

Nové terapeutické strategie a technologické inovace u levostranných srdečních podpor

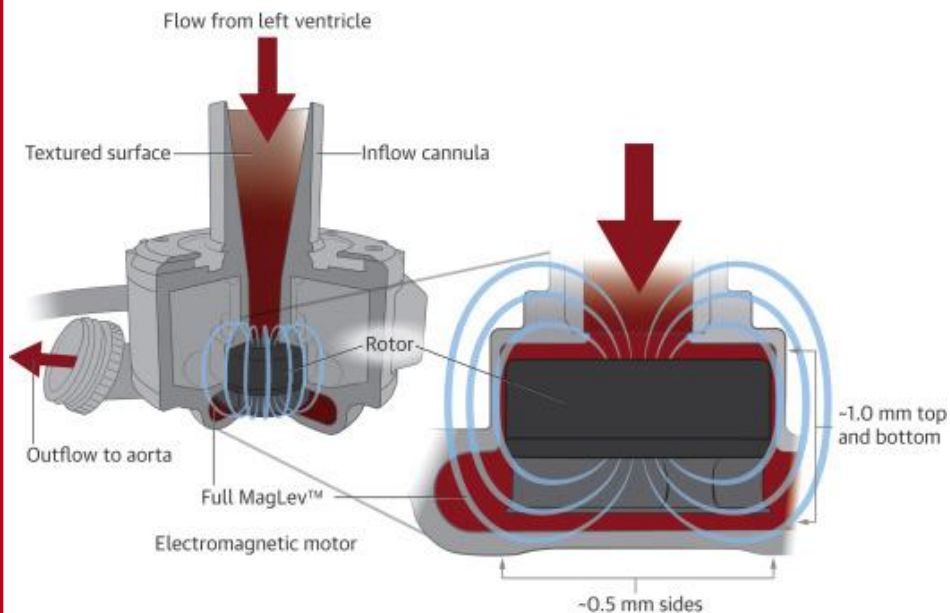
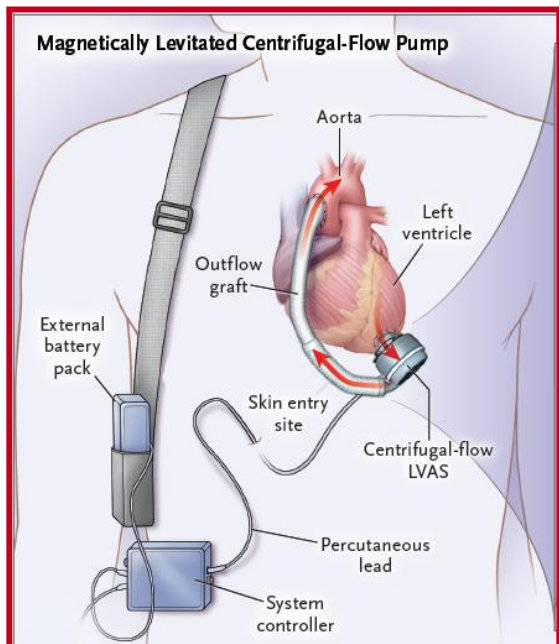
prof. MUDr. Ivan Netuka, Ph.D.

Klinika kardiovaskulární chirurgie

Institut klinické a experimentální medicíny, Praha



Nový technologický standard MSP



Klíčové atributy

Zvýšená "Tromboresistence"

- Eliminace trombozy čerpadla
- Snížení CMP



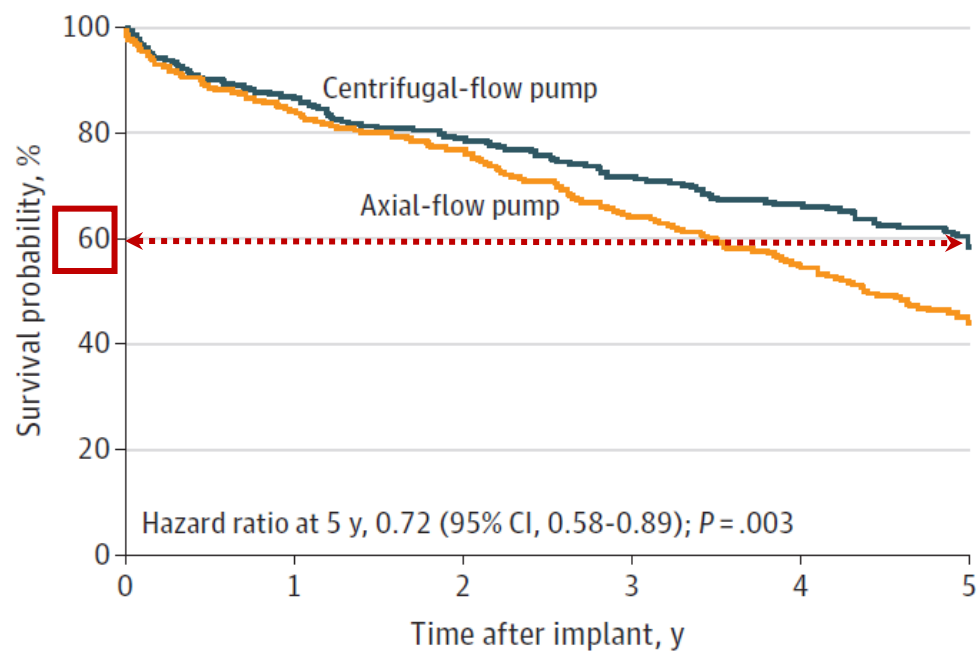
Zlepšení dlouhodobého přežívání

Netuka I. et al. *J Am Coll Cardiol.* 2015;66:2579-2589.

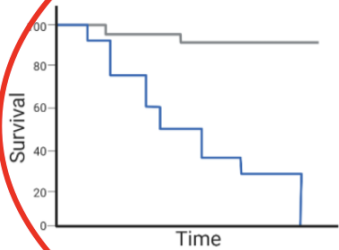
Mehra MR. et al. *N Engl J Med.* 2019;380:1618-1627.

Five-Year Outcomes in Patients With Fully Magnetically Levitated vs Axial-Flow Left Ventricular Assist Devices in the MOMENTUM 3 Randomized Trial

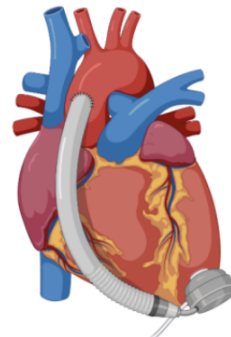
Mandeep R. Mehra, MD, MSc; Daniel J. Goldstein, MD; Joseph C. Cleveland, MD; Jennifer A. Cowger, MD, MS; Shelley Hall, MD; Christopher T. Salerno, MD; Yoshifumi Naka, MD, PhD; Douglas Horstmanshof, MD; Joyce Chuang, PhD; AiJia Wang, MPH; Nir Uriel, MD, MSc



EXPECTED OUTCOMES IN ADVANCED HF PATIENTS



- Median survival **<1 year** in those dependent on iv inotropic therapy
- Median survival **<2 years** in ambulatory advanced HF not yet on inotropes



LVAD THERAPY



LONG TERM BENEFITS OF LVAD THERAPY

SURVIVAL



Median survival of
5 years

FUNCTIONAL STATUS



- **NYHA class I-II** in 75-80% at 2 years
- **2.5 fold** improvement in 6MWD (to >300 meters at 2 years)

