

Best Device and Innovation Concepts: TCT 2021 & THT2022

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Disclosure Statement of Financial Interest

I am a full-time employee of Cardiovascular Research Foundation, which organizes and operates Transcatheter Cardiovascular Therapeutics

None of the companies participating in the Shark Tank innovation competition have any business relations with the Cardiovascular Research Foundation



TCT SHARK TANK COMPETITION



TCT2020 Winner

ULTRASIGHT: Streamlining Cardiac Pocus With AI

- Realtime guidance in image acquisition for faster and more accurate clinical decisions
- Reduce training time and cost
- Drive standardization
- Expand ultrasound into new markets



ULTRASIGHT

Non-Invasive Fluid Overload Management System

Wearable Suit

- Creates a micro-climate arounds the body initiating perspiration
- Secreted interstitial fluids evaporate instantaneously at rates $>200\text{ml/hr}$.

Micro-climate Generator & Control unit

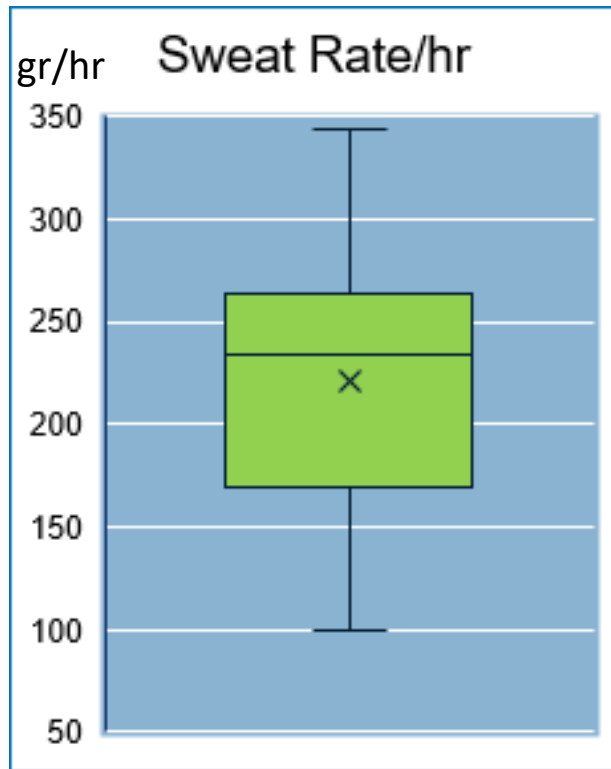
- Generates the micro-climate through a built-in proprietary algorithm
- Optimizes treatment to match each patient's physiology
- Core temperature and vital signs monitored & maintained
- Typically, 3hr-8hr session



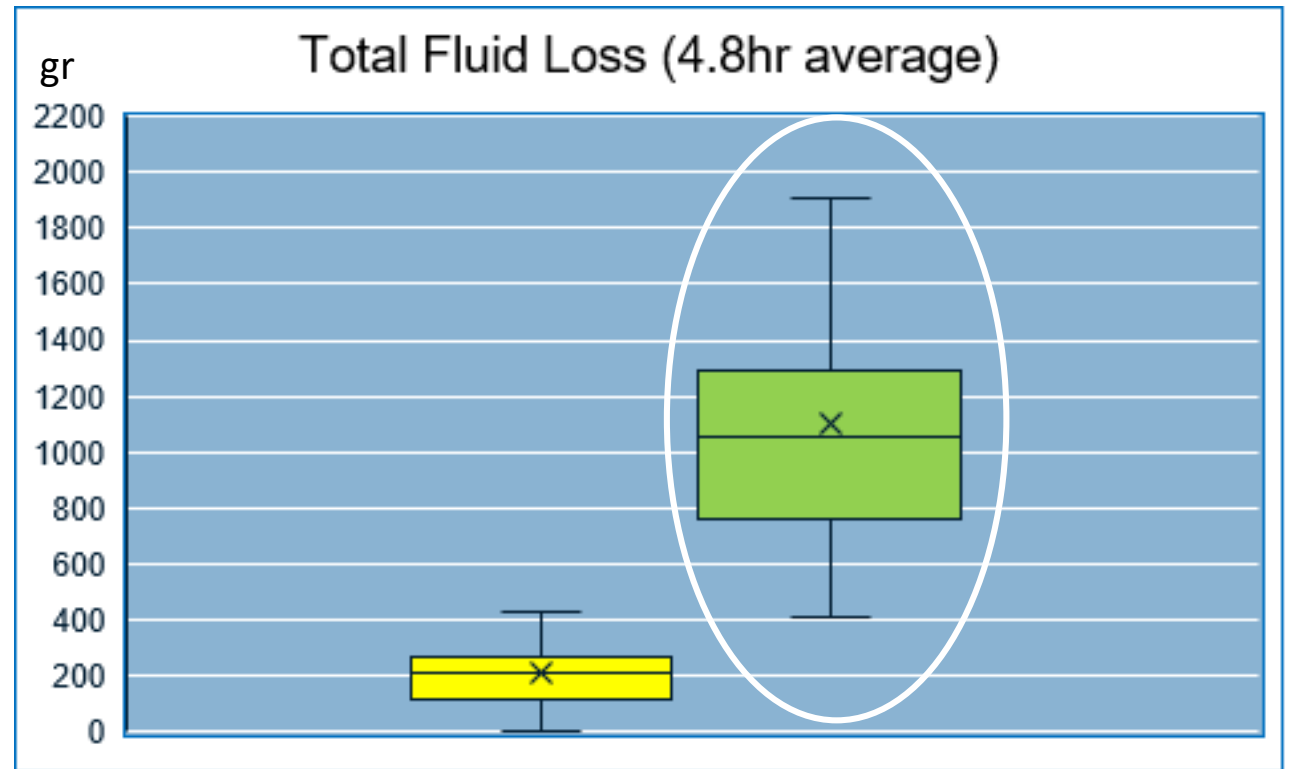
AquaPass system (for clinical trial)

