“Left ventricular volume measurement from a VAD cannula perspective”

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Scientific outcome

Left ventricular assist devices (VAD) are used for the treatment of advanced heart failure to ensure sufficient blood perfusion. In order to adapt to individual needs so-called physiological control strategies are currently being developed. Left ventricular (LV) volume measurement is key for monitoring and as a control parameter to adapt pump speed in LVAD patients. An implantable LV volume sensor remains to be developed.

An impedance-based volume sensor is developed at the Chair of Medical Information Technology (MedIT) for the Impella®. At the same time, an ultrasound-based volume sensor is developed at Product Development Group Zurich (pd|z) for apical VADs. We have found the rare opportunity to compare the two LV volume sensor methods in terms of accuracy and sensitivity. In this joint study, both sensor methods were integrated in the cannula of an apical VAD. The measurements were performed on an in vitro test bench with clinical silicone heart phantoms at pd|z.

Results have shown that the ultrasound based measurement was sensitive to volume changes but also to trabecular structures. The impedance measurements enables smooth tracking of the left ventricular volume changes, however, the long catheter interferes with the papillary muscles.

As a future perspective we suggest to combine both methods profiting from the stability and continuity of impedance measurement and exploiting the high sensitive regions with ultrasound.

Interdisciplinary and social outcome

This exchange combined the expertise of two institutes located at an electrical and mechanical engineering department. This offered the unique opportunity to compare measurement principle from different disciplines at an early development stage. We learned the most important principles in impedance and ultrasound measurement simply by working together.

The location at each others institutions gave valuable insights to alternative ways of organizing everyday’s working life of a research group.

The process of applying for this exchange gave us first experience in acquiring research funding involving multiple institutions.

We had a good time exploring each others cities and getting to know not only us but also colleagues from each group.

Many thanks to yESAO committee for offering us this great opportunity.