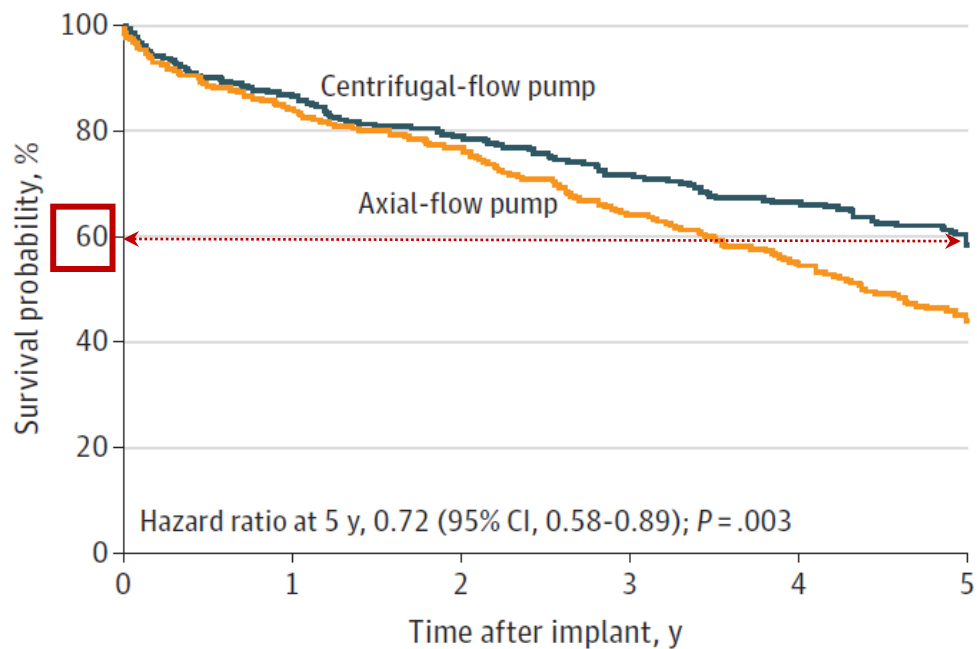
QUALITY OF LIFE



- **>75% increase** in KCCQ score (+30 points)

Five-Year Outcomes in Patients With Fully Magnetically Levitated vs Axial-Flow Left Ventricular Assist Devices in the MOMENTUM 3 Randomized Trial

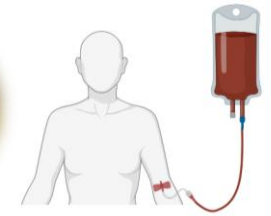
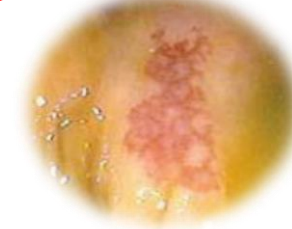
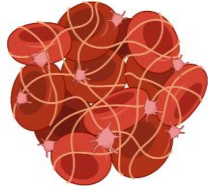
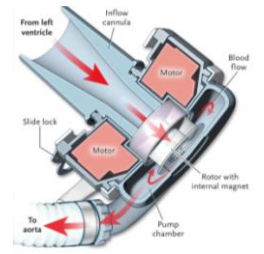
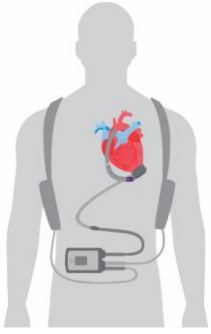
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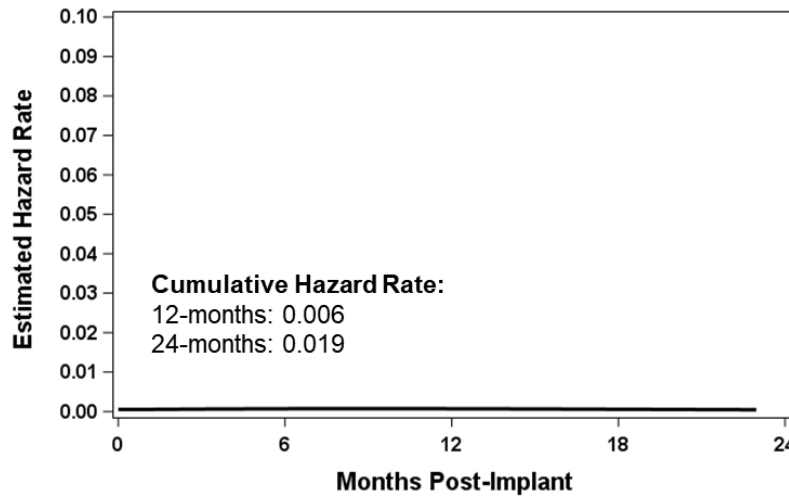
Cause of death	Difference, % (95% CI) % ^a	Hazard ratio (95% CI)	Favors centrifugal-flow pump	Favors axial-flow pump	P value ^b
Hemocompatibility-related event (device thrombosis, stroke, bleeding)	-6.8 (-10.0 to -3.6)	0.33 (0.20-0.55)	Yes	No	<.001
Heart failure	0.6 (-2.9 to 4.1)	1.01 (0.67-1.53)	No	No	.95
Infection	-0.1 (-2.8 to 2.6)	0.92 (0.54-1.59)	No	No	.77
Other ^c	0.0 (-4.1 to 4.0)	0.94 (0.66-1.33)	No	No	.72

0.2 1 2
Hazard ratio (95% CI)