Clinical Proof of Concept (17 Patients)

Composite Fluid loss (45 sessions, 4.8hr average)



No diuretics taken

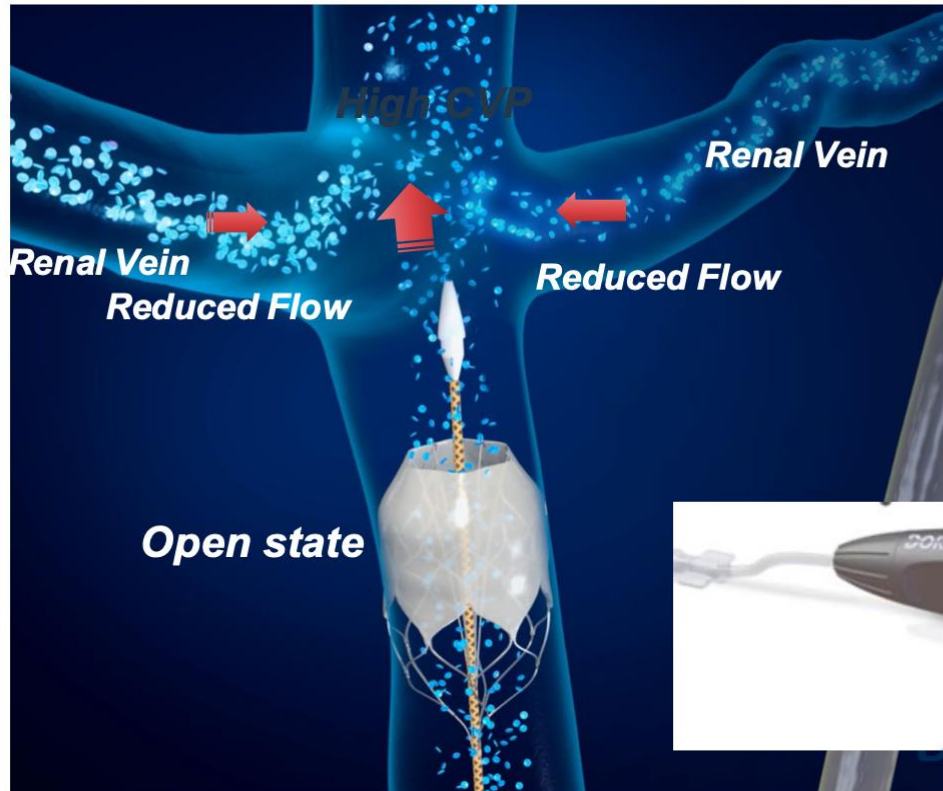


Urine

Sweat

Enhancing diuretic efficiency by reducing venous congestion

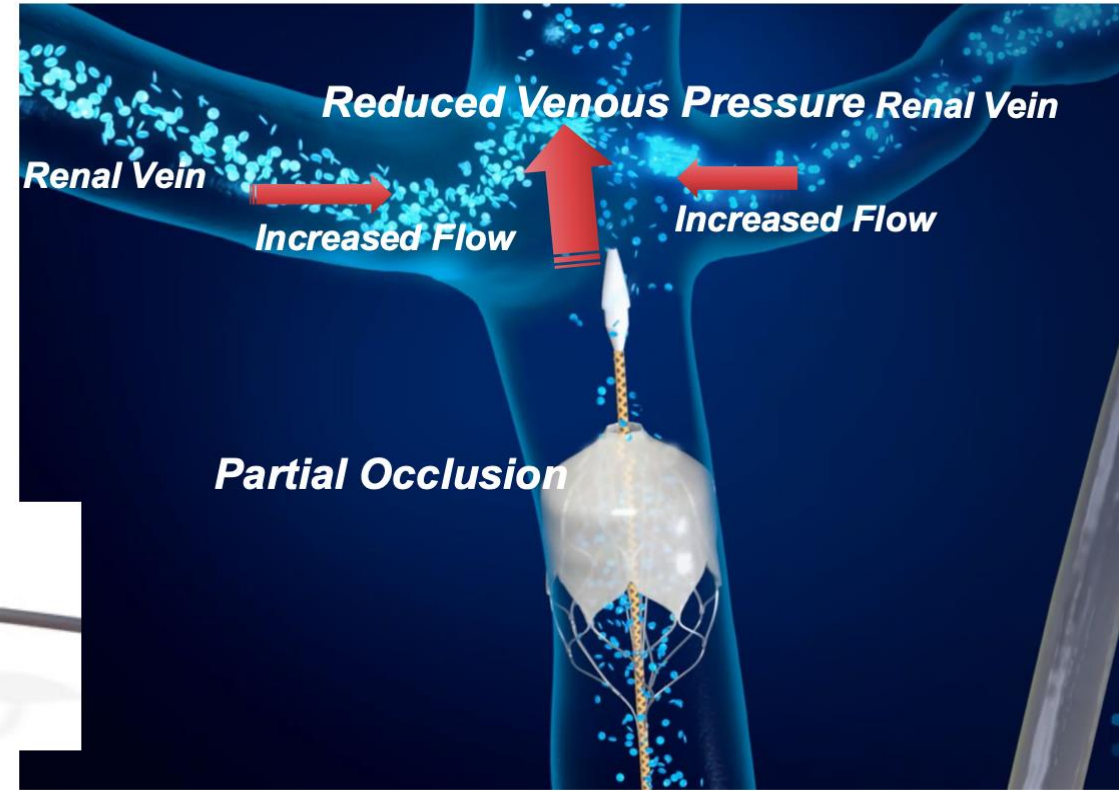
Doraya – a temporary partial obstruction of the IVC, below the renal veins.
Decreased renal venous pressure resulting in “Pulling” blood from the renal veins outlet



