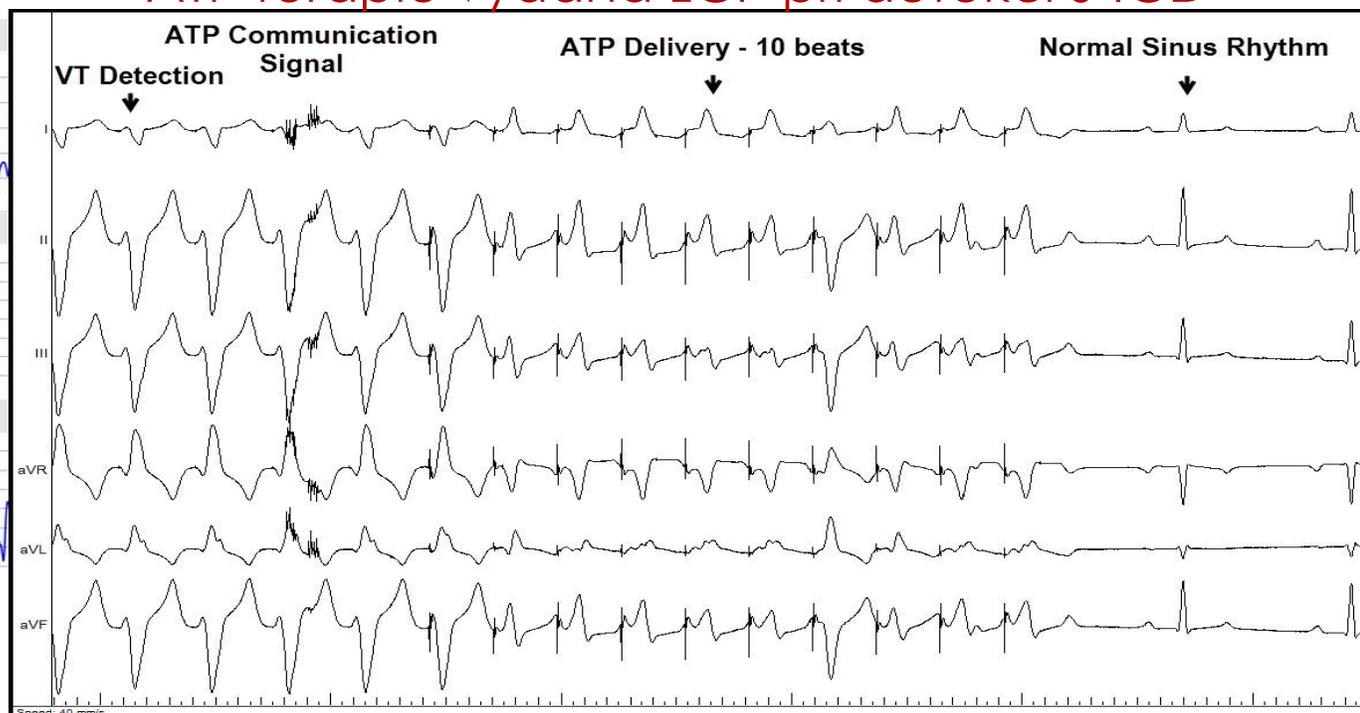
Preklinický model

S-ICD diskriminace rytmu při stimulaci



Tjong F.V.Y. et. al., JACC:CE

ATP terapie vydaná LCP při detekci S-ICD

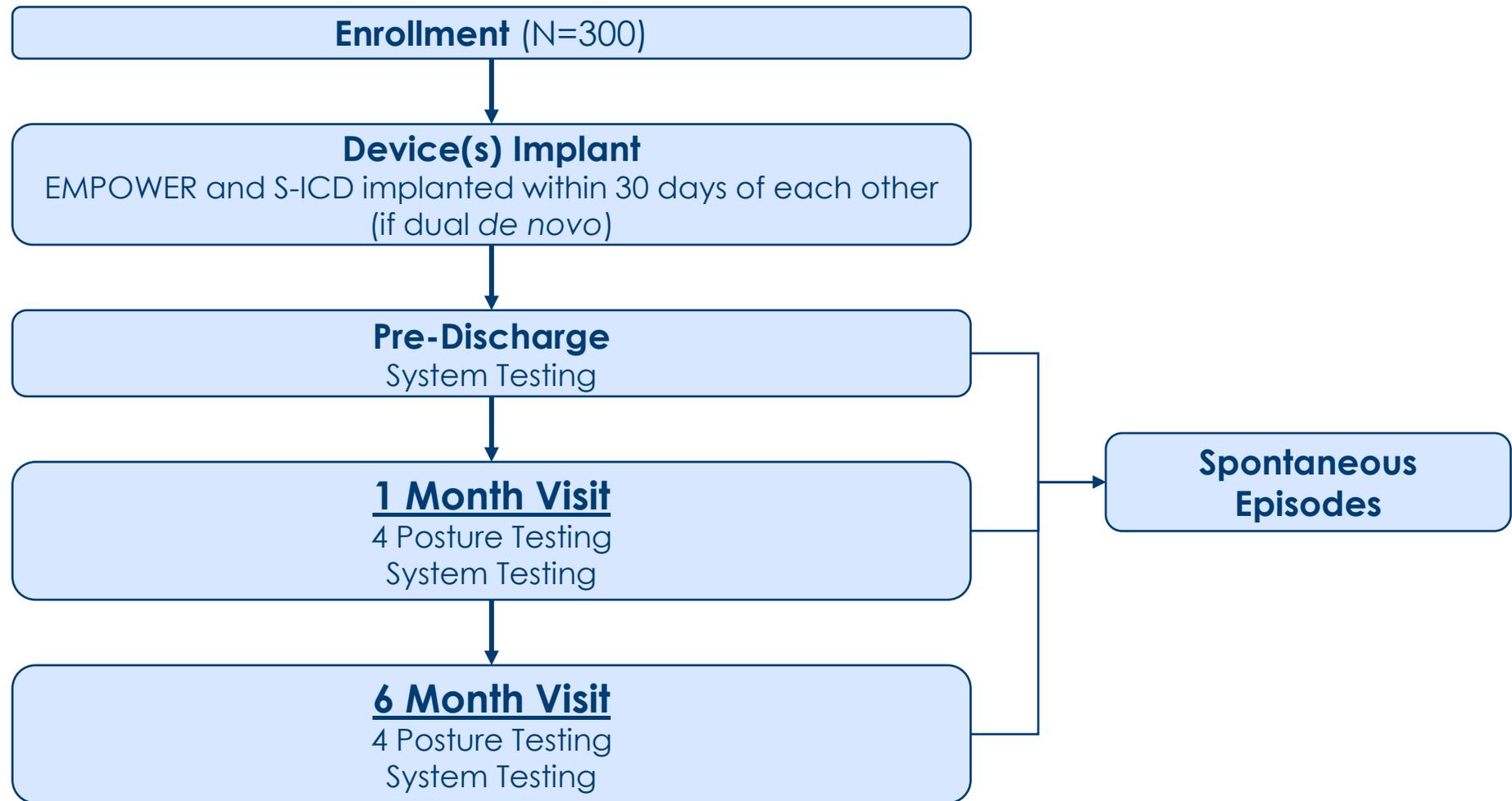


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MODULAR ATP Trial: *design and overview*



Inclusion and exclusion criteria

Inclusion

- Class I, IIa, or IIb guideline ICD indications, or an existing TV-ICD* or S-ICD
- History of at least one of the following:
 - Non-sustained MVT with LVEF \leq 50%
 - Sustained VA (secondary prevention) with LVEF \leq 50% or scar
 - Syncope of arrhythmic origin
 - Ischemic cardiomyopathy LVEF $<$ 35%
 - Nonischemic cardiomyopathy LVEF $<$ 35% + scar

Exclusion

- Need for chronic pacing or CRT
- Pacing not required for pacemaker-dependency, chronotropic incompetence, or ventricular dyssynchrony