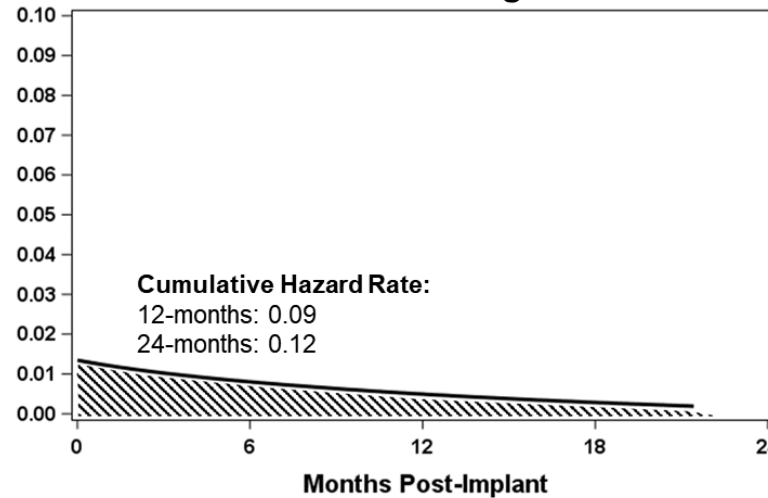
Hemokompatibilita současných MSP



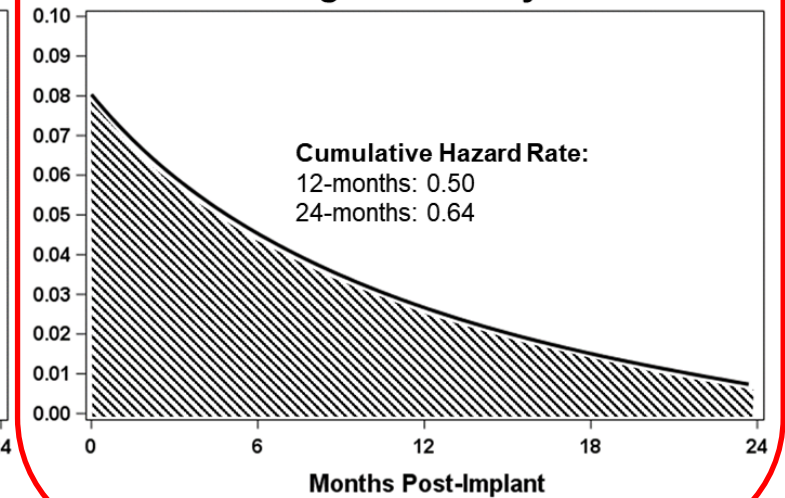
De Novo Pump Thrombosis



Ischemic or Hemorrhagic Stroke



Bleeding Due to Any Cause



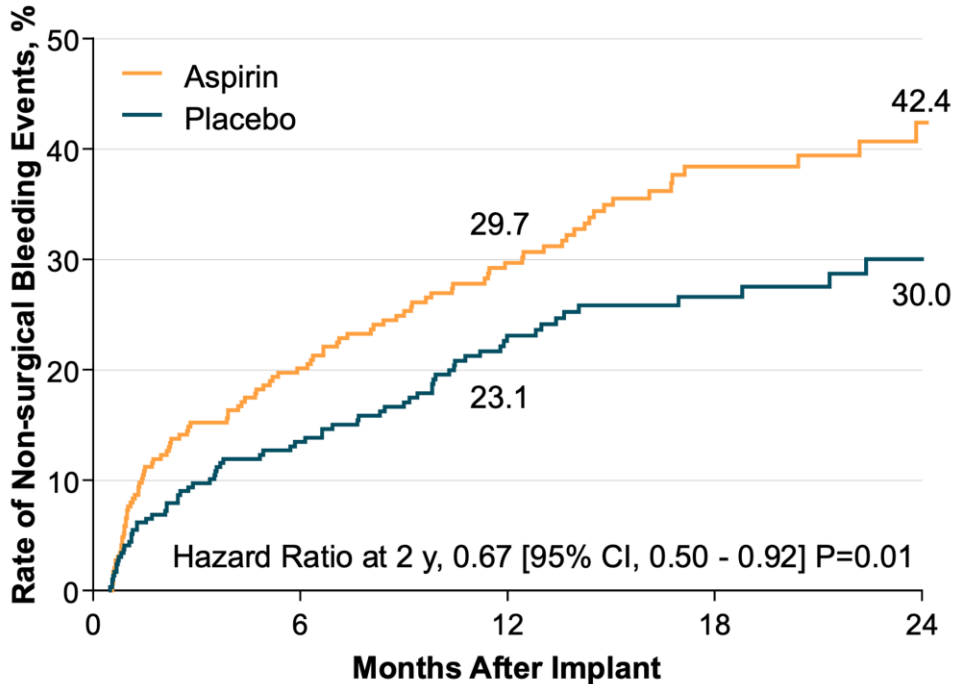
Opportunity to Reduce Residual Risk

Aspirin and Hemocompatibility Events With a Left Ventricular Assist Device in Advanced Heart Failure

The ARIES-HM3 Randomized Clinical Trial

Mandeep R. Mehra, MBBS, MSc; Ivan Netuka, MD, PhD; Nir Uriel, MD, MSc; Jason N. Katz, MD, MS; Francis D. Pagani, MD, PhD; Ulrich P. Jorde, MD; Finn Gustafsson, MD, PhD, DMSci; Jean M. Connors, MD; Peter Ivak, MD, PhD; Jennifer Cowger, MD, MS; John Ransom, MD; Aditya Bansal, MD; Koji Takeda, MD, PhD; Richa Agarwal, MD; Mirnela Byku, MD, PhD; Michael M. Givertz, MD; Abbas Bitar, MD; Shelley Hall, MD; Daniel Zimpfer, MD, PhD; J. David Vega, MD; Manreet K. Kanwar, MD; Omar Saeed, MD, MSc; Daniel J. Goldstein, MD; Rebecca Cogswell, MD; Farooq H. Sheikh, MD; Matthew Danter, MD; Yuriy Pya, MD, DMSc; Anita Phancao, MD; John Henderson, MS; Daniel L. Crandall, PhD; Kartik Sundareswaran, PhD; Edward Soltesz, MD; Jerry D. Estep, MD; for the ARIES-HM3 Investigators

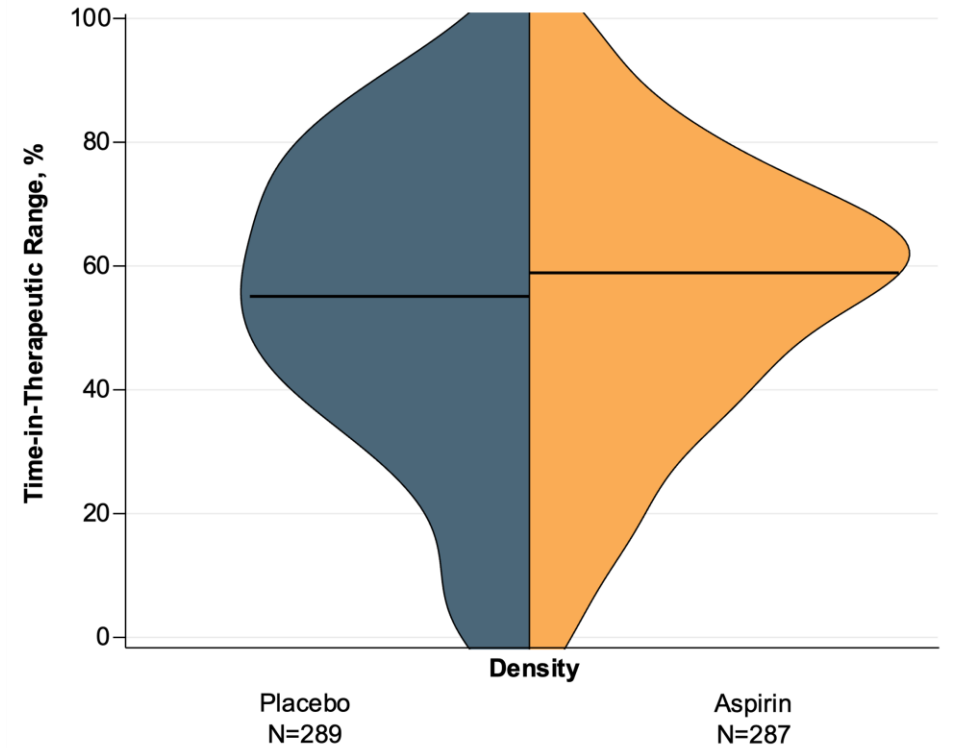
Rate of Non-surgical Bleeding Events



No. at Risk:

	0	6	12	18	24
Placebo	296	222	163	85	44
Aspirin	293	207	148	73	34

Vitamin-K Antagonist Management

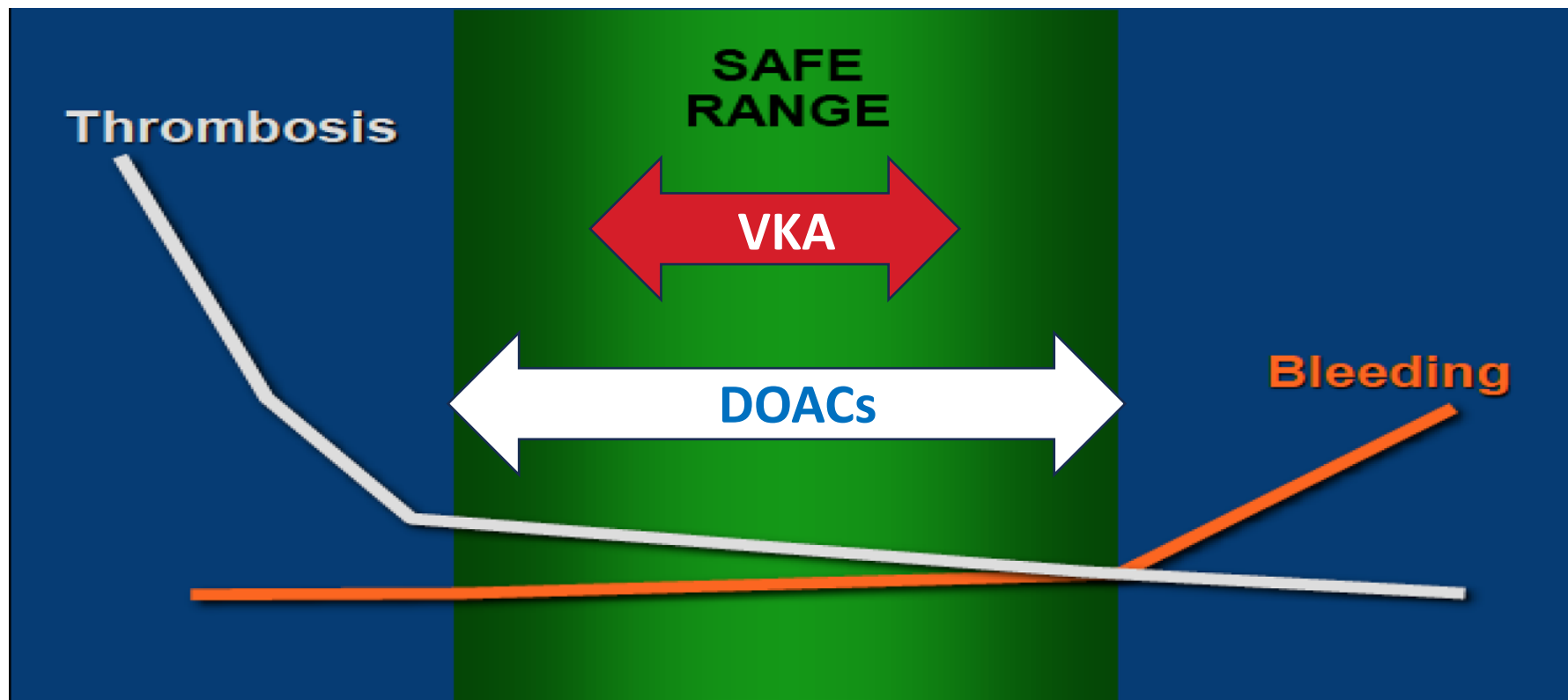


Target Therapeutic Range INR 2.0 - 3.0

Time in Therapeutic Range (TTR) 56%

Potenciál NOACs v terapii MSP

- Terapie warfarinem suboptimální a náročná na lidské zdroje
- Přímá antikoagulancia (NOACs) – alternativa s potenciálem lepší efektivity bez nutnosti monitorace a úprav dávkování