**Normally open,
after deployment**



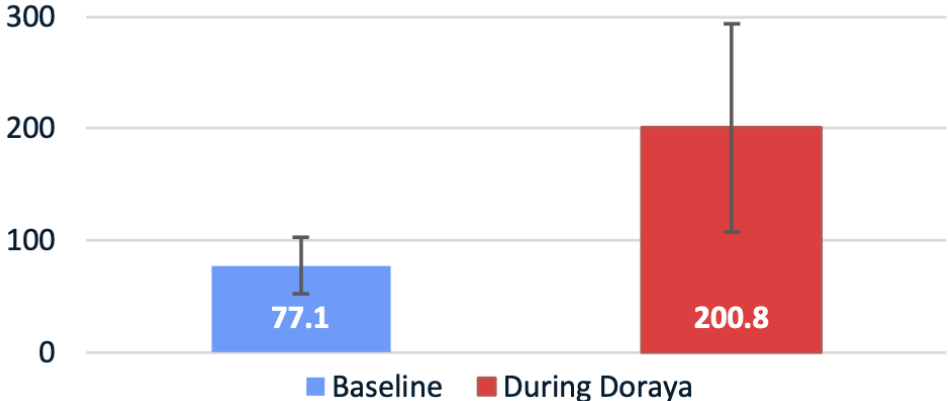
**Adjustment using an external
handle**



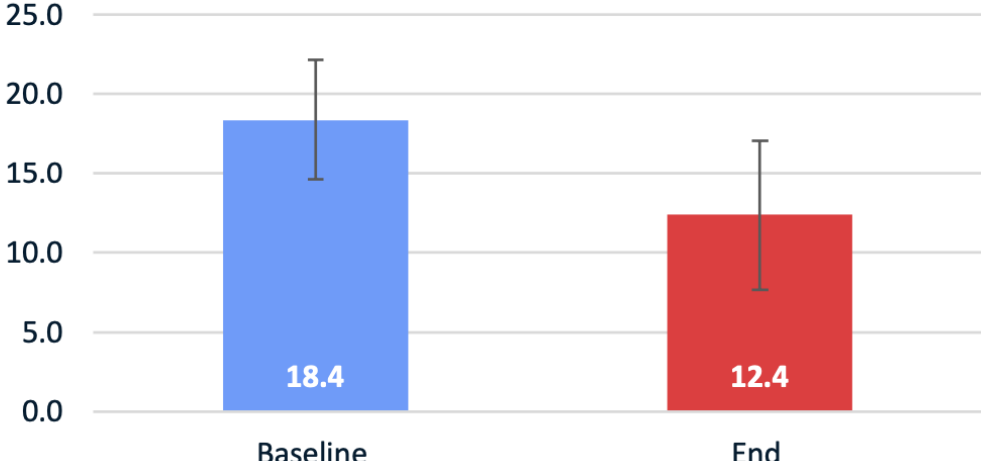
**After adjustment, modulating flow through central
passage, thus effecting hemodynamics**

