# Monitoring of volume status using a novel sensor for the assessment of inferior vena cava area and collapsibility in a patient with HFrEF receiving advanced heart failure therapies

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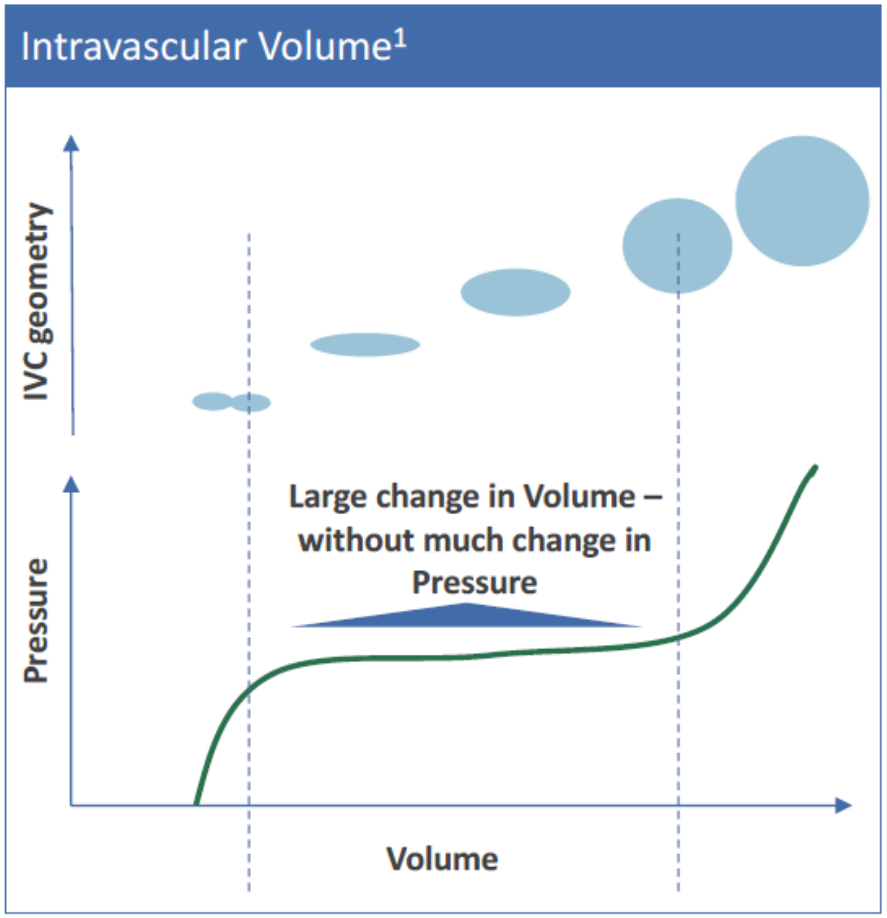
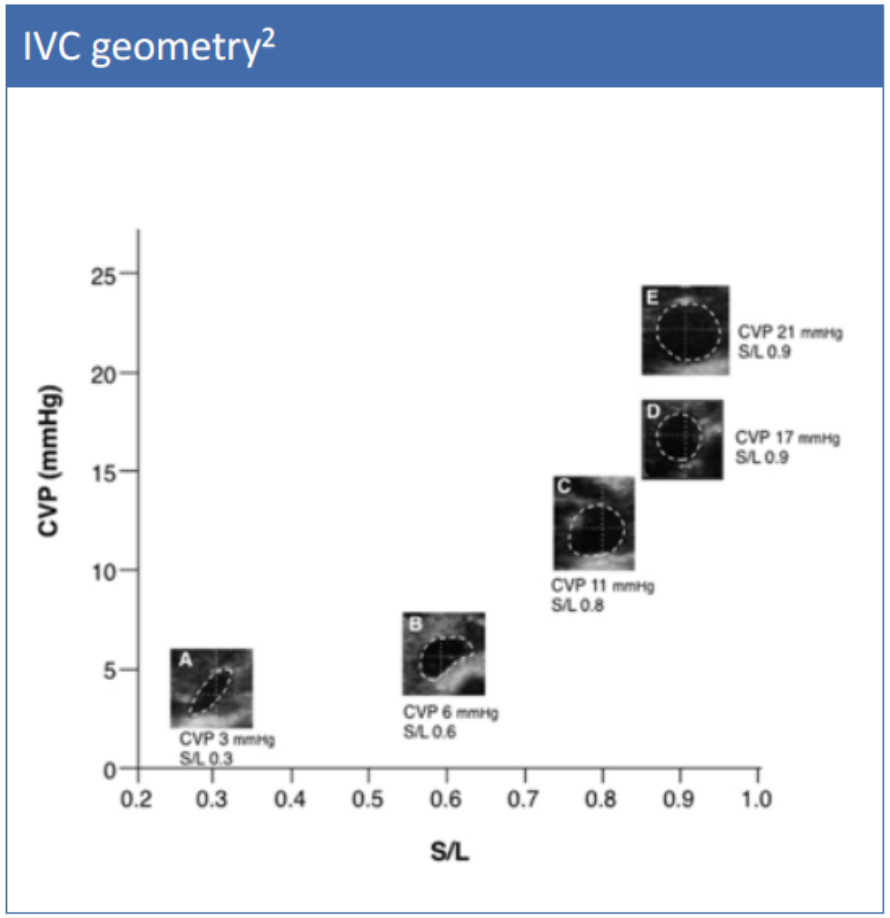
# Background:
# Dynamic changes of IVC morfology precede systemic congestion