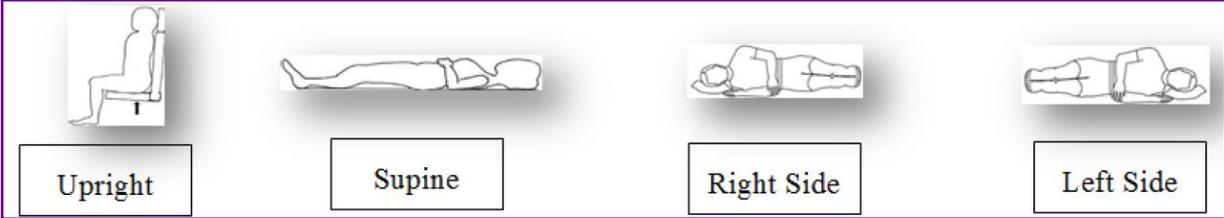


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MODULAR ATP Trial: 6-month's endpoints

Endpoint	Performance Goal
Major EMPOWER™ System and procedure-related complication-free rate	>86% ^a
<p>Communication success rate between the S-ICD and EMPOWER LP</p> <p>Communication testing required in 4 body posters</p> <div data-bbox="422 644 1646 862" style="text-align: center;">  </div>	>88% ^b
% of patients with adequate pacing capture threshold (PCT) ≤ 2 V @ 0.4 ms	>80% ^c

^a The performance goal of >86% is similar to other LP performance goal endpoints – Nanostim³: > 86% and Micra⁴: > 83%.

^b The mCRM wireless communication is inductive, one-way communication from the S-ICD to the LP to request ATP delivery. The communication testing endpoint, which assessed pass/fail of communication at the programmed S-ICD Telemetry Setting, was required at the 6-month visit in 4 body postures..

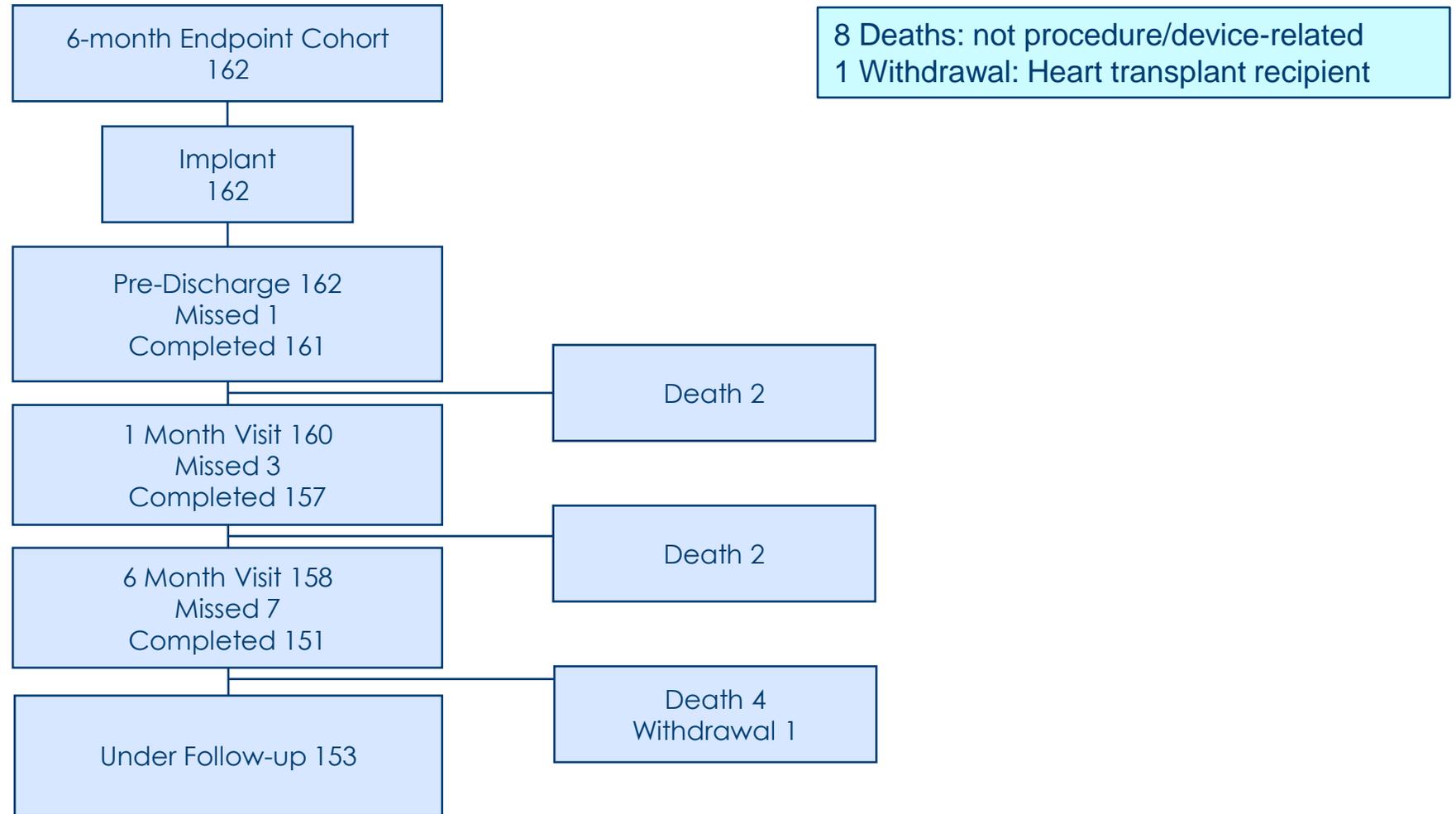


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MODULAR ATP Trial: 6-month endpoint follow-up



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MODULAR ATP Trial: *Patient characteristics*

Characteristic	N=162
Age-yr	60±12
Female	27 (16.7)
Body-mass index†	29.8±5.9
Race/ethnicity, White	110 (67.9)
Race/ethnicity, Black or African heritage	12 (7.4)
Race/ethnicity, Other	10 (6.2)
Race/ethnicity, Not Disclosed	31 (19.1)
Primary prevention—no. (%)	87 (53.7)
Secondary prevention – no. (%)	75 (46.3)
NYHA Class I	40 (24.7)
NYHA Class II	82 (50.6)
NYHA Class III	38 (23.5)
NYHA Class IV	2 (1.2)
Diabetes—no. (%)	57 (35.2)
Hyperlipidemia—no. (%)	103 (63.6)
Renal dysfunction—no. (%)	32 (19.8)
LVEF – %	33.1±13

Characteristic	N=162
Ischemic cardiomyopathy	99 (61.1)
Non-ischemic cardiomyopathy	59 (36.4)
Other cardiac diseases	52 (32.1)
No Cardiac Disease History	9 (5.6)
Ventricular Arrhythmias	95 (58.6)
Sustained VT and non-sustained VT	19 (11.7)
Monomorphic VT – non-sustained	35 (21.6)
Monomorphic VT – sustained	31 (19.1)
Stable VT	24 (14.8)
Sustained VF and non-sustained VF	2 (1.2)
Sustained VF	3 (1.9)
Non-sustained VF	23 (14.2)
Transvenous pacemaker	0 (0.0)
Prior defibrillator	77 (47.5)
Transvenous defibrillator	16 (9.9)
Subcutaneous defibrillator	69 (42.6)