FIH Results

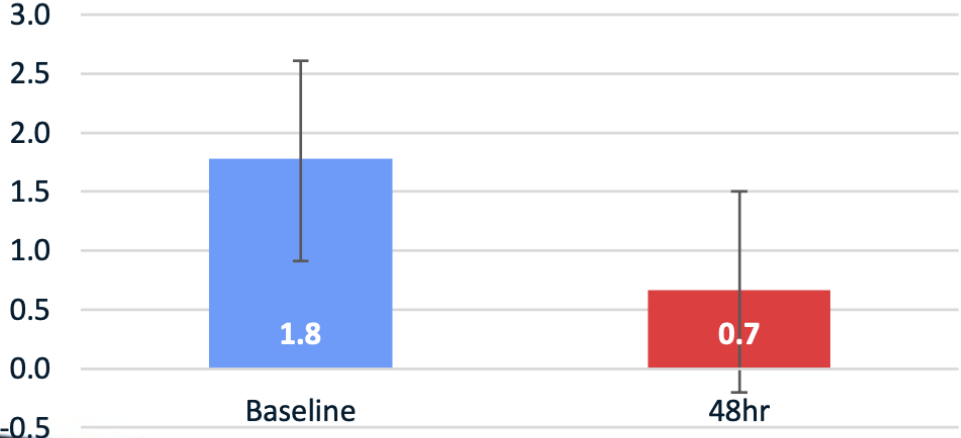
Urine output, ml/hr



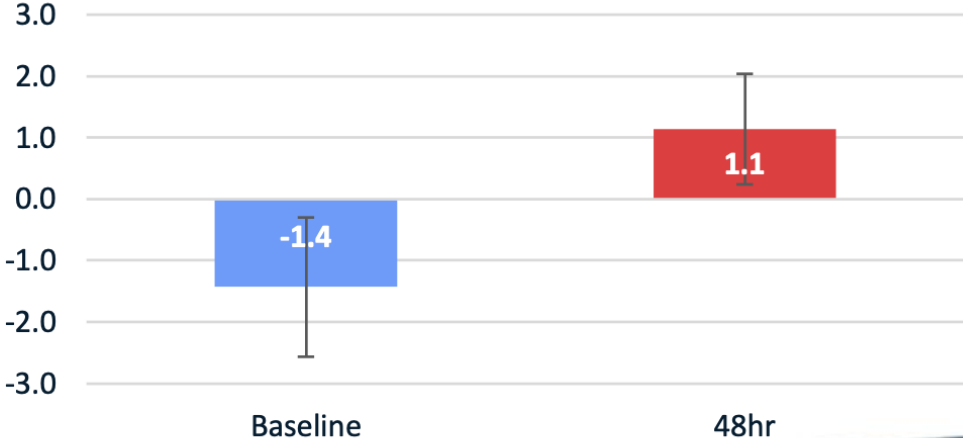
Renal afterload (CVP), mmHg



Edema



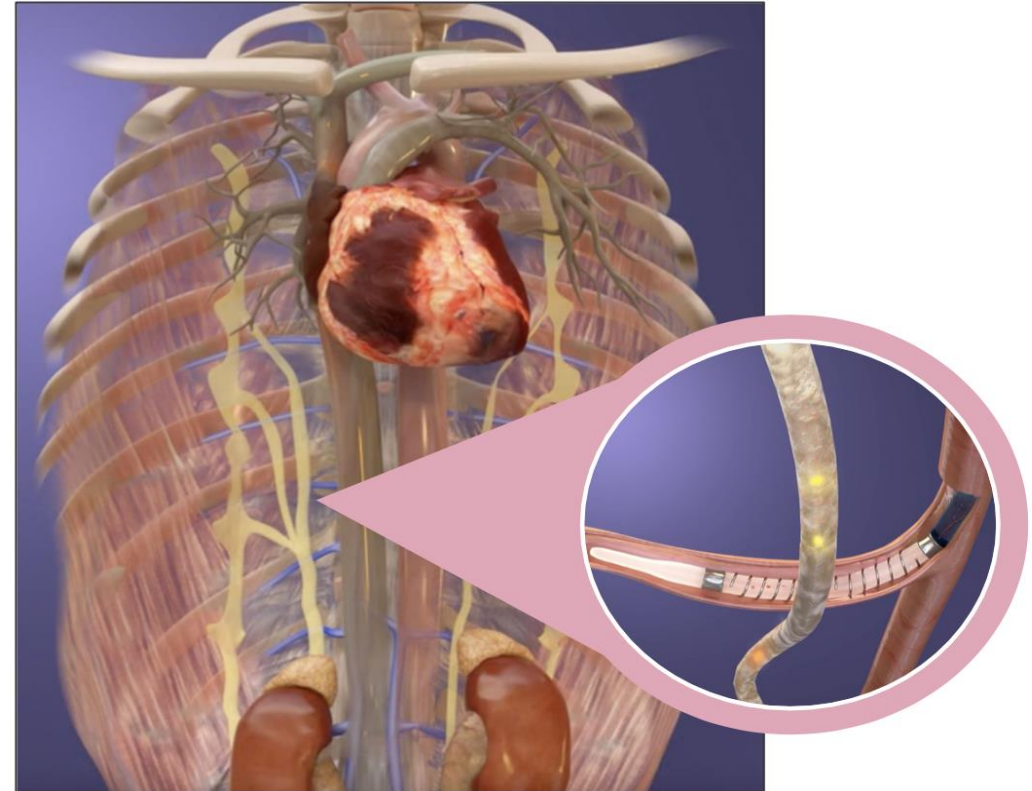
Dyspnea (n=7)



Splanchnic Ablation for Volume Management (SAVM) Addresses this Underlying Cause of HF

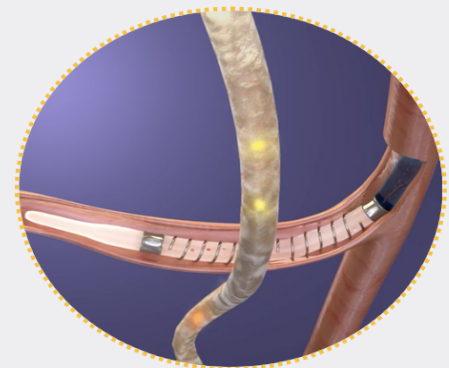
New Approach for Treating HFpEF

- ▶ Unilateral ablation of the right greater splanchnic nerve (GSN)
- ▶ Designed to interrupt sympathetic nervous activity to the splanchnic bed, reducing congestion
- ▶ Transvenous femoral, implant-free procedure
- ▶ < 1 hour procedure time (skin-to-skin)
- ▶ Patients typically go home the same day

