Abstract: P1547

Voltage field simulation of transesophageal left atrial pacing in combination with cardiac resynchronization therapy

Authors:
K Goekues¹, M Heinke¹, J Hoerth¹, M Schleh¹, ¹University of Applied Sciences Offenburg - Offenburg - Germany,

Topic(s):
Cardiac Resynchronization Therapy

Citation:

Abstract
Background: Transesophageal left atrial (LA) pacing and transesophageal LA ECG recording are semi-invasive techniques for diagnostic and therapy of supraventricular rhythm disturbance. Cardiac resynchronization therapy (CRT) with right atrial (RA) sensed biventricular pacing is an established therapy for heart failure patients with reduced left ventricular (LV) ejection fraction, sinus rhythm and interventricular electrical desynchronization.

Purpose: The aim of the study was to evaluate electromagnetic and voltage pacing fields of the combination of RA pacing, LA pacing and biventricular pacing in patients with long interatrial and interventricular electrical desynchronization.

Methods: The modelling and electromagnetic simulations of transesophageal LA pacing in combination with RA pacing and biventricular pacing would be staged and analyzed with the CST (Computer Simulation Technology) software. Different electrodes were modelled in order to simulate different types of bipolar pacing in the 3D-CAD Offenburg heart rhythm model: The bipolar Solid S (Biotronik) electrode where modelled for RA pacing and right ventricular (RV) pacing, Attain 4194 (Medtronic) for LV pacing and TO8 (Osypka) multipolar esophageal electrode with hemispheric electrodes for LA pacing.

Results: The pacemaker amplitudes for the electromagnetic pacing simulations were performed with 3 V for RA pacing, 1.5 V for RV pacing, 50 V for LA pacing and 3V for LV pacing with pacing impulse duration of 0.5 ms for RA, RV and LV pacing and 10 ms for LA pacing. The atrioventricular pacing delay after RA pacing was 140 ms. The different pacing modes AAI, VVI, DDD, DDD0V and DDD0D were evaluated for the analysis of the electric pacing field propagation of pacemaker, CRT and LA pacing. The pacing results were compared at minimum (LOW) and maximum (HIGH) parameter settings. While the LOW setting produced fewer tetrahedral and more inaccurate results, the HIGH setting produced many tetrahedral and therefore more accurate results.

Conclusions: The simulation of the combination of transesophageal LA pacing with RA sensed biventricular pacing is possible with the Offenburg heart rhythm model. The new temporary 4-chamber pacing method may be additional useful method in CRT non-responders with long interatrial electrical delay.
Abstract: P1547
Voltage field simulation of transesophageal left atrial pacing in combination with cardiac resynchronization therapy

Authors: K Goekues 1, M Heinke 1, J Hoerth 1, M Schleh 1

University of Applied Sciences Offenburg – Offenburg – Germany,

Topic(s): Cardiac Resynchronization Therapy

Citation: Abstract

Background: Transesophageal left atrial (LA) pacing and transesophageal LA ECG recording are semi-invasive techniques for diagnostic and therapy of supraventricular rhythm disturbance. Cardiac resynchronization therapy (CRT) with right atrial (RA) sensed biventricular pacing is an established therapy for heart failure patients with reduced left ventricular (LV) ejection fraction, sinus rhythm and inter ventricular electrical desynchronization.

Purpose: The aim of the study was to evaluate electromagnetic and voltage pacing fields of the combination of RA pacing, LA pacing and biventricular pacing in patients with long interatrial and interventricular electrical desynchronization.

Methods: The modelling and electromagnetic simulations of transesophageal LA pacing in combination with RA pacing and biventricular pacing would be staged and analyzed with the CST (Computer Simulation Technology) software. Different electrodes were modelled in order to simulate different types of bipolar pacing in the 3D-CAD Offenburg heart rhythm model: The bipolar Solid S (Biotronik) electrode was modelled for RA pacing and right ventricular (RV) pacing, Attain 4194 (Medtronic) for LV pacing and TO8 (Osypka) multipolar esophageal electrode with hemispheric electrodes for LA pacing.

Results: The pacemaker amplitudes for the electromagnetic pacing simulations were performed with 3 V for RA pacing, 1.5 V for RV pacing, 50 V for LA pacing and 3 V for LV pacing with pacing impulse duration of 0.5 ms for RA, RV and LV pacing and 10 ms for LA pacing. The atrioventricular pacing delay after RA pacing was 140 ms. The different pacing modes AAI, VVI, DDD, DDD0V and DDD0D were evaluated for the analysis of the electric pacing field propagation of pacemaker, CRT and LA pacing. The pacing results were compared at minimum (LOW) and maximum (HIGH) parameter settings. While the LOW setting produced fewer tetrahedral and more inaccurate results, the HIGