

Development of a leadless pacemaker fixation mechanism for catheter-based atrial implantation

Background

Leadless cardiac pacemakers (PMs) have been introduced recently. They overcome key limitations of conventional PMs and are currently revolutionizing the world of cardiac implantable devices. Leadless PMs are implanted directly in the right ventricle via a minimally invasive catheter-based implantation technique (Fig. 1). Although this approach works well, it is only suitable for about 20% of all patients requiring a PM. Most other patients qualify for a dual-chamber PM, which stimulates the heart not only in the right ventricle but also in the right atrium.

However, the right atrium is a delicate implantation site. Its wall is thin, which makes mechanical anchoring difficult and dangerous for patients. Thus, contemporary leadless PMs are not intended for atrial implantation.

Aim

In this project, the student will conceptualize, build and test a novel PM anchoring system for the fixation of a leadless PM in the right atrium.

Materials and Methods

The student will first familiarize with the concept of leadless pacing and gain a detailed knowledge on possible implantation techniques. Subsequently, different anchoring and implant design prototypes will be developed using rapid prototyping and conventional machining approaches. Mechanical stability will be assessed on the bench using a dedicated cardiac motion robot and a long-term stress testing setup. The final implant design will be tested *in vivo*.

Nature of the Thesis

Analytical: 25%
Hardware development: 40%
Experimental testing: 25%
Documentation: 10%

Requirements

Interest in applied medical device development.
A strong mechanical background is considered an advantage.

What we provide

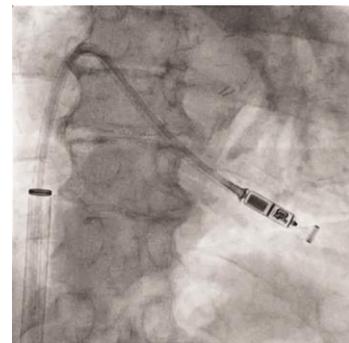
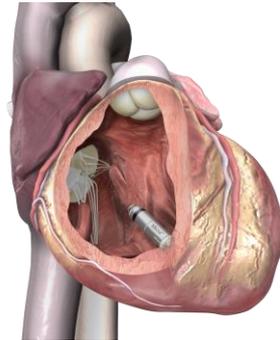
We have been working for several years on leadless cardiac pacemaker technologies. We provide expertise in medical device development, bench testing and the possibility to perform *in-vivo* experiments. The candidate will work in a dynamic team of engineers and physicians, where creative and innovative work is highly appreciated. The position provides the opportunity to be involved in the development of cutting-edge cardiovascular technology and the development of active medical implants.

References

- Zurbuchen A, Haeberlin A et al.: "Endocardial energy harvesting by electromagnetic induction", IEEE Trans Biomed Eng 2018;65(2):424-430.
- Haeberlin A, Bereuter L et al.: "Herzschrittmacher – die kabellose Revolution", info@Herz+Gefäss, online.

Contact

Please send a short CV to both project supervisors: Andreas Haeberlin, MD, PhD (andreas.haeberlin@insel.ch) and Adrian Zurbuchen, PhD (adrian.zurbuchen@artorg.unibe.ch)



Leadless pacemaker implanted in the right ventricle (top panel, courtesy Medtronic Inc.) via a steerable catheter controlled by x-ray imaging (bottom panel).

Supervisors

Adrian Zurbuchen, PhD
Andreas Haeberlin, MD, PhD

Institutes

- Dept. of Cardiology, Bern University Hospital
- Swiss Institute for Translational and Entrepreneurial Medicine – SITEM-Insel