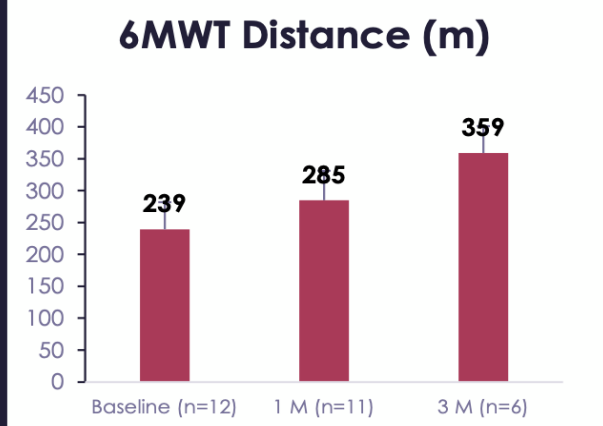
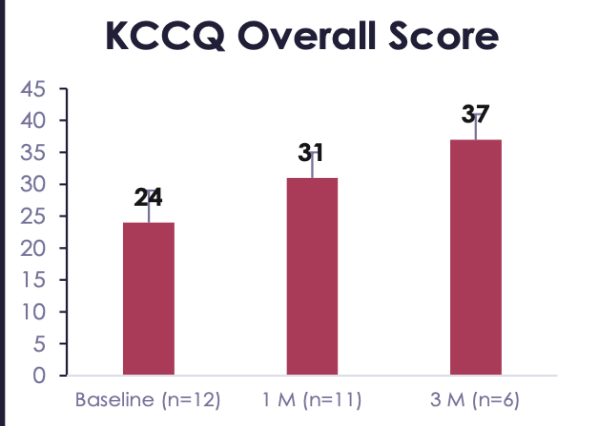
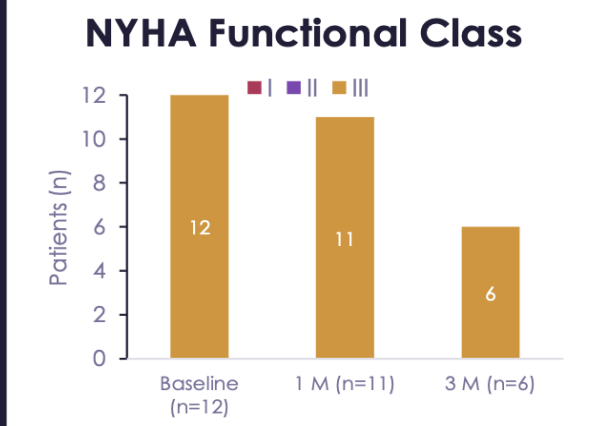
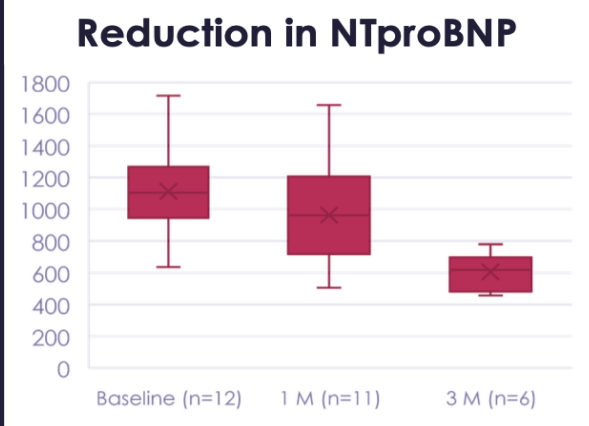


Endovascular GSN Ablation in HFrEF

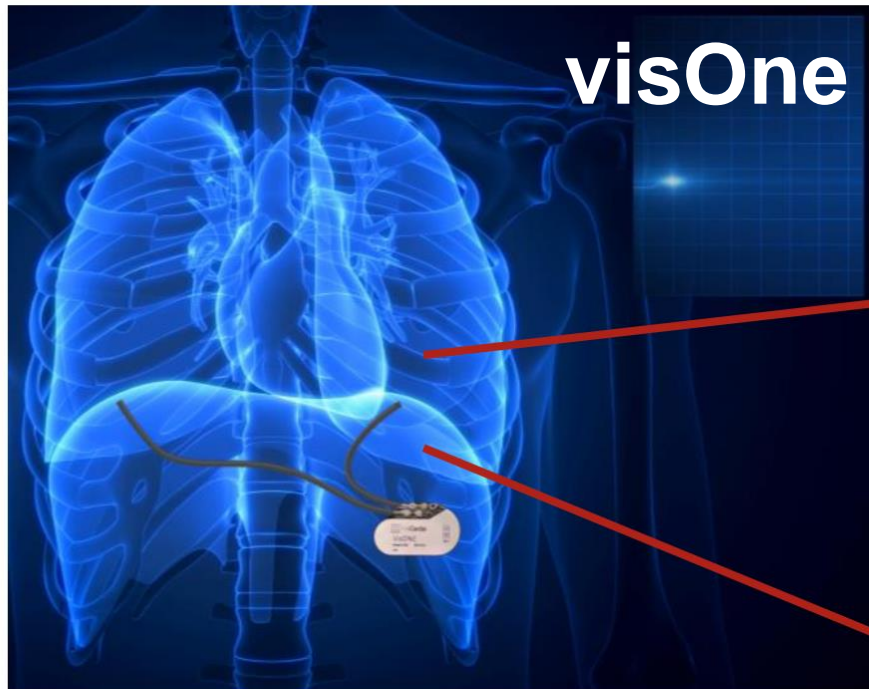
- ▶ Transvenous GSN ablation with Satera Ablation System
- ▶ 12 HFrEF patients
- ▶ No device-related serious adverse events
- ▶ Ongoing follow-ups