## Intravascular Volume[1]



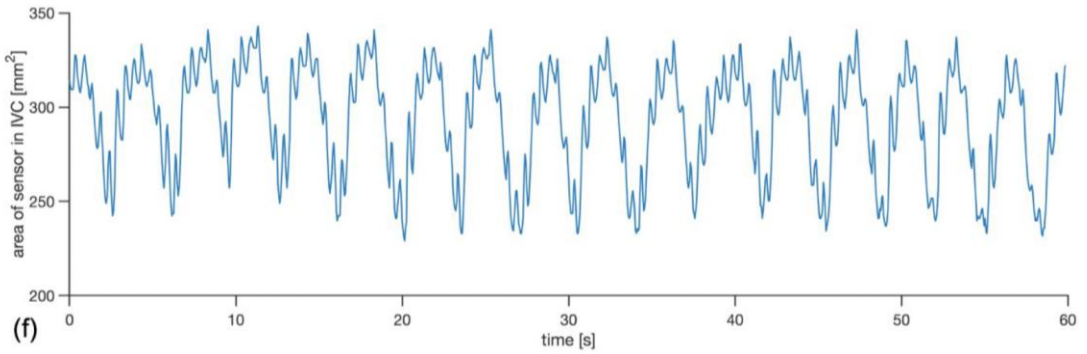

## IVC geometry[2]




*Mintz 1981, Moreno 1984, Tetsuka 1995*

# The novel remote monitoring system for IVC area (FIRE 1)

- The system consists of an implantable permanent sensor in the IVC and an externally worn belt
- Radio-frequency energy generated energises the sensor
- Sensor produces a signal
- Detected by the externally placed belt
- Provides a measure of IVC Cross Sectional Area




*Sheridan, Burkhoff et al., European Journal of Heart Failure, 2023*
*https://doi.org/10.1002/ejhf.2822*

# A case study

- A patient, 48 years old male

- six years history of chronic HFrEF, - idiopathic dilated cardiomyopathy

- Patient had stable NYHA class III symptoms at time of study entry

(Jan 2020) - FIRE 1 study

- Episodes of rapid AFib with inadequate ICD therapies

→Upgrade to CRT-D with subsequent A-V nodal ablation (Dec 2020)