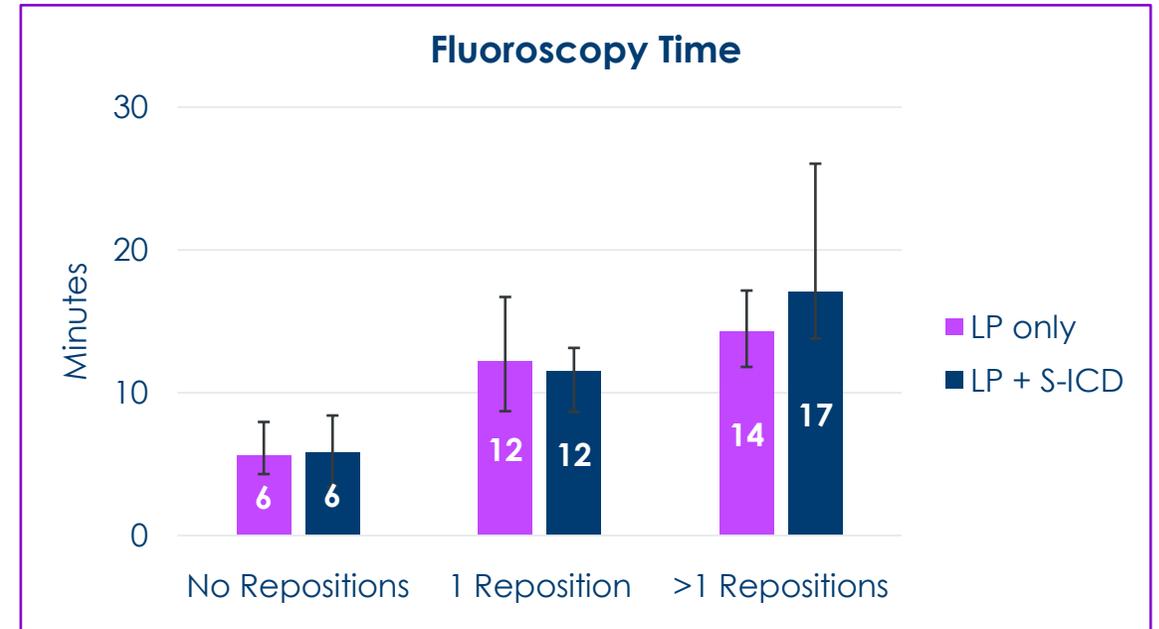
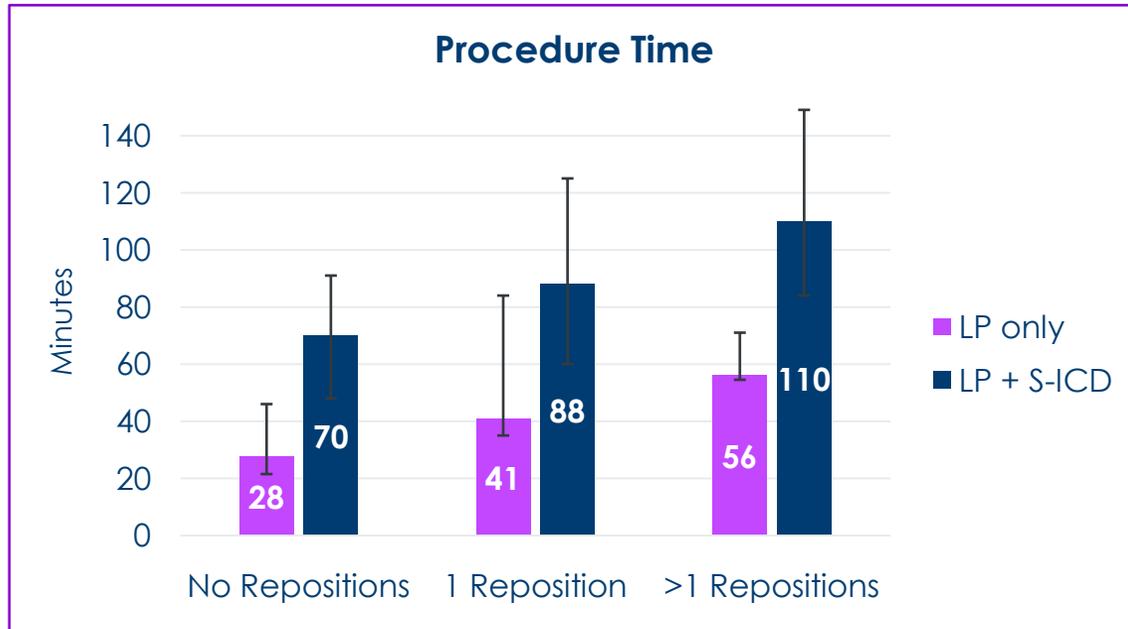


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MODULAR ATP Trial: Procedure and fluoroscopy times



Median procedure times⁸

- LP implant only = 35 min
- Dual de novo (S-ICD and LP) = 77 min

Median fluoroscopy times⁸

- LP implant only = 6.7 min
- Dual de novo (S-ICD and LP) = 6.8 min



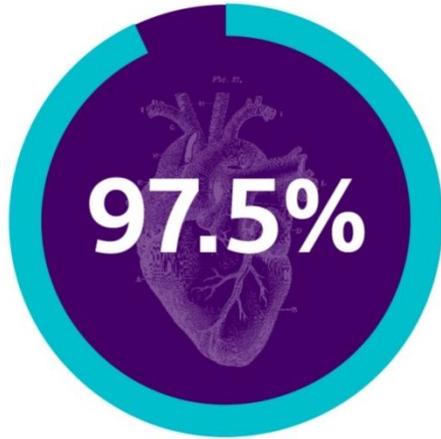
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MODULAR ATP Trial: Major LP Complication-Free Rate

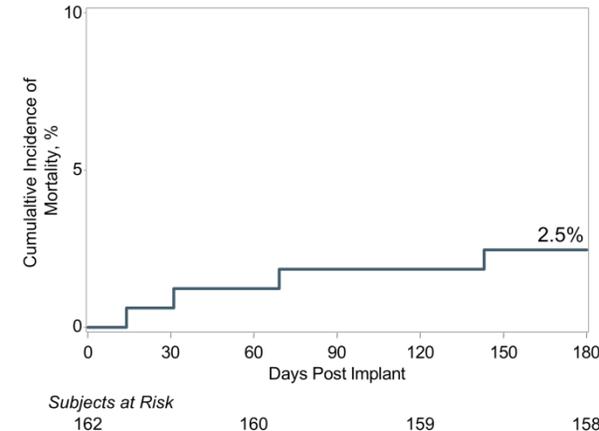
The EMPOWER System demonstrated a major complication-free rate (CFR) of 97.5%⁷ (n=162)



	6-month complication free rate
Nanostim	93.3% ⁹
Micra	96.0% ¹⁰

- EMPOWER's 6-month CFR are comparable to 6-month CFR of other LP systems

- Major LP-related complications⁷
 - 2: Myocardial perforation with tamponade
 - 1: Adverse reaction - vasovagal syncope – procedure
 - 1: LP inadvertently implanted in the left ventricle via interatrial septum
- 2 retrievals post implant⁷
 - Patient developed heart block
 - LP inadvertently implanted in LV
- Mortality risk: 2.5% (Kaplan-Meier)
 - 4 deaths** in first 6 months
- No deaths were device or procedure-related⁷