A Prospective Randomized Trial of Direct Oral Anticoagulant Therapy with A Fully Magnetically Levitated LVAD

The DOT-HM3 Study

Ivan Netuka, Zuzana Tucanova, Peter Ivak, Stanislav Gregor, Dushan M. Kolesar, Tomas Marek, Vojtech Melenovsky, Jana Binova, Zora Dorazilova, Marketa Hegarova, Martina Podolec, Hynek Riha MD, Jean M. Connors and Mandeep R. Mehra



Studie DOT-HM3

Design studie

- Prospektivní, unicentrická randomizovaná studie bezpečnosti apixabanu u pacientů s HeartMate 3 LVAS (*Clinical Trials.gov NCT04974684*)

Primární cíl

- Primární cíl bezpečnosti – přežití bez trombózy pumpy, CMP a závažného krvácení ve 3 měsících od randomizace
- Při absenci bezpečnostních nežádoucích příhod klinické zhodnocení v 6 měsících

Studie DOT-HM 3

HeartMate 3 LVAS



- INR 2.0-3.0 + ASA 100mg*



Entry Criteria

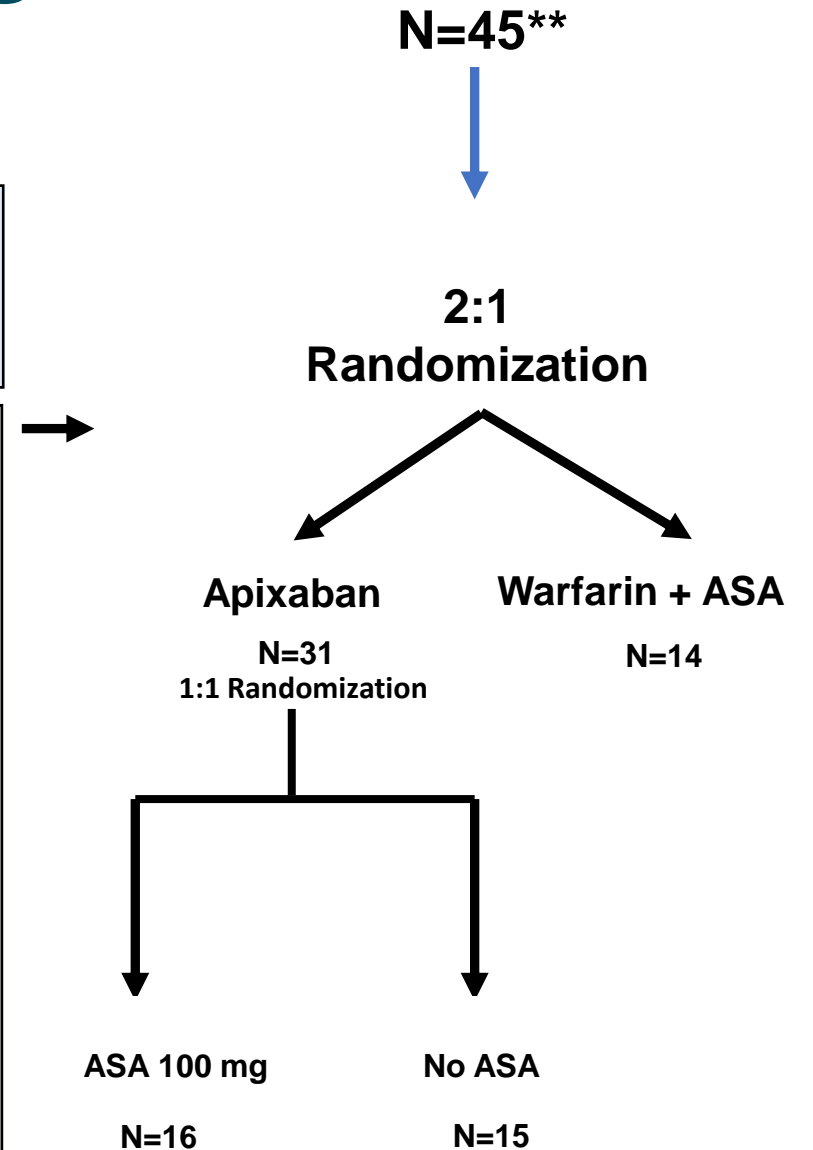
- Minimum 3 months post HeartMate 3 implant
- Stable, ambulatory and home discharged
- Consent provided

Key Exclusion Criteria

- Any Thromboembolism or Major Bleeding after implant
- Weight \leq 60 kgs. or age \geq 80 years
- Poor kidney function with serum creatinine \geq 221 μ mol/L or creatinine clearance $<$ 0.042 mL/s
- Mechanical valve or ancillary MCS
- Hemodynamically significant carotid stenosis
- Need for antiplatelet therapy for reasons other than LVAD therapy
- History of hyper-/hypo- coagulable disorder
- Aspirin or Apixaban hypersensitivity

*ARIES trial results unknown at inception of trial

**No study power assigned in this exploratory study and ITT principles used in describing outcomes



Klinické výsledky (6 měsíců)

CLINICAL OUTCOME (6-months)	APIXABAN + 100mg ASA N=15	APIXABAN Alone N=16	Warfarin + 100 mg ASA N=14
Cumulative Follow-up (pt/days)	2338	2656	2338
Primary outcome: Patient survival-free of pump thrombosis, disabling stroke, or major bleeding (HTx considered success and other withdrawal a failure)	13/15 (86.7%)	15/16 (93.7%)	12/14 (85.7%)
Individual Components			
Thromboembolism (pump malfunction, stroke or arterial thromboembolism) at 6 months	0	0	0
Major bleeding	1 (Gastrointestinal)	0	2* (uterine)
Withdrawals (without a primary event or transplantation)	1	1	1
Heart transplants	4	2	1

* 2 uterine bleeding events occurred in 1 patient (treated as a single count in the primary endpoint)



A Prospective Randomized Trial of Direct Oral Anticoagulant Therapy with A Fully Magnetically Levitated LVAD: The DOT-HM3 Study

Ivan Netuka, MD, PhD¹, Zuzana Tucanova, MD¹, Peter Ivak, MD, PhD¹, Stanislav Gregor, PharmD¹, Dushan Michael Kolesar, MD¹, Tomas Marek, MD¹, Vojtech Melenovsky, MD¹, Jana Binova, MD¹, Zora Dorazilova, MD¹, Marketa Hegarova, MD, PhD¹, Martina Podolec, MD¹, Hynek Riha MD, PhD¹, Jean M. Connors, MD², Mandeep R. Mehra, MD, MSc²