Demonstrated clinically meaningful improvements in key clinical and physiological parameters



Novel Concept: Synchronized Diaphragmatic Stimulation



SDS induced modulation of Intrathoracic Pressure (ITP)



Impacts

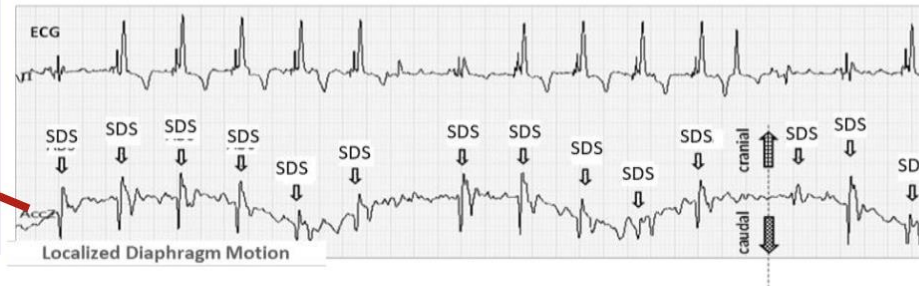
Preload Reserve

Pericardial Restraint

Afterload

Diaphragm Strength

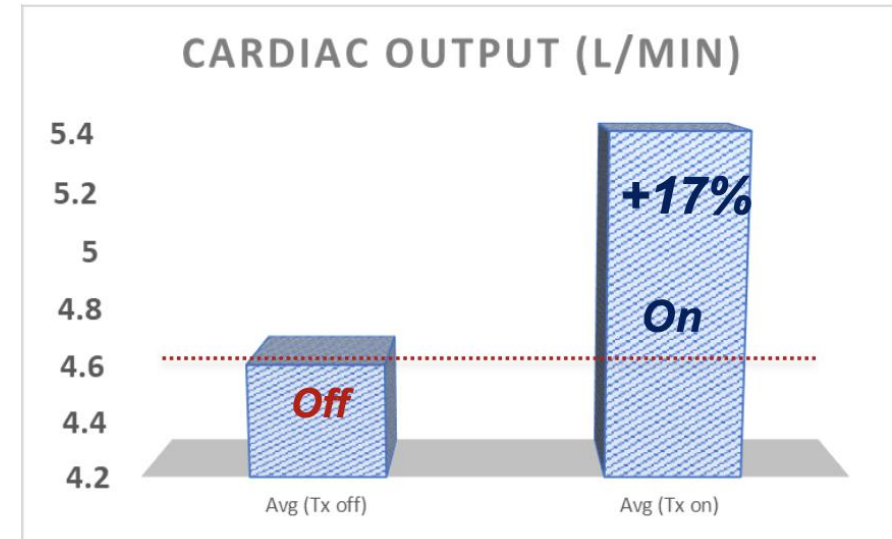
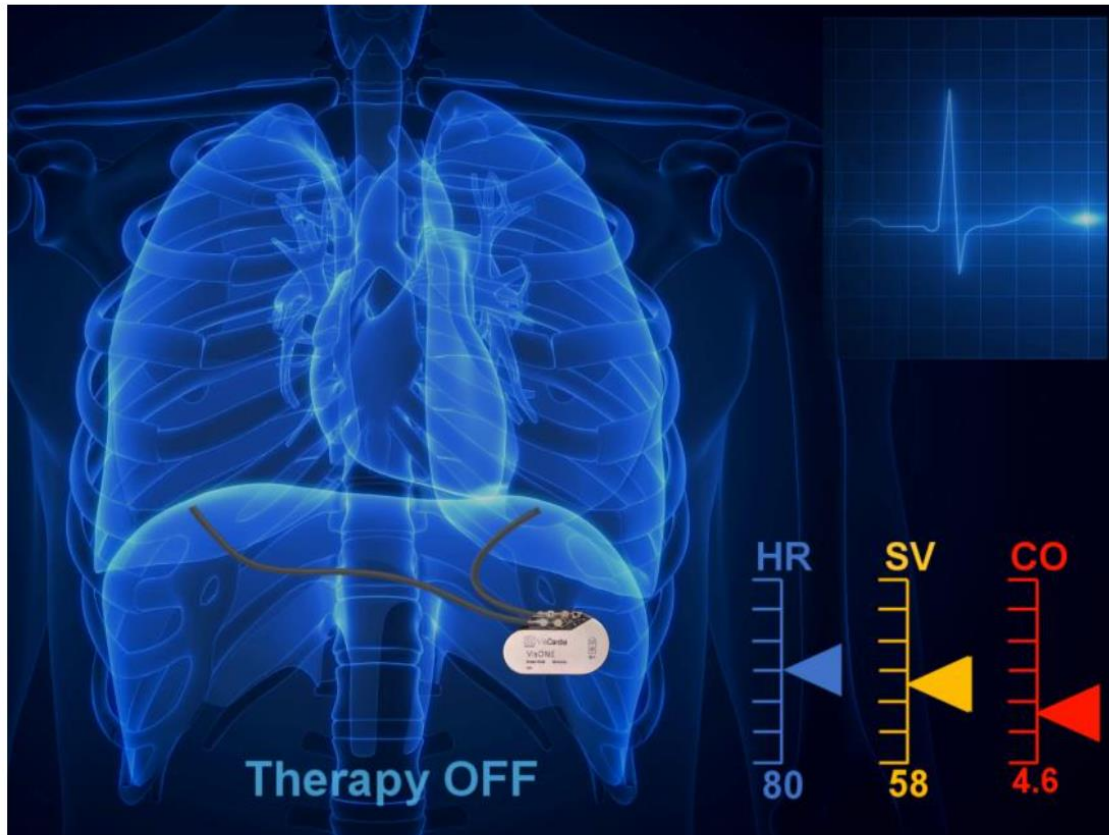
SDS induced localized, imperceptible diaphragm response