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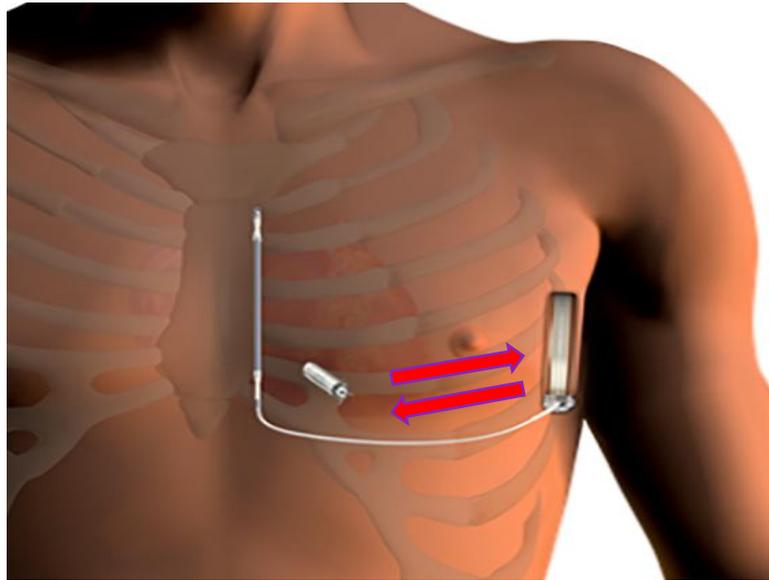
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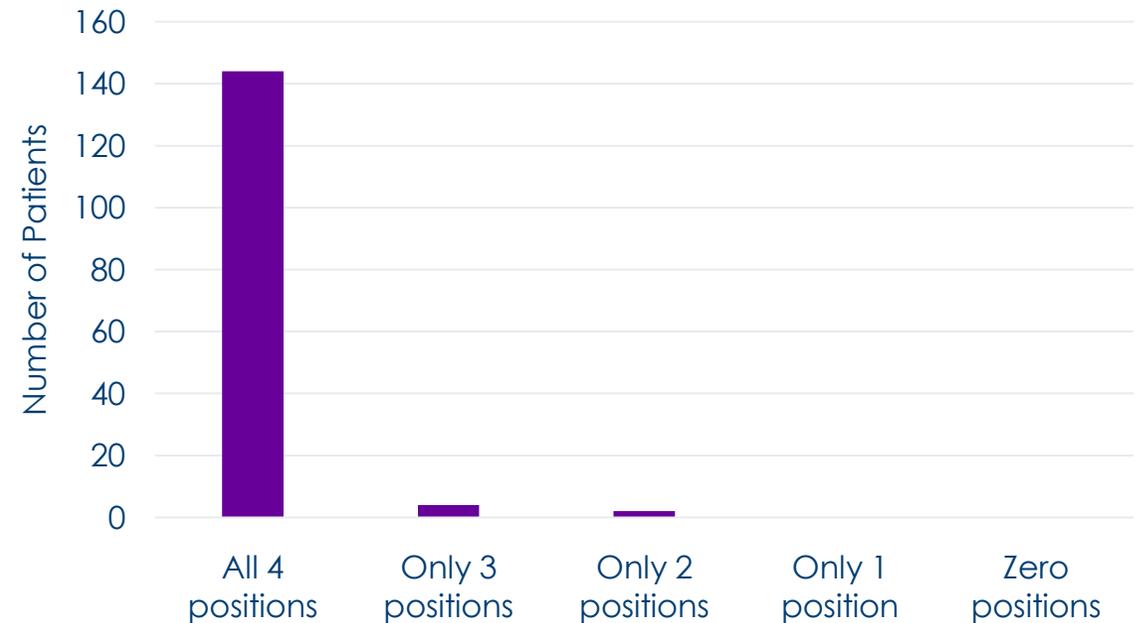
MODULAR ATP Trial: Communication success

S-ICD and EMPOWER LP

Communication success rate
98.8% between the EMBLEM S-ICD and
EMPOWER LP



Communication Success Across Patients (n=150**)7



No patient experienced a failure of therapy delivery due to device communication failure.



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MODULAR ATP Trial: *Pacing Capture Threshold*

97.4% of patients experienced PCTs ≤ 2.0 volts (0.4 ms pulse width)⁷ (n=151)



- EMPOWER LP PCTs across patients in the 6-month endpoint cohort were 0.56 ± 0.49 V
- EMPOWER LP's 6-month PCT was similar to 6-month PCTs from other LP systems

	6-month PCT
Nanostim*	88% ⁹
Micra**	98.3% ¹⁰

* Nanostim PCT endpoint⁹: $< 2.0V$ at 0.5 ms and R-wave $> 5mV$

** Micra PCT endpoint¹⁰: ≤ 2.0 V at a pulse width of 0.24 msec and an increase of ≤ 1.5 V from the time of implantation



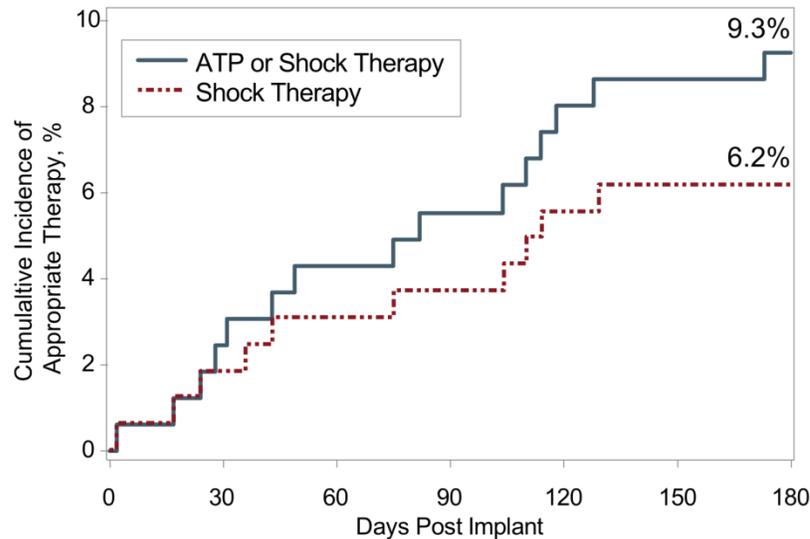
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Successful ATP therapy: 61.3%

- ATP delivered in 31 episodes in 13 patients⁷
- Appropriate therapy rate⁷ = 9.3%
- Appropriate shock rate⁷ = 6.2%



Subjects at Risk

ATP or Shock Therapy	162	155	148	145
Shock Therapy	162	157	152	150

- ATP accelerated arrhythmia in 3 episodes⁷
- Episodes post ATP failure⁷:
 - Terminated by shock (9 episodes from 4 patients)
 - Self-terminated (after 2 ATP bursts (1 episode))
 - Arrhythmia stabilized to a rate below the conditional zone (2 episodes from 2 patients)
- ATP therapy provided by EMPOWER was similar to ATP success rates in other large ICD trials (46 – 72%) and similar to the EV ICD (70%)
 - However, the ATP or pause prevention pacing in the EVI ICD caused pain or discomfort in some patients, leading to the therapy being turned off or the device explanted.



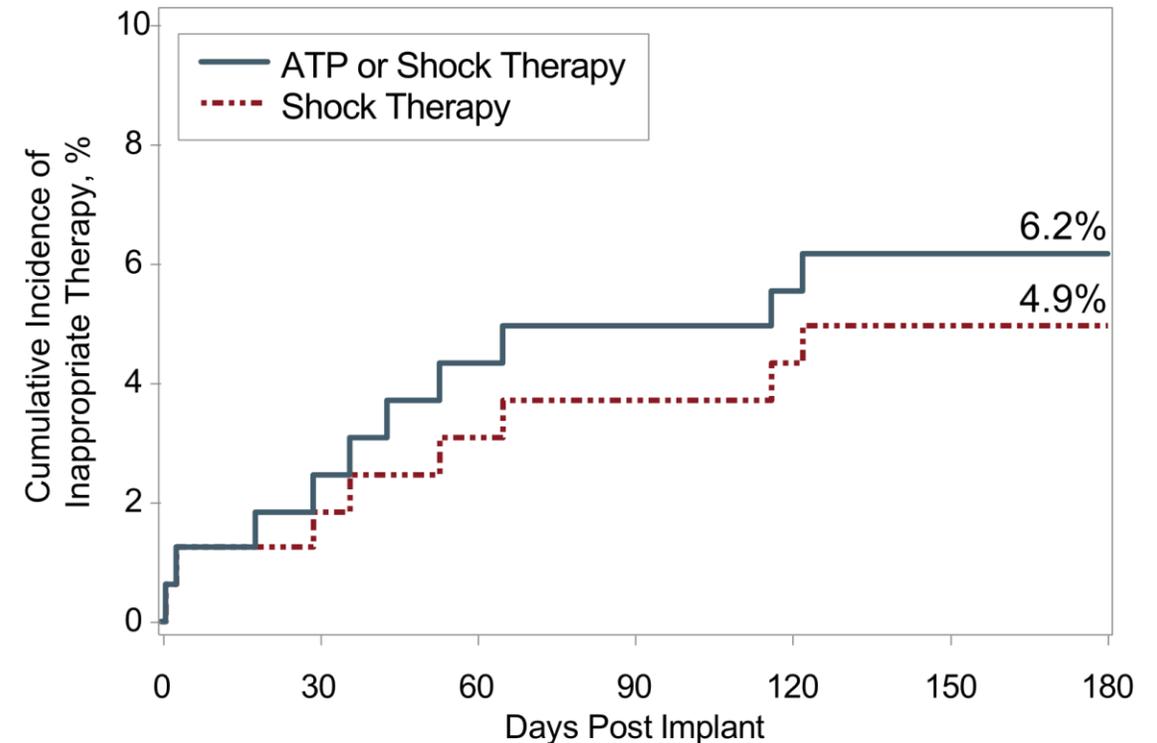
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Inappropriate shock and therapy

