How inferior vena cava collapsibility index from a novel implantable sensor correlates with estimated plasma volume and NT-proBNP: a study in patients with chronic heart failure

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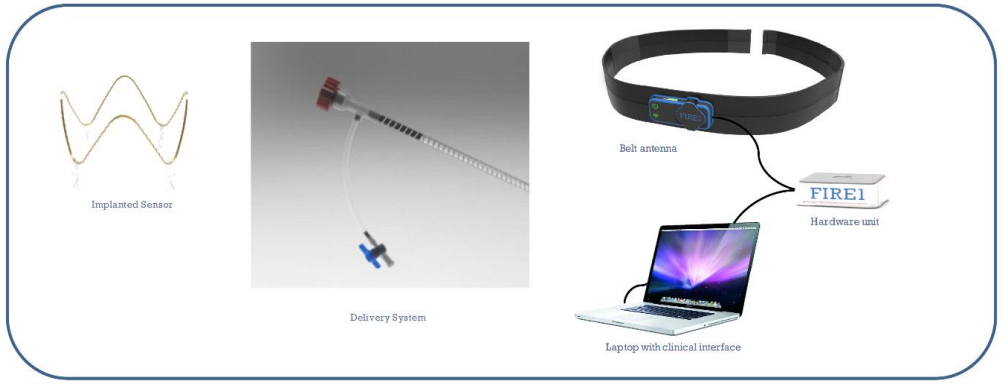
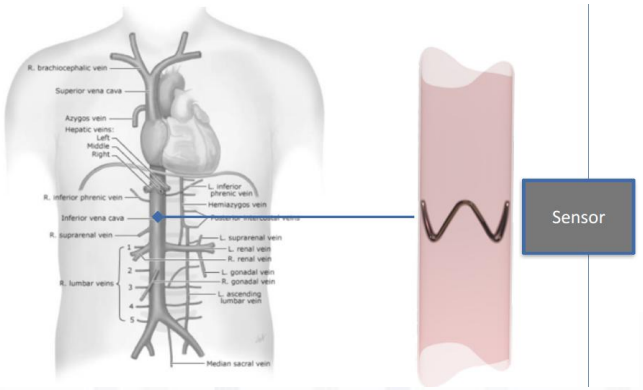
Background

- Natriuretic peptides are recommended as basic diagnostic tools in HF.
- Biomarkers of hemoconcetration may be used for the estimation plasma volume and thus volume status.
- A new wireless implantable sensor can measure inferior vena cava (IVC) area and collapsibility index and was invented for remote monitoring in heart failure.



Study objective

- To evaluate the relationship between IVC collapsibility, estimated plasma volume and NT-proBNP concentration in patients with chronic heart failure (CHF).



Patients

- Participants of the First in Human Clinical Investigation of the FIRE1 System in Heart Failure Patients (FUTURE-HF)
- Total number six patients (five males, one female)

Mean age 62 years, LV EF range 20-35% (mean 27%)

Aetiology 50 % CAD, Functional class 100% NYHA III

Device therapy: ICD 100 % (67% CRT-D)

Medical therapy: 83% BB, 100 % ACEI/ARB/ARNI, 100% MRA, 33% SGLT2I, mean daily furosemid dose 40 mg