- Pericardial restraint is a well-recognized cause of impaired cardiac performance
- Negative intrathoracic pressure leads to “micro” reduction of pericardial pressure
- Reduction in pericardial restraint at the right time of the cardiac cycle can improve cardiac filling / pressure conditions and systolic performance ¹

First-In-Human Study – Acute Effect

- Multisite, open label. 15 patients, 100% ischemic HF
- Post implant w/ Swan Ganz – acute effect after “SDS On ”for 5+ minutes



| | Avg (Tx off) | Avg (Tx on) |
|------------------------|--------------|-------------|
| Cardiac Output (l/min) | 4.6 | 5.4 |
| Heart Rate (bpm) | 80 | 80 |
| Stroke Volume (ml) | 58 | 68 |

➔ On average +10ml per beat!

Artificial Ventilation Induces Muscle Atrophy that Impacts Clinical Outcomes

Diaphragm Atrophy

- Mechanical ventilation-induced diaphragm muscle atrophy leads to:
 - Extended weaning times¹
 - Reduced weaning rates¹
 - Longer ICU/hospital stays^{2,3}
 - Respiratory complications and mortality^{2,3}



1. Dres, Diaphragm Weakness at Time of Liberation from MV in Medical Intensive Care Unit Patients, Am J Respir Crit Care Med, Sep 2017; 195: 57-66.

2. Goligher, Mechanical Ventilation-induced Diaphragm Atrophy Strongly Impacts Clinical Outcomes, Am J Respir Crit Care Med, Jan 2018.

3. Goligher, Diaphragmatic myotrauma: a mediator of prolonged ventilation and poor patient outcomes in acute respiratory failure, The Lancet, Jan 2019.

Lungpacer AeroPace™ System

Novel transcatheter therapy

AeroPace Catheter

- Surface electrodes **stimulate phrenic nerves**
- Left jugular & left subclavian compatible
- Easily placed and removed at bedside