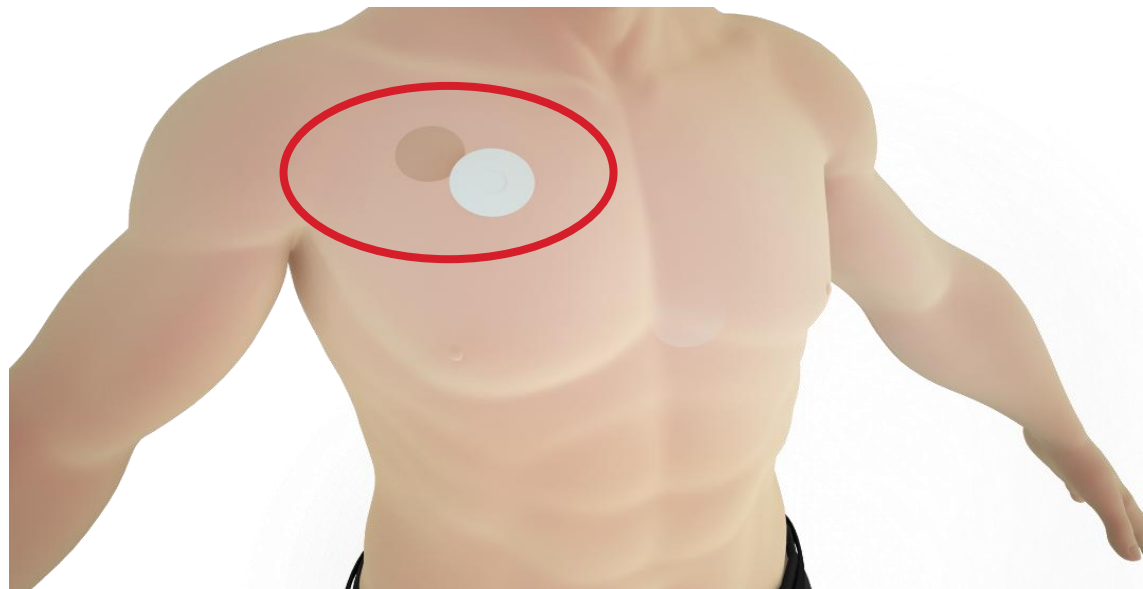
¹Institute for Clinical and Experimental Medicine, Prague, Czech Republic, ²Brigham and Women's Hospital and Harvard Medical School, Boston, MA

Infekce perkutánního vodiče a nároky na implantabilní MSP

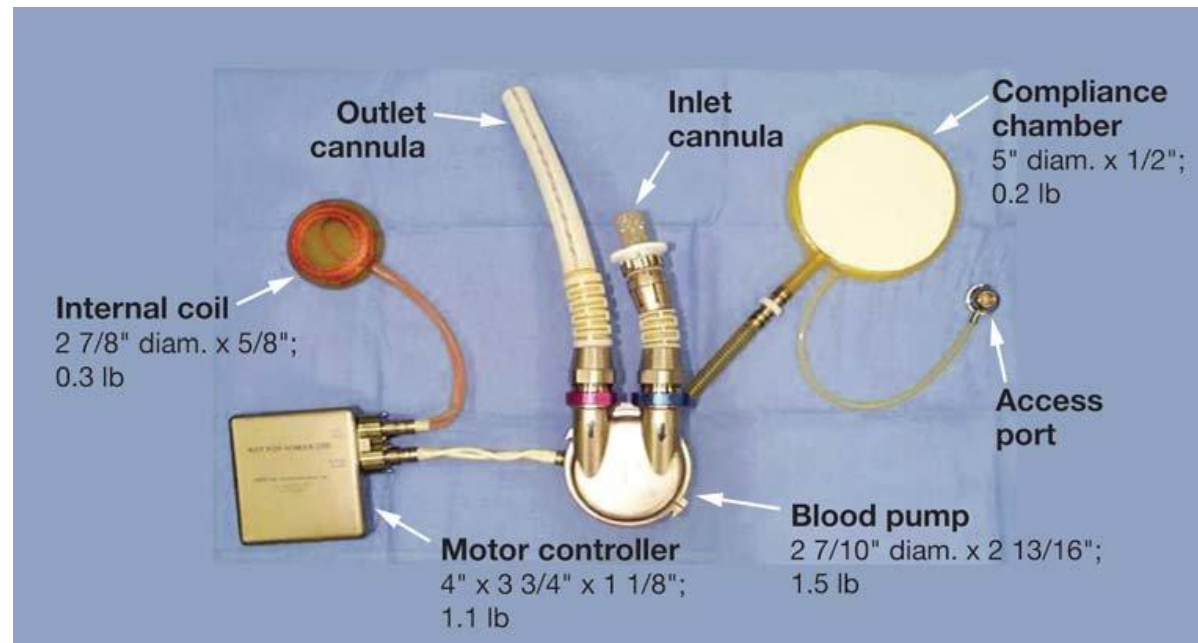


- **Prodloužené intervaly bez externích komponent**
- **Nízká frekvence alarmů**
- **Bez negativního vlivu na běžné aktivity**
- **Kompatibilita s aktivním životním stylem (sport a plavání)**

Transkutánní přenos energie - TET

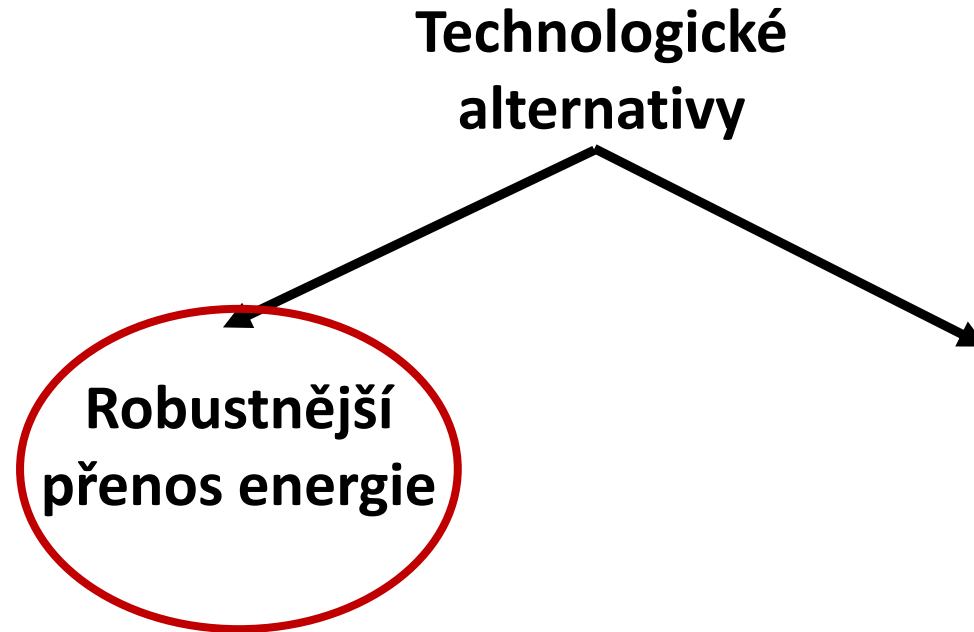


TET – “cívka na cívce”

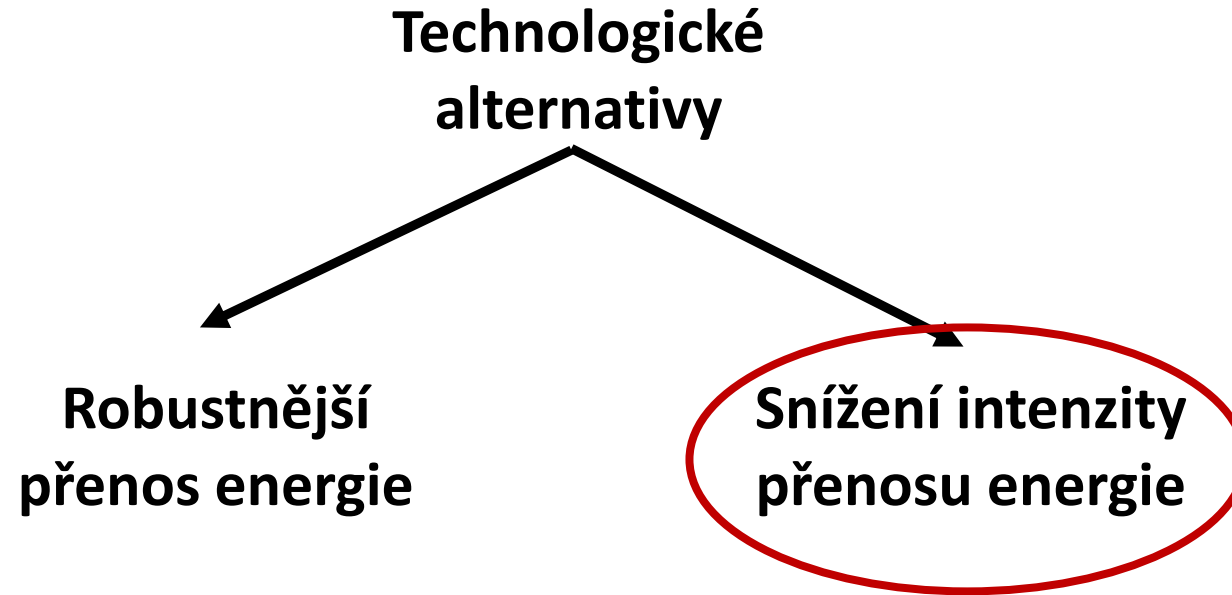


- Přehřívání externích i interních komponentů
- Malpozice cívek
- Časté alarmy
- Lokální bolestivost a otok tkání