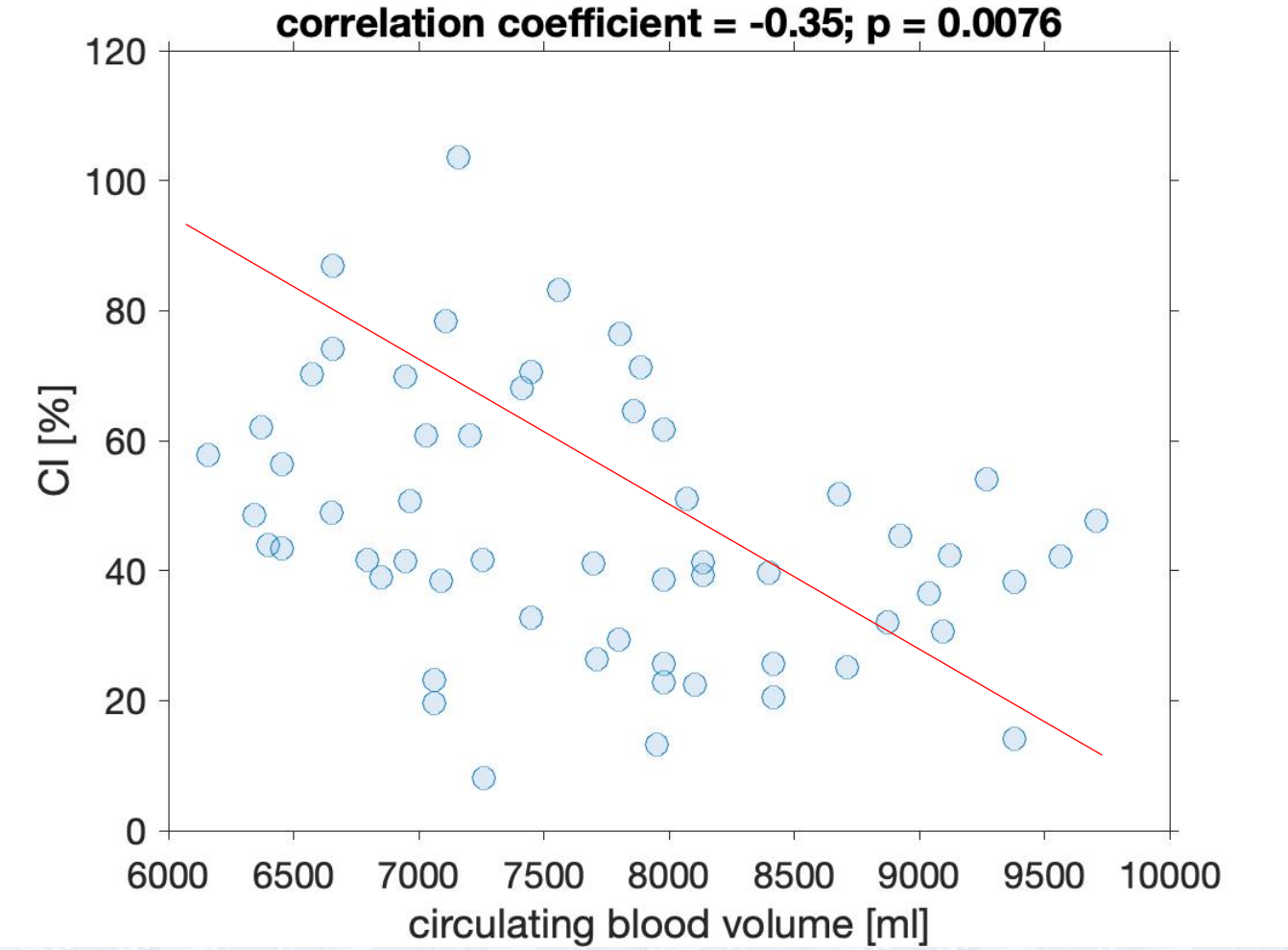
Methods

- The collapsibility index of the IVC was recorded on each clinic follow-up visit. CI – collapsibility index = (IVCe-IVCi)/IVCe x 100%
- Patient´s weight recorded and hematocrit (Hct) and NT-proBNP analyzed
- An estimated plasma volume (ePV) was calculated by the Tetsuka Formula (ePV_0 = weight x 0.070 L/kg - constant, $ePV_1 = ePV_0 \times Hct_0/Hct_1$).
- Statistics: The correlation of parameters evaluated by Pearson´s correlation coefficient.

Results, Pearson´s correlation coefficient
Total number 58 measurments

- Mean ePV 7713.5 ml (median 7465 ml)
- Mean (CI) 46.5 % (median 42.2%)
- Mean NT-proBNP 1122.7 (median 988) ng/l

- **Inverse correlation between CI and ePV (*r* = - 0.35, p = 0.0076)**



Results, Pearson´s correlation coefficient
Total number 58 measurments

- The correlation

of NT-proBNP with CI

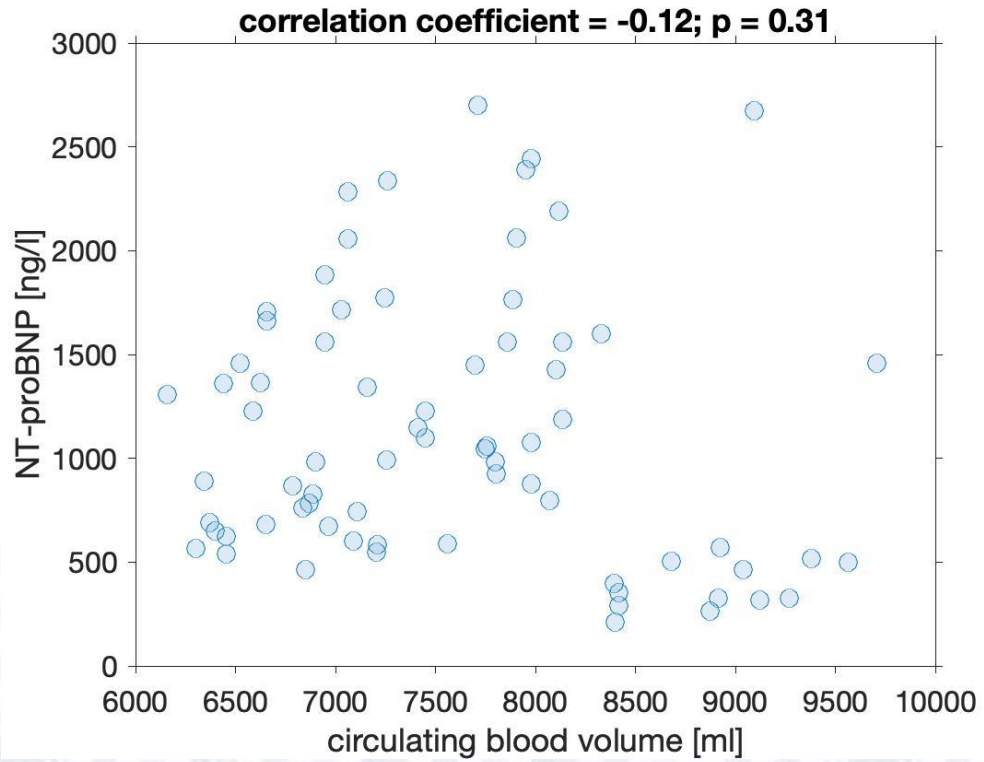
(*r* = - 0.12, p = 0.31).

- It was expected that IVC CI is

accompanied by early volume

increase and that its reduction

preceeds rise in NT-proBNP



Conclusions

- The CI of the IVC as assessed by a novel implantable sensor correlated with a biomarker of hemoconcentration, showing a statistically significant inverse correlation with ePV, and thus may provide a promising tool to evaluate volume status in heart failure patients in their homes.

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