AeroPace Controller

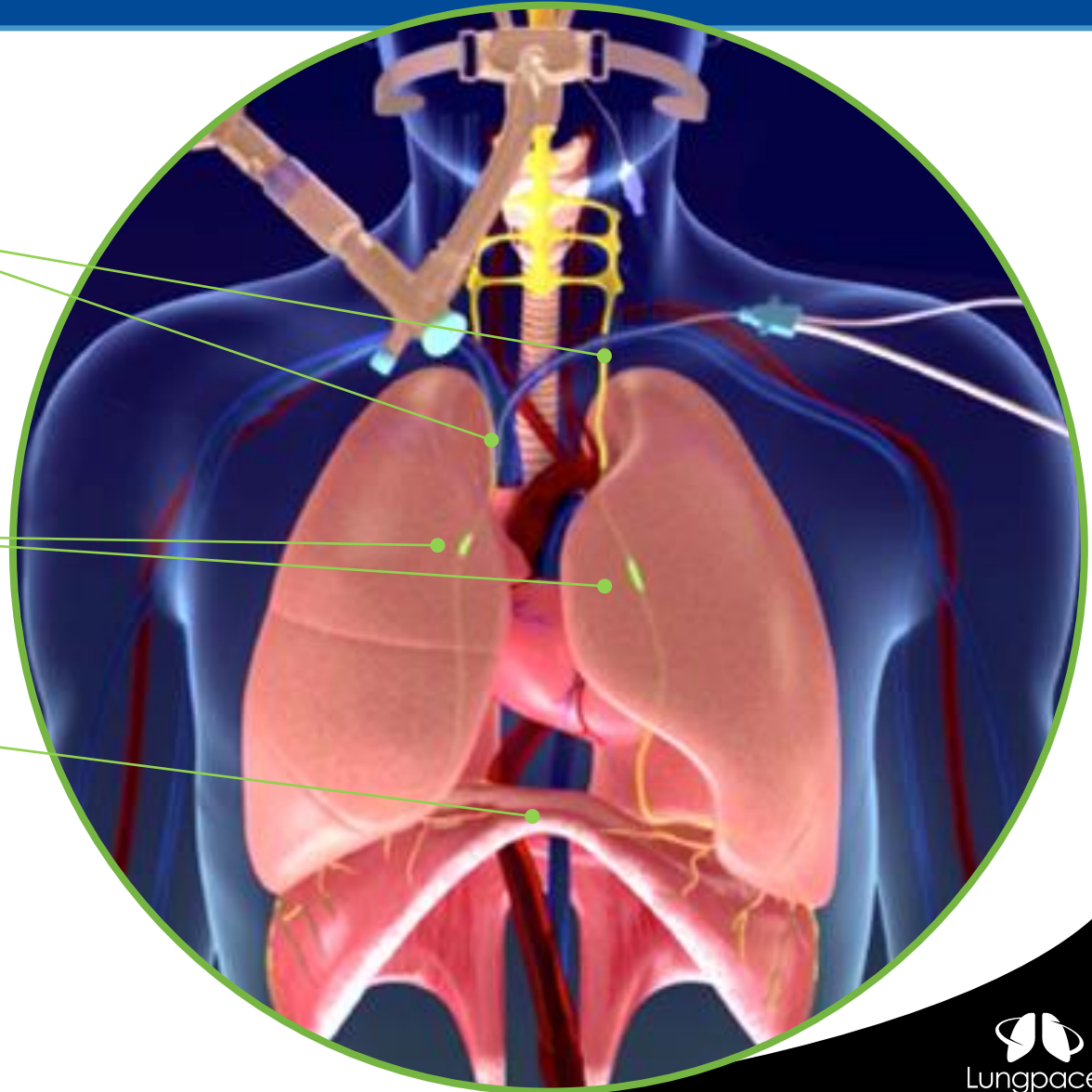
- ECG guided catheter placement
- Automated mapping and synchronized therapy with limited user interaction



FDA Breakthrough Technology & Emergency Use Authorization
For use to support mechanically ventilated COVID-19 patients

AeroPace Activates the Diaphragm

- 1 Lungpacer's AeroPace Catheter crosses near the left and right phrenic nerves
- 2 The catheter stimulates the phrenic nerves
- 3 The diaphragm muscle contracts to induce inspiration



RESCUE 2 RCT Feasibility Study Results (N=112)

246%

Stronger Diaphragm (MIP)
P=0.0010

167%

Improved Lung Function (RSBI)
P=0.047

+60%

Increased Diaphragm Thickening vs. 40% decrease in Control Group
P=0.031

7.4%

Increased ventilator independence

7.9%

Greater Survival at 30 days

1.4 Days

Less dependent on a ventilator

Trending results...

1. Dres, et al. Neurostimulation in difficult-to-wean mechanically ventilated patients - Results of the RESCUE 2 randomized controlled trial. Poster presented at ERS International Congress 2020, August 2020: 246% stronger diaphragm (MIP)/P=0.0010; +7.4% increased ventilator independence/P=0.586; survival was 92.9% in the Treatment Group and 85% in the Control Group /P=0.216; 1.4 days less dependent on a ventilator/P=0.498. Modified Intent To Treat Subset (mITT)
2. Lungpacer Data on File: 128% improved lung function (RSBI) /P=0.102. Modified Intent To Treat Subset (mITT), 60% improved right side diaphragm thickening fraction for Treatment vs. 40% reduction in Control (P=0.031).
3. Dres M, Gama De Abreu M, Similowski T. Temporary Transvenous Diaphragm Neurostimulation in Mechanically Ventilated Patients: Per Protocol Results from the RESCUE-2 Randomized Controlled Trial. Am J of Respir Crit Care Med 2021;203: A4668. (167% improved lung function (RSBI)/P=0.0487. Per Protocol (PP) group received at least 50% of Lungpacer therapy sessions.



Digital Biomarkers for Neurodegenerative Disorders



OCTOBER 2021

TCT 2021

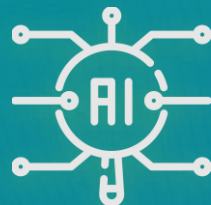
ViewMind Solution



VR headset, eye tracking technology and AI



Ocular stimuli activates and stimulates specific brain regions



AI correlates the patient's data with the specific pathologies

~ 100k
data points
in 15min

Clinical Validation

MILD COGNITIVE IMPAIRMENT (MCI) TO ALZHEIMER'S SYNDROME PREDICTION 4 YEAR STUDY

BASELINE

34

Predicted
Convertors

YEAR 4

PPV: 94%

32 / 34



105 SUBJECTS | 63 WITH MCI

29

Predicted
Non-Convertors

NPV: 100%

0 / 29



BLINDLY DIFFERENTIATE PRE-SYMPTOMATIC FAMILIAL ALZHEIMER'S DISEASE PATIENTS FROM CONTROLS UP TO 17 YEARS BEFORE CLINICAL SYMPTOMS
UNIVERSIDAD DE ANTIOQUIA, COLOMBIA

98%

Sensitivity

N° of subjects: 60
Age: 28 to 35

98%

Specificity