Optimalizace transkutánního přenosu energie

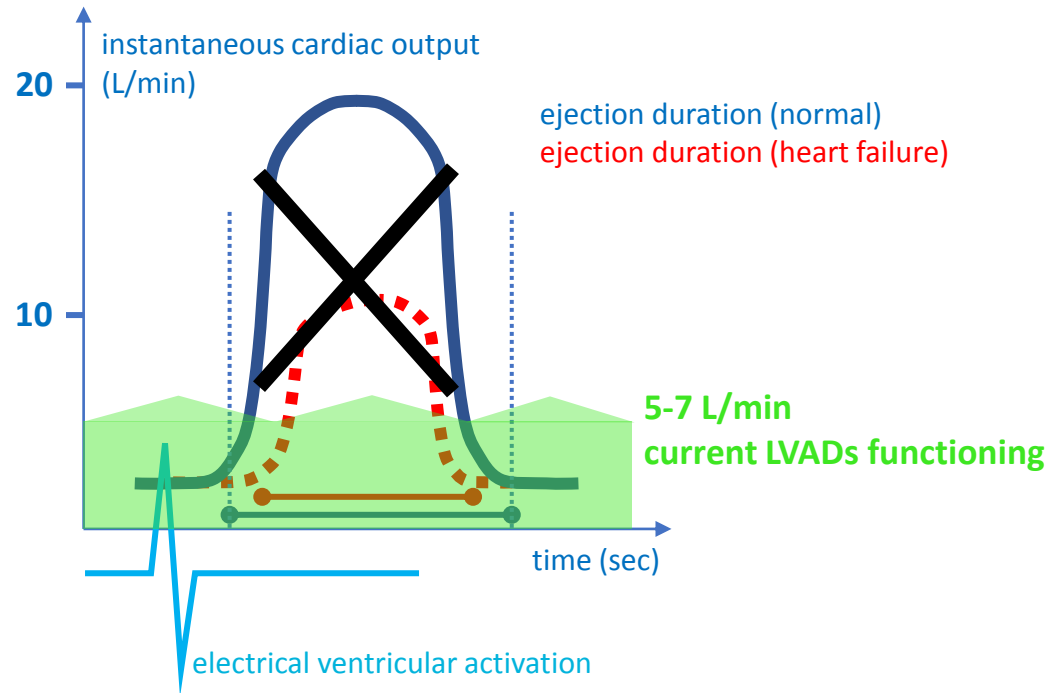


Optimalizace transkutánního přenosu energie



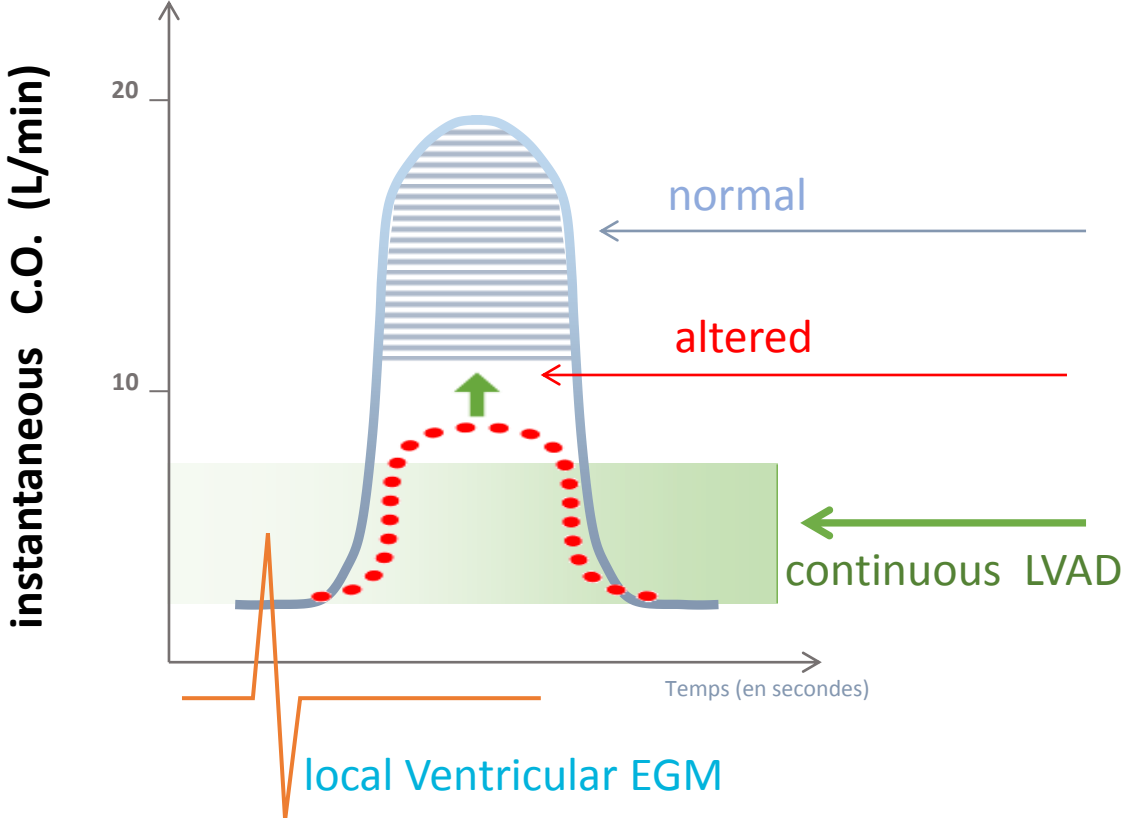
Konvenční MSP

Nepulsatilní nesynchronizované pumpy



FineHeart Flowmaker

CO – součet nativní a facilitované ejekce



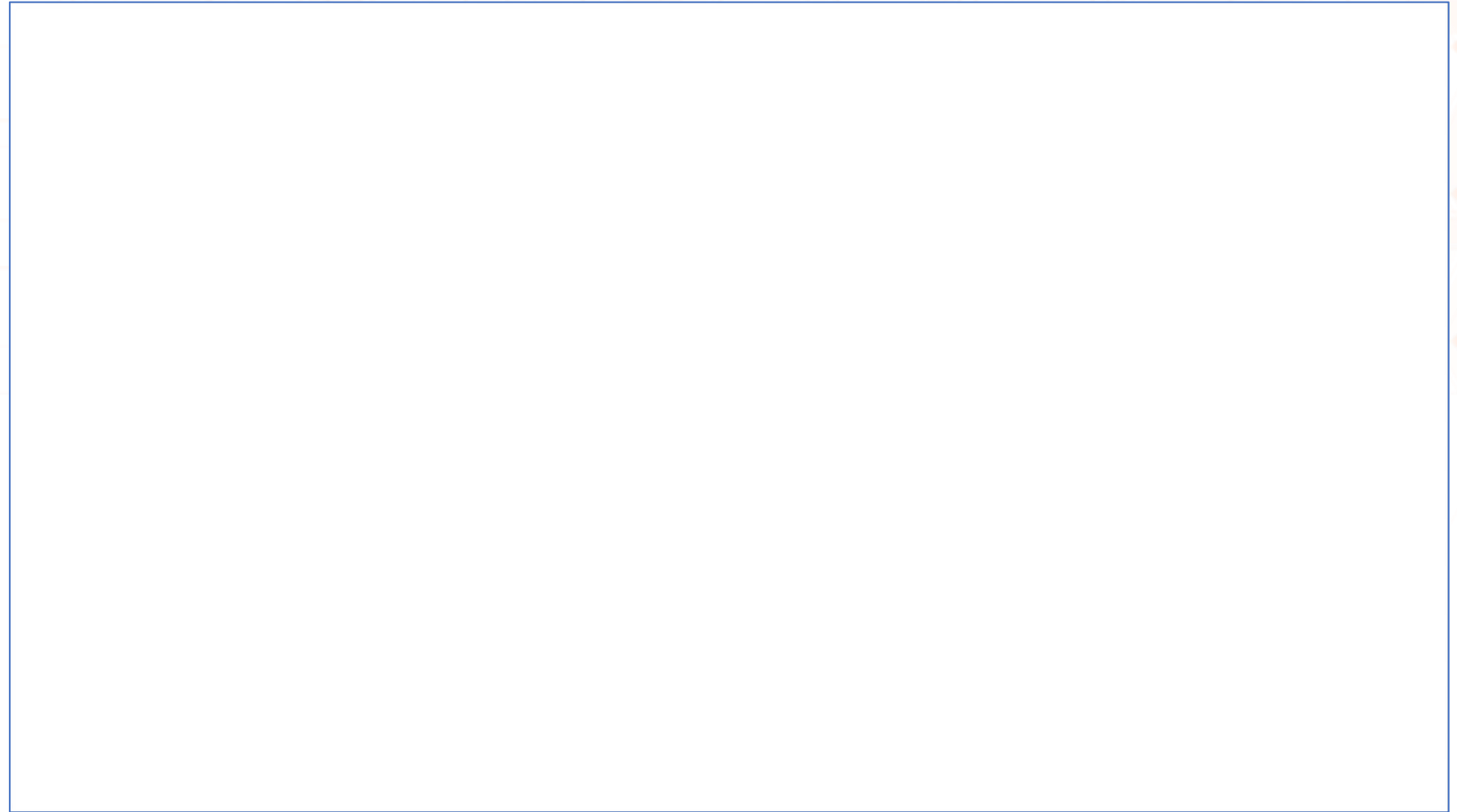
Implantace FineHeart Flowmaker - thorakotomie