- Inappropriate therapy occurred in 14 patients with 36 episodes.
 - 67% of the episodes were cardiac oversensing of slow VT
- Risk of inappropriate therapy = 6.2%
- Risk of inappropriate shock = 4.9%
- Most inappropriate shocks were delivered to slower ventricular arrhythmias, this finding may be attributable to patient selection and device programming.
- No inappropriate episodes due to oversensing of pacing.
- At 6 months, the substernal ICD experienced an inappropriate shock rate of 8.5%.



Subjects at Risk

	0	30	60	180
ATP or Shock Therapy	162	154	151	149
Shock Therapy	162	156	153	151

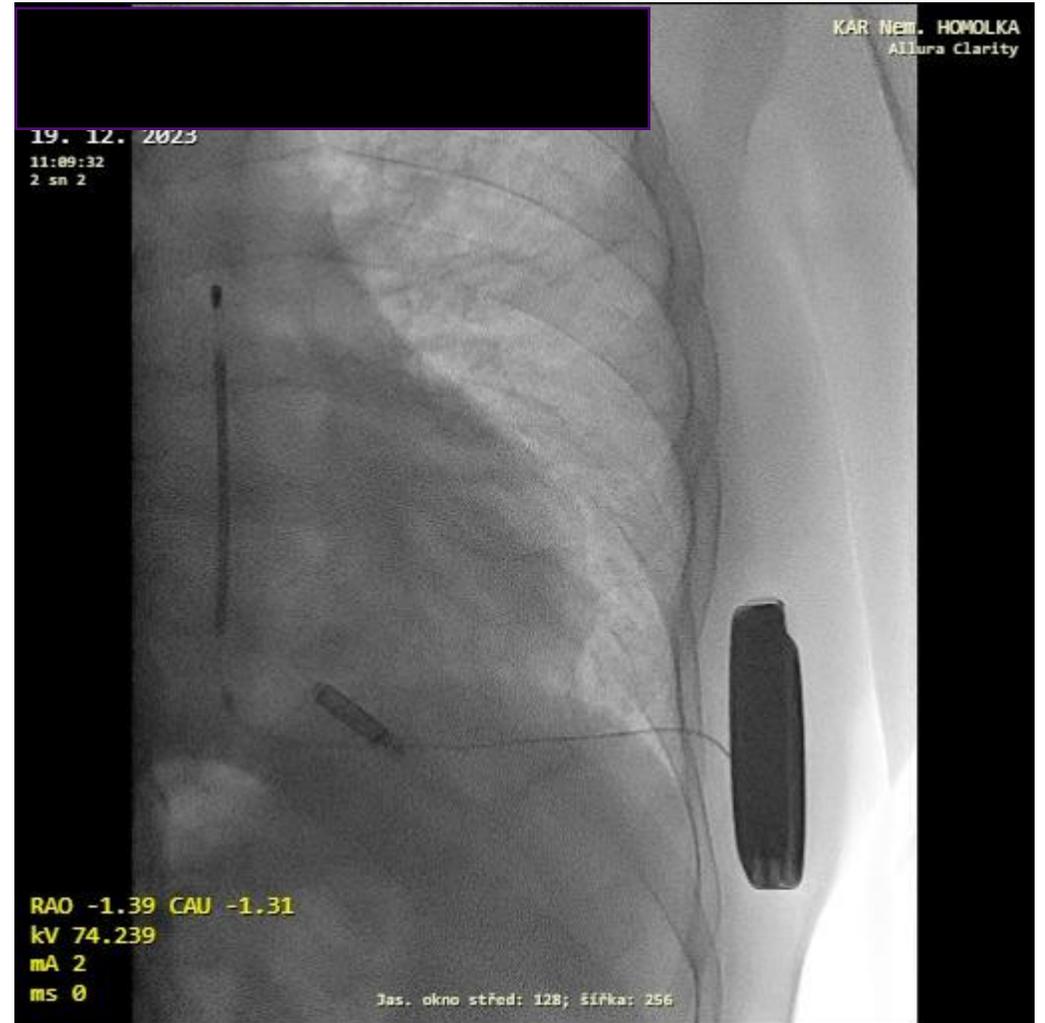
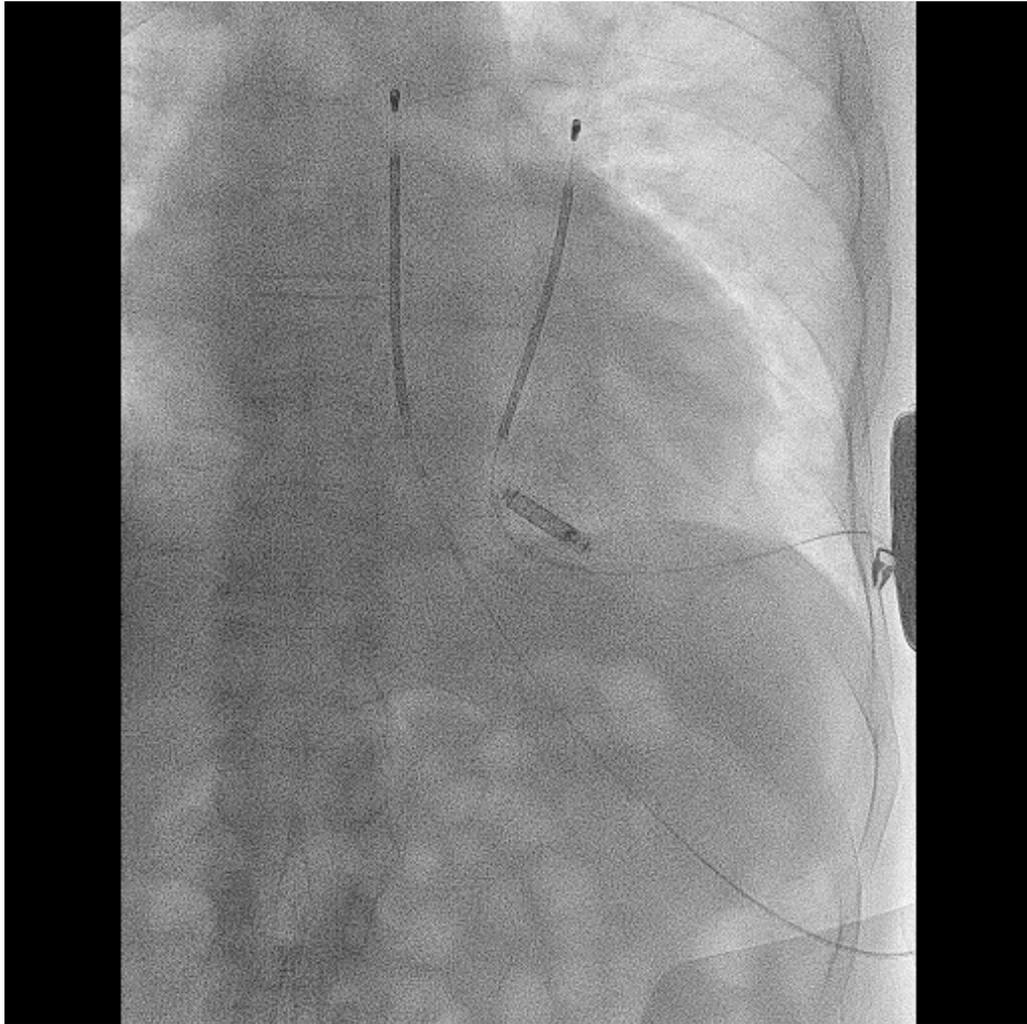


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Komunikace Leadless ATP & S-ICD: *Kazuistika*



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MODULAR ATP Trial: Conclusion

- The mCRM system achieved all pre-specified safety and effectiveness 6-month endpoints and the results demonstrated the safety profile of the EMPOWER LP system.
- The EMPOWER LP's complication free rate of **97.5%** is comparable to complication free rates of other LP systems.
- The communication success rate was **98.8%** between the S-ICD and EMPOWER LP.
- Almost all patients (**97.4%**) had a low and stable PCT (≤ 2.0 volts) and is similar to other LP systems. No late repositions or retrievals for PCT were necessary.



