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Hemodynamic Monitoring Using Electrical Impedance Tomography (EIT)

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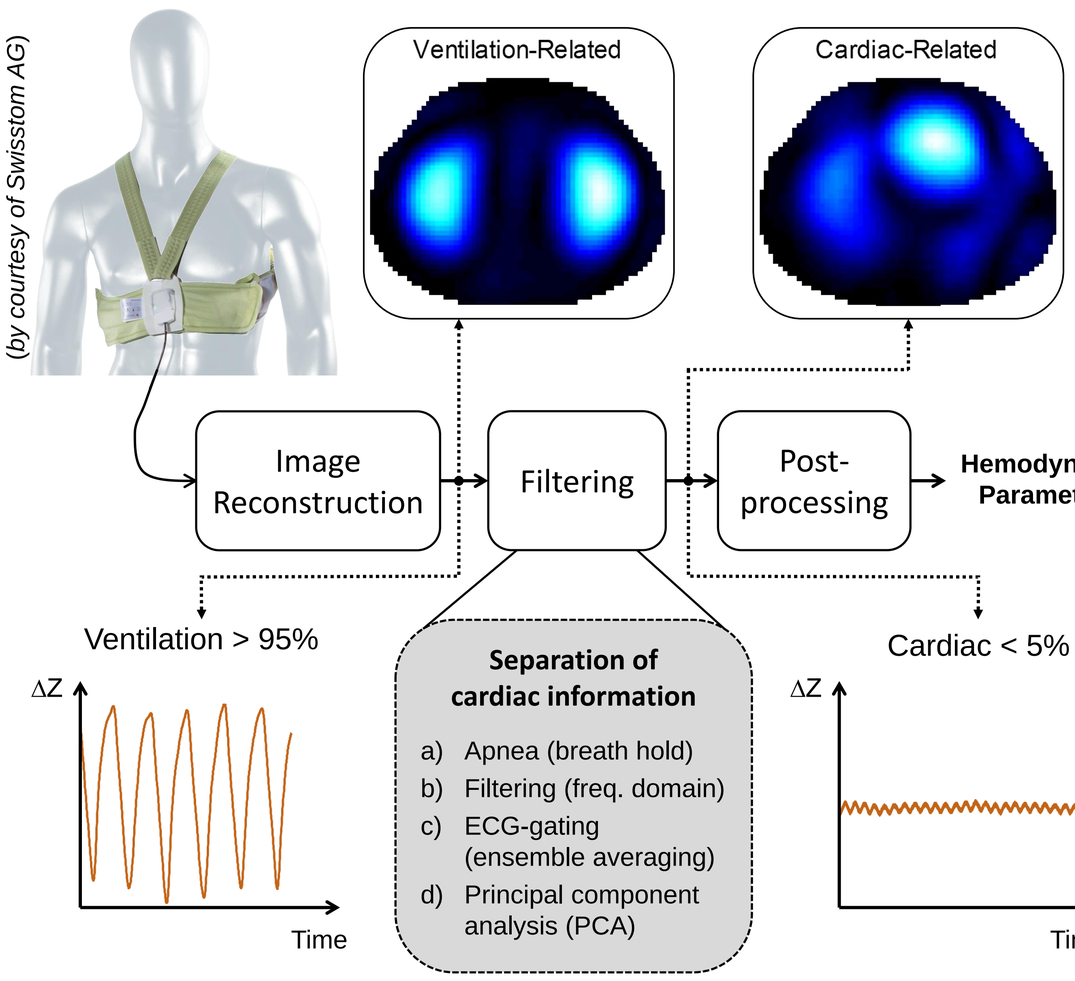
Introduction

Electrical Impedance Tomography (EIT) is a functional medical imaging technique successfully used to monitor ventilation [1]. Conductivity images enable a regional analysis of lung tissue.

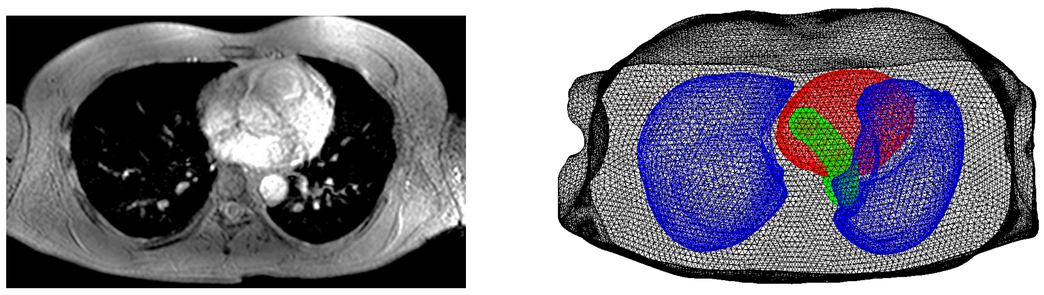
EIT has its advantages of being a non-invasive, low-cost imaging modality and enables continuous bedside monitoring.



Conclusion and Outlook

The potential of EIT to measure hemodynamics is promising. Nevertheless, to reveal more about the origin of cardiac EIT signals, dynamic bio-impedance simulations are required and need to be validated with real measurements. These findings should then be used to develop algorithms which reliably estimate hemodynamics such as stroke volume or blood pressure.