FineHeart 

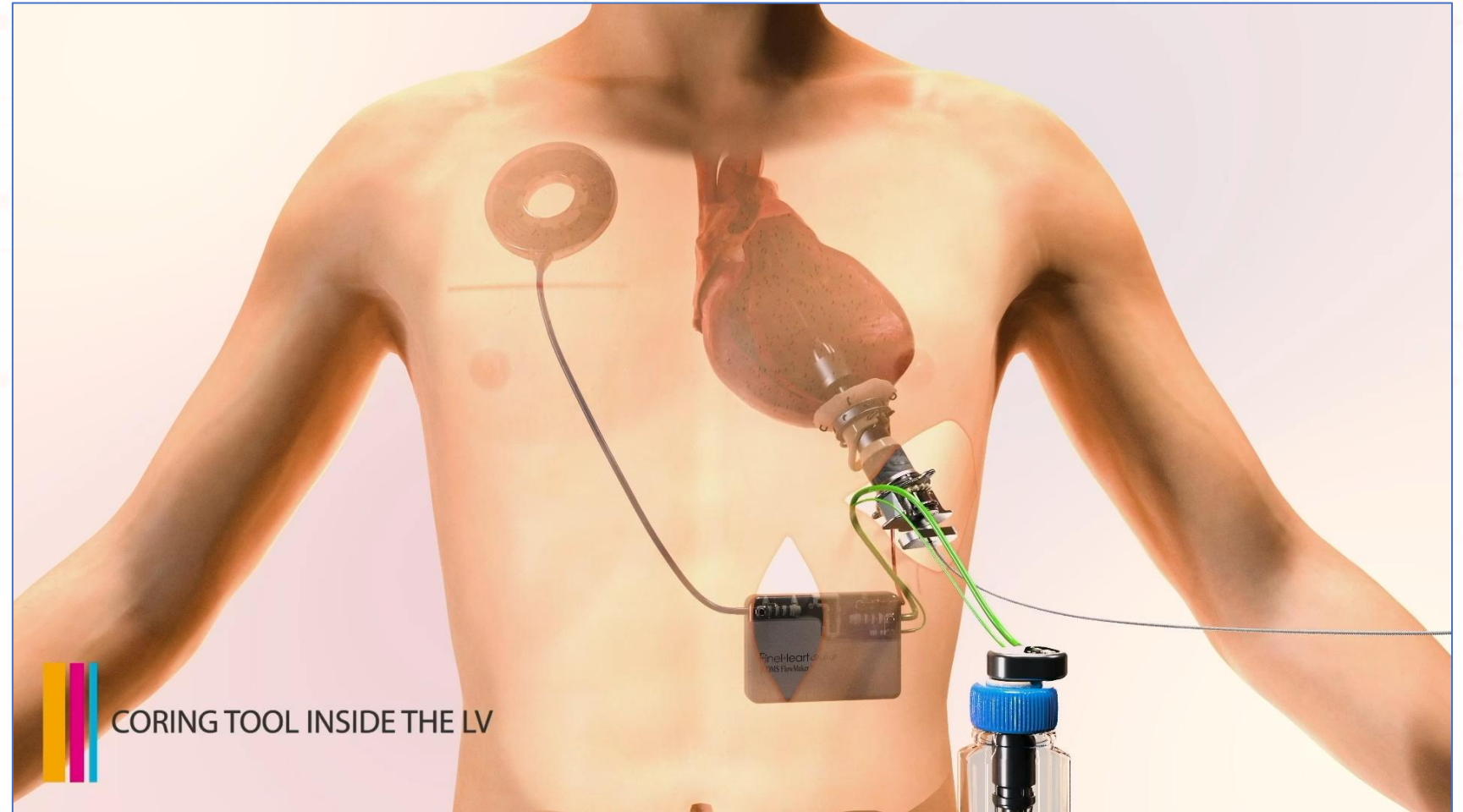
A healthier life with every beat

The ICOMS® | FLOWMAKER®

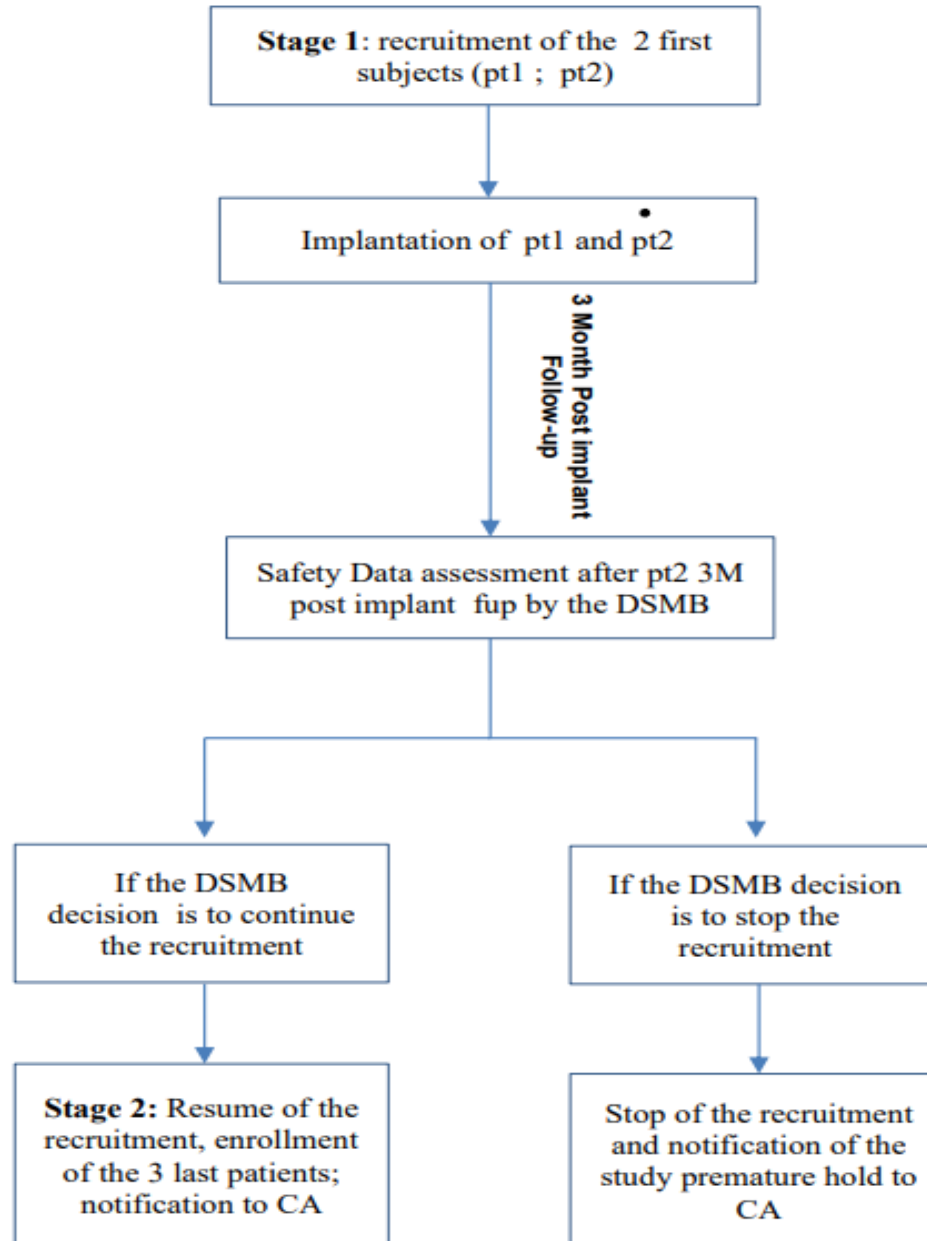
Implantace FineHeart Flowmaker – fixace prstence



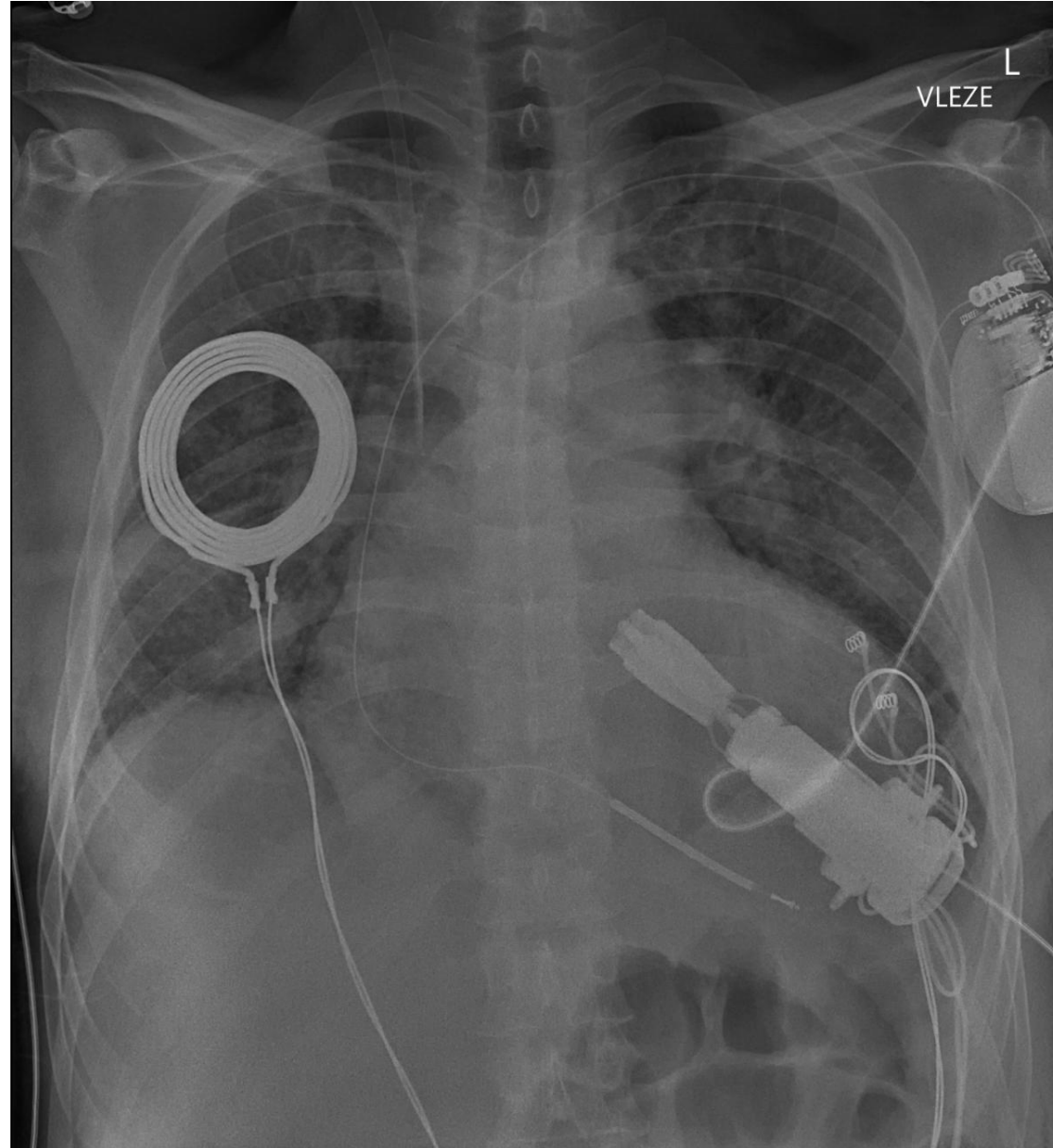
Implantace FineHeart Flowmaker – zapojení pumpy



Design studie FIM IKEM (5 pacientů)



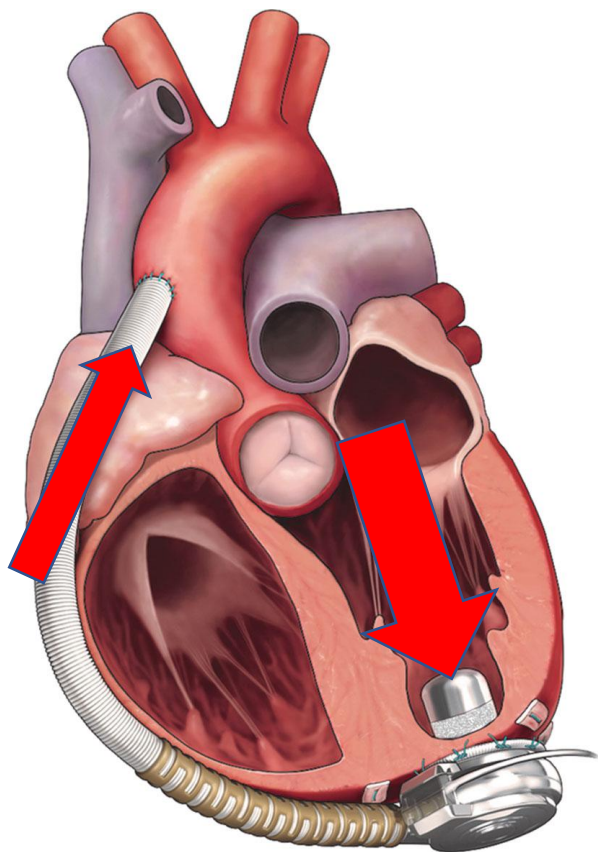
FIM FineHeart Flowmaker – Patient #1 IKEM



Shrnutí

- MSP – zásadní zlepšení prognózy přežití i kvality života
- Signál bezpečnosti použití NOACs u HeartMate 3
- Validace v nadcházejících randomizovaných studiích
- FineHeart Flowmaker – plná implantabilita a synchronizace
- Navigovatelnost v LK/LVOT a interakce v rámci srdeční remodelace

FineHeart FlowMaker



Spotřeba energie: 4-5 W

Karate



Aikido



Spotřeba energie: 1.0 W