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CAUTION:

The law restricts these devices to sale by or on the order of a physician. Indications, contraindications, warnings, and instructions for use can be found in the product labelling supplied with each device or at www.IFU-BSCI.com Products shown for INFORMATION purposes only and may not be approved or for sale in certain countries. This material not intended for use in France.

mRCM™ System – designed for the future of personalized patient care

- Upon the EMPOWER™ Leadless Pacemaker* and mCRM system* receiving FDA approval, EMPOWER will be the first and only LP designed to be a standalone VVIR pacemaker** that is compatible with all existing EMBLEM™ S-ICD devices as part of the mCRM system.¹
- Will provide an upgrade pathway to patients with an EMBLEM S-ICD who develop a need for ATP or VVIR pacing.¹
- Designed to deliver painless intracardiac ATP and/or brady pacing.^{1,7}
- Designed to provide upgrade pathways regardless if the EMBLEM S-ICD or EMPOWER LP is implanted first.¹



* Caution: Investigational Device. Limited by US law to investigational use only. Not available for sale.

** Rate-response results will be reported in a future publication.

Practical implications of MODULAR & APPRAISE ATP Trials¹⁵

“Together, data from the MODULAR ATP and APPRAISE ATP trials reinforce the promise of the groundbreaking mCRM System, illustrating a clear path forward for physicians to offer therapies that prevent sudden cardiac death and deliver ATP for the small number of patients who benefit from it.”

“Instead of subjecting all patients to the risks of more invasive approaches, such as placing leads in the heart or tunneling them under the sternum to provide therapies they might not require, these data indicate physicians may have the opportunity to tailor therapy to the patient’s individual needs and health.”

- Ken Stein MD, Global Chief Medical Officer BSC

References

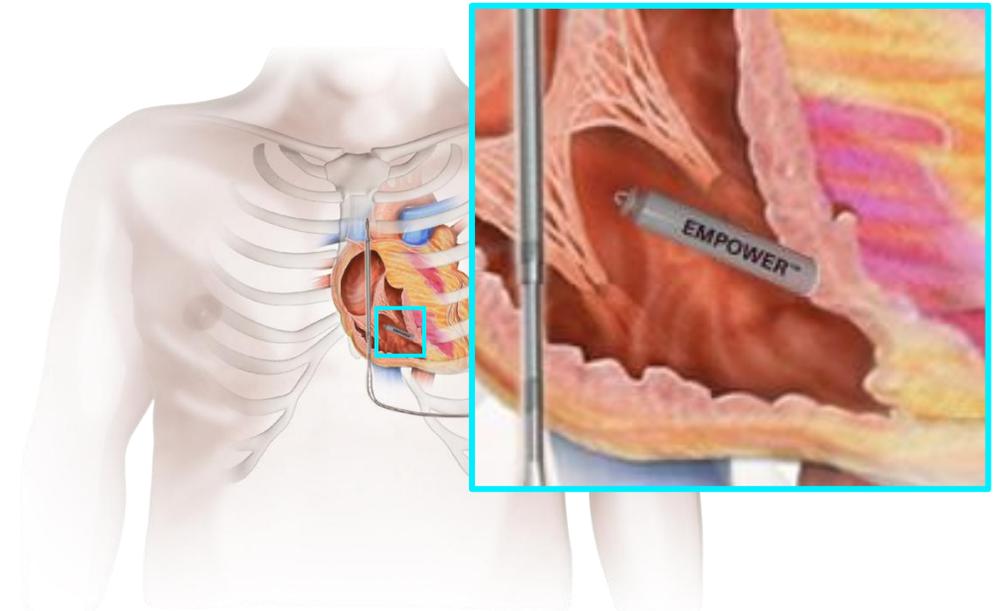
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The EMPOWER LP delivers painless intracardiac ATP⁷

- The EMPOWER LP is designed to deliver intracardiac ATP and brady pacing therapy that should not lead to pain or discomfort, in contrast to extracardiac pacing.^{7,13}

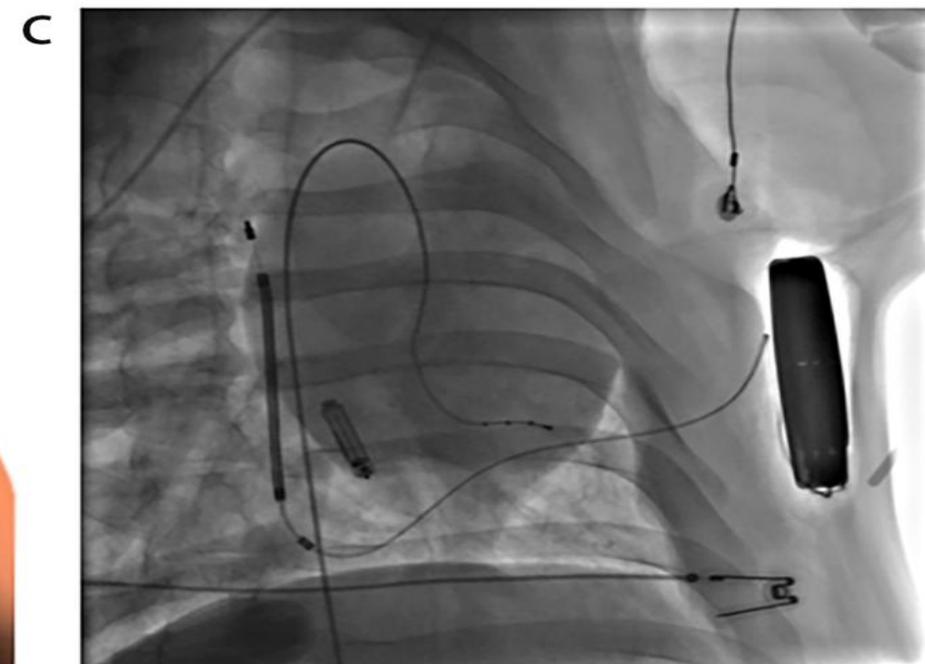
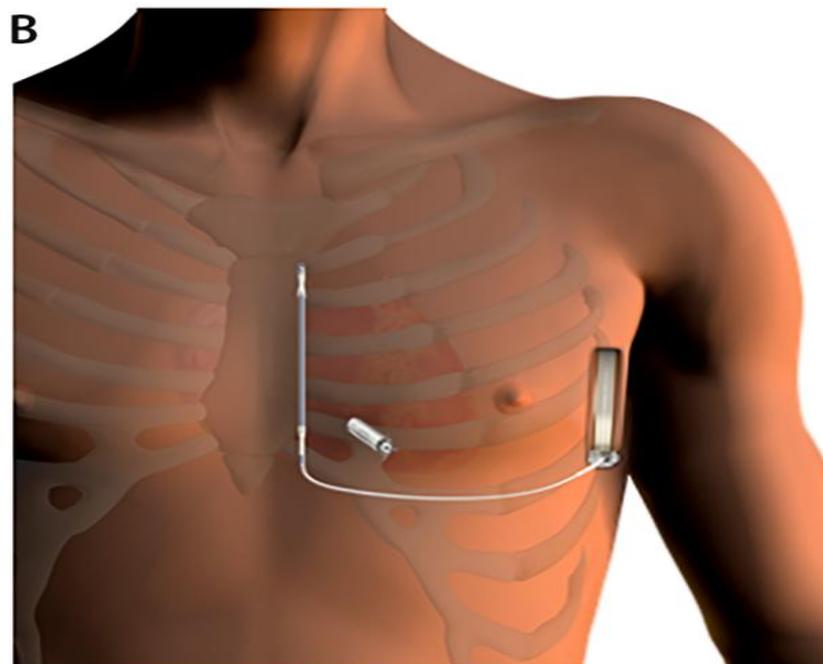
No patient in the 6-month endpoint cohort⁷:

- Reported pain or discomfort during communication or ATP therapy from the LP.
- Requested LP therapy be turned off for any reason.