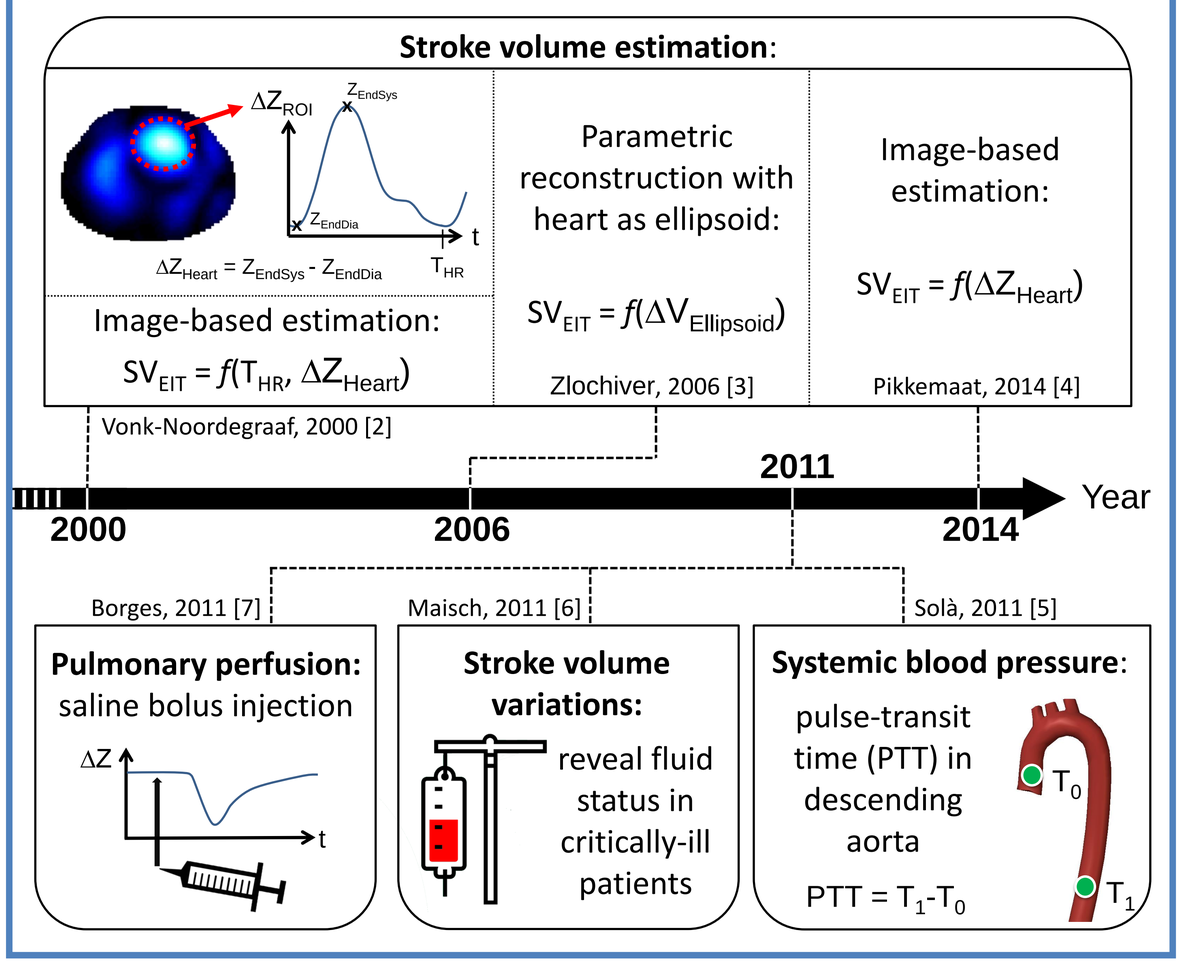
Possible alternations of the state-of-the-art measurement setup are not excluded: an array of electrodes – instead of a belt – might improve the measurement sensitivity. Additionally, different reconstruction algorithms could lead to more robust results.



(Left) MRI recording of a human volunteer with (Right) the corresponding finite-element model used as basis for dynamic bio-impedance simulations.

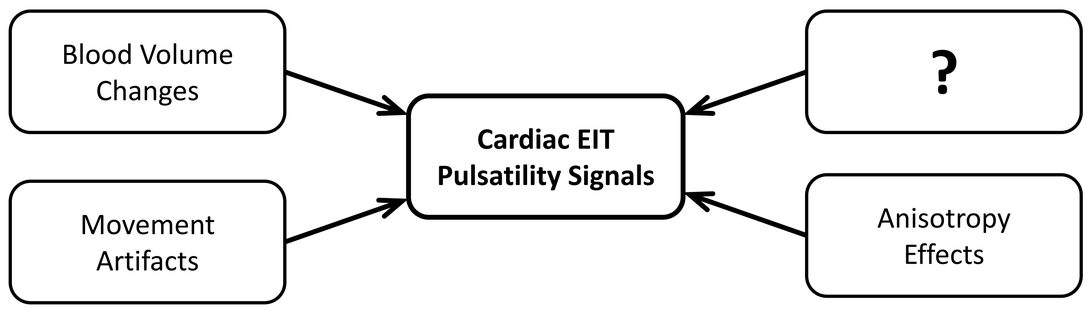
EIT Hemodynamic Monitoring History

A variety of applications for EIT to extract hemodynamic parameters are proposed in the literature:



Controversial Origin of Cardiac EIT

The **exact origin of cardiac EIT signals is unclear** and there exists contradictory interpretations in the literature [8].



Different contributors to the cardiac EIT signal.

Cardiac EIT does **not only measure perfusion** [8,9]. It is therefore suggested to talk about *pulsatility*.

Cardiac EIT ≠ Perfusion ➡ Cardiac EIT = Pulsatility

Nevertheless, perfusion can be imaged but requires an invasive injection of contrast agent (highly conductive saline bolus) [7,9].

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