→Status remained stable for several months

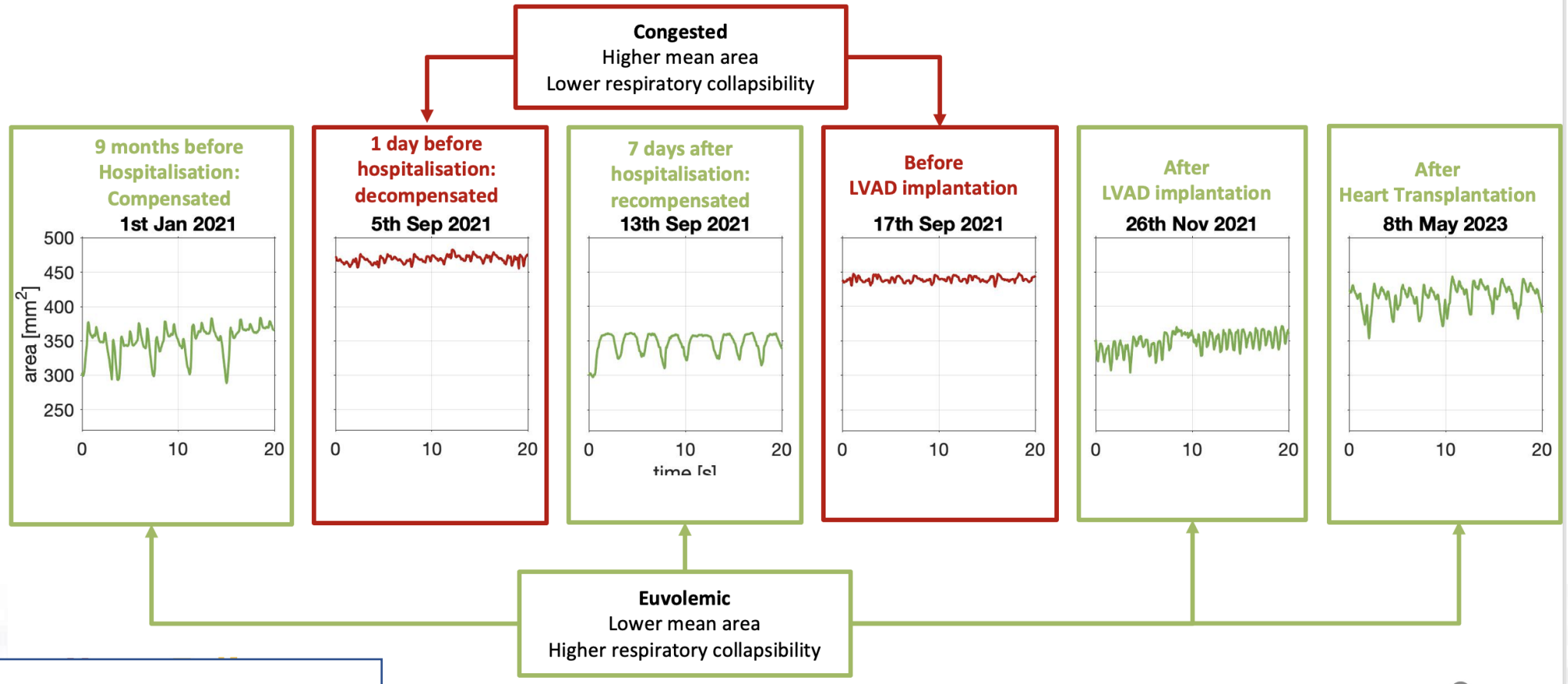
# A case study – cont.

- Admitted to hospital due to worsening HF (signs of low CO and congestion due to slow VT) (Sep 2021)

- Dependent on inotropes and referred for advanced HF therapy
- → Received LVAD (HeartMate 3) as a bridge to HTx (Oct 2021)
- and → then HTx (March 2023)
- **IVC area changes at time worsening HF and after LVAD**

**and HTx are shown**

# Area and collapsibility changes of IVC as assessed by a novel sensor during follow-up of a patient receiving advanced heart failure therapy




CCRID 2023, Prague

# Table - IVC area and IVC collapsibility index during patient´s journey

## CI – collapsibility index = (IVCe-IVCi)/IVCe x 100%

| Observation time | IVC area max, $mm^2$ [mean ± std] | IVC collapsibility index, % [mean ± std] |
|---|---|---|
| Baseline Jan 1-3 2021 | 393±10 | 22±12 |
| Deterioration 3-5 Sept 2021 | 478±6 | 5±1 |
| Recompensated Sept2021 | 357±8 | 17±2 |
| Before LVAD 15-17 Oct 2021 | 430±21 | 5±1 |
| After LVAD 6-8 May 2022 | 380±4 | 20±7 |
| Before Tx 22,24, 25 Jan 2023 | 466±10 | 14±0.4 |
| After Tx 21May, 6-7 July 2023 | 370±34 | 28±14 |

# Conclusions

- The FIRE1 IVC sensor represents a novel approach for remote monitoring of HF via IVC area and collapsibility

- IVC changes as assessed by novel sensor appeared to have predictive value of the subject's deterioration towards advanced therapies, and subsequently responded positively post LVAD implantation and after heart transplant

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