Komunikace Leadless ATP & S-ICD: *Preklinický model*

Koncept: Leadless Systém umožňuje brady pacing, ATP a defibrilaci



Komunikace Leadless ATP & S-ICD:

Kazuistika

- Muž, 61 let
- ICHS (st.p. NSTEMI spodní stěny s dPCI ACD a RMS + 2x BSM 11/2006)
- Chronické srdeční selhání HFrEF (EF LK 20 %)
- V roce 2007 implantován transvenózní ICD v rámci sekundární prevence NSS
- Opakované infekční komplikace
- Leden 2022 extrakce původního ICD včetně elektrod
- **Únor 2022 - Implantace S-ICD - Boston Scientific EMBLEM MRI**

Komunikace Leadless ATP & S-ICD:

Kazuistika

- **Od první implantace ICD v roce 2007 zaznamenáno 90 incesantních epizod setrvalé KT**
 - **Leden 2017 - Katetrizační RF ablace arytmogenního substrátu LK**
 - **Pouze jediná epizoda setrvalé KT v únoru 2022 : Ukončena 1. výbojem S-ICD**
 - Středně významná mitrální regurgitace (konzervativní postup)
 - Arteriální hypertenze
 - Hyperlipoproteinemie
 - Diabetes mellitus 2. typu na PAD
 - Amauróza levého oka, revmatoidní artritida
- **Prosinec 2023 implantace LCP EMPOWER (BSCI) v režimu VVICD**
Klinická studie: MODULAR ATP

Komunikace Leadless ATP & S-ICD:

Kazuistika



SUMMARY REPORT

Report Printed: 01/02/2024 3:53 pm
 Programmer Software Version: 1.04
 Device Software Version: 3.2.662

Patient Name: 0492MA555
 Last Follow-up Date: 12/19/2023
 Follow-up Date: 01/02/2024
 Implant Date: 01/25/2022

Device Model#: A219 EMBLEM™ MRI S-ICD
 Device Serial#: 143993
 Electrode Model#: 3501
 Electrode Serial#: 200119
 Pacemaker Model/Serial#: B170/151351

Programmable Parameters

Current Device Settings

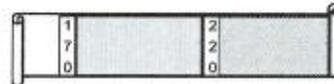
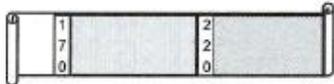
Therapy: ON
 Shock Zone: 220 bpm (ATP On)
 Conditional Shock Zone: 170 bpm (ATP x2)
 Post Shock Pacing: OFF
 SMART Pass: OFF

Gain Setting: 1X
 Sensing Configuration: Secondary
 Shock Polarity: REV

Initial Device Settings

Therapy: ON
 Shock Zone: 220 bpm (ATP On)
 Conditional Shock Zone: 170 bpm (ATP x2)
 Post Shock Pacing: OFF
 SMART Pass: OFF

Gain Setting: 1X
 Sensing Configuration: Secondary
 Shock Polarity: REV



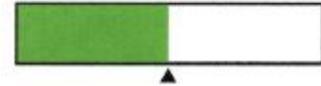
Parameter changes this session: NO

Episode Summary

Since Last Follow-Up
 Untreated Episodes: 0
 Treated Episodes: 14
 # of Shocks Delivered: 24
 # of ATPs Requested: 9

Since Implant
 Untreated Episodes: 0
 Treated Episodes: 15
 # of Shocks Delivered: 30
 # of ATPs Requested: 23

Battery Status



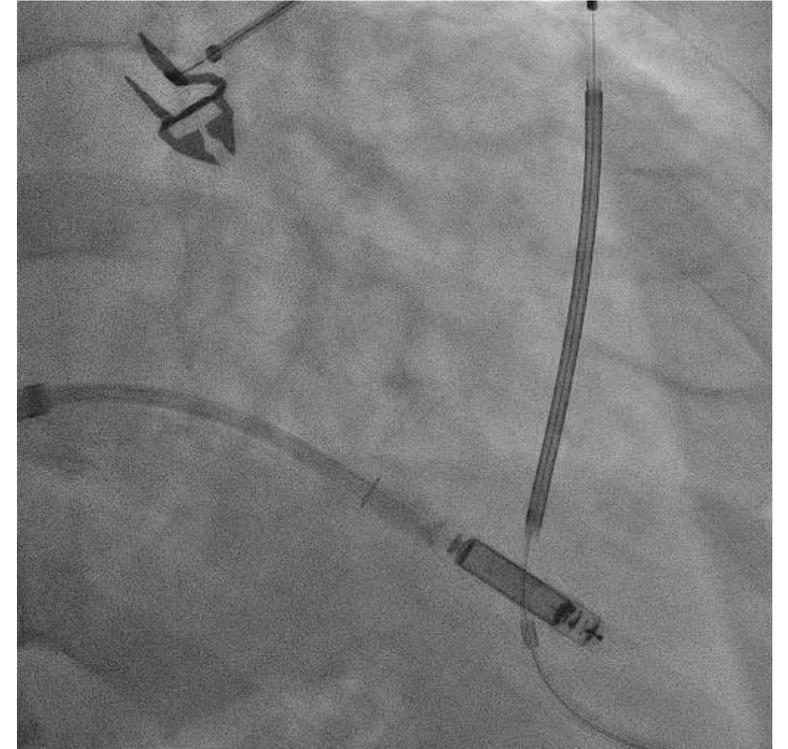
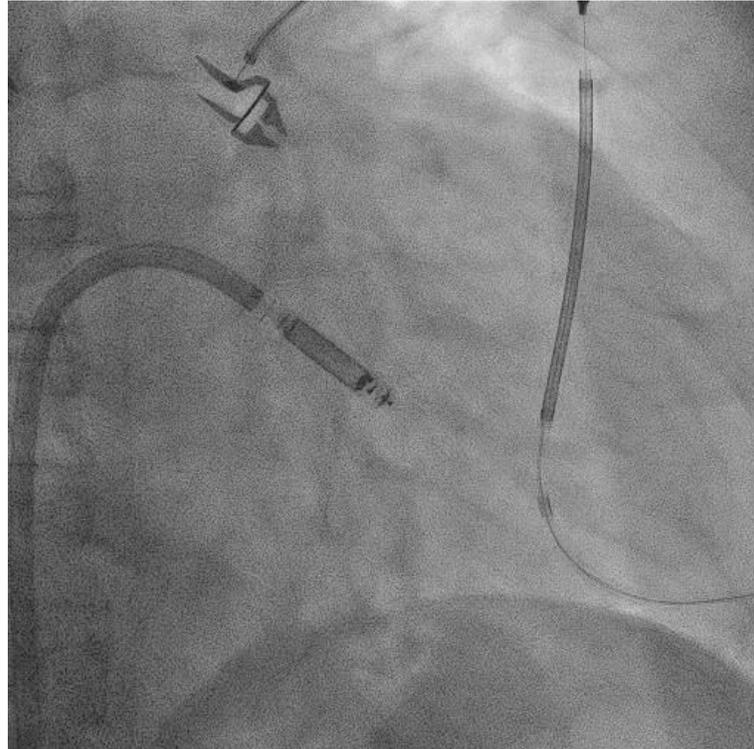
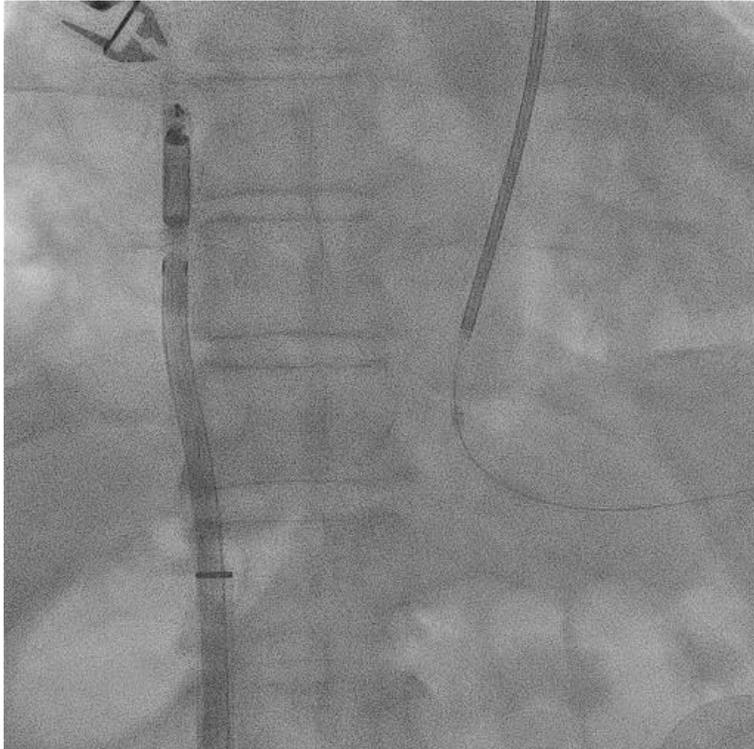
Remaining Battery Life to ERI: 43%

Electrode Impedance Status

 System Impedance = 210 Ohms

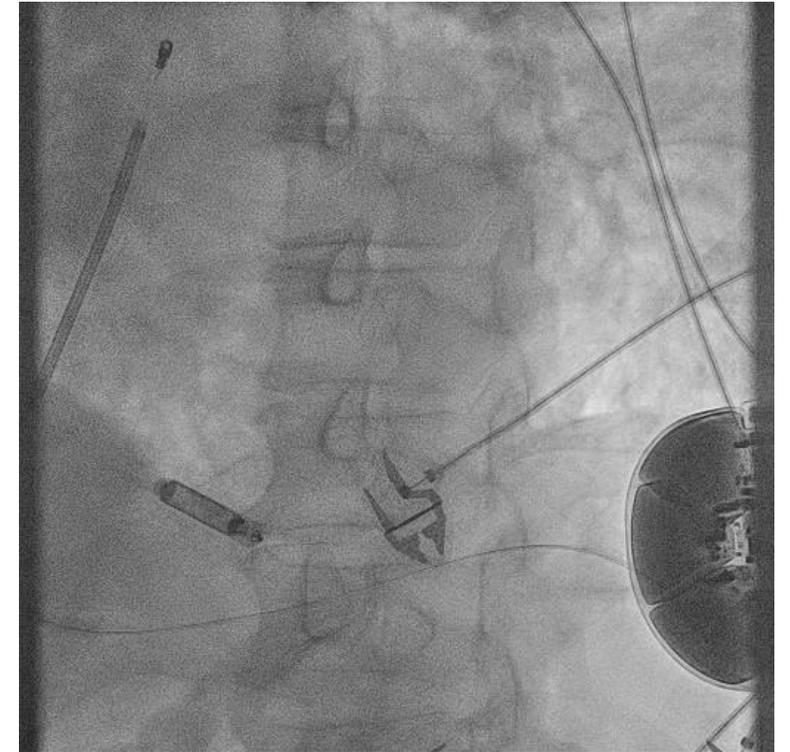
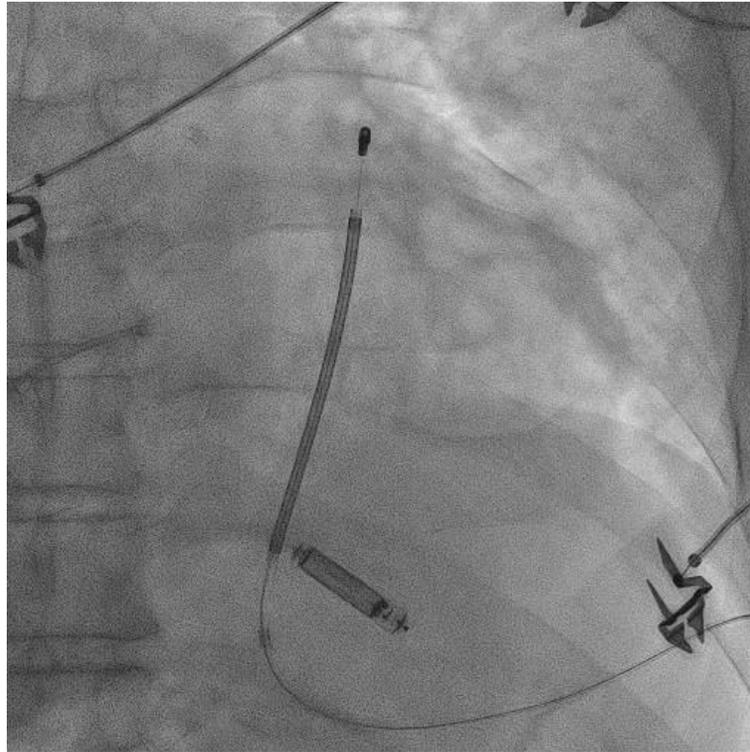
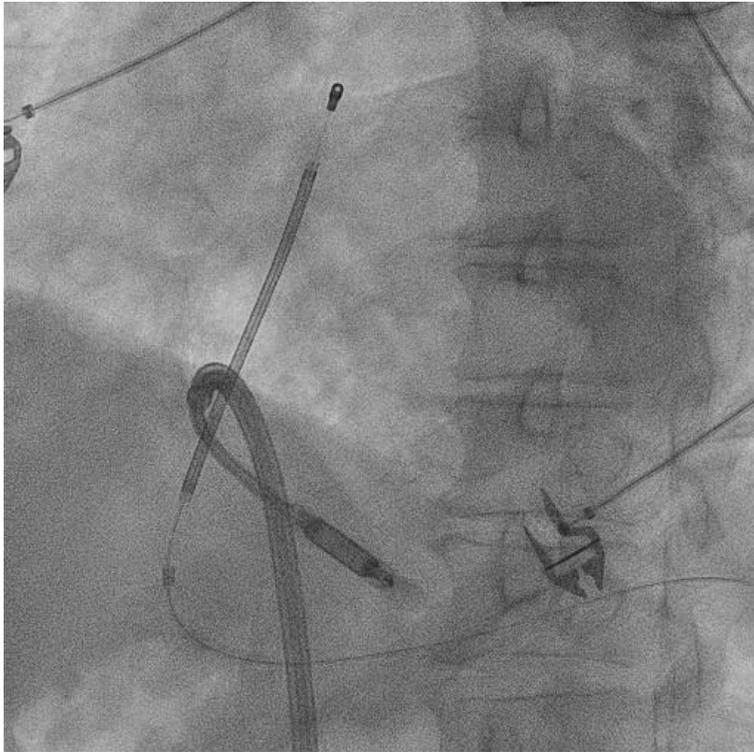
Komunikace Leadless ATP & S-ICD:

Kazuistika



Komunikace Leadless ATP & S-ICD:

Kazuistika



EMBLEM™ S-ICD Is Designed to be Compatible with the EMPOWER™ Leadless Pacemaker

TODAY'S S-ICD



FUTURE S-ICD Implantable Device Prototypes



The S-ICD you implant today is intended to be compatible with the EMPOWER™ leadless pacemaker, which will begin human trials in 2019.

EMPOWER™ Modular Pacing & ATP System
EMBLEM™ Family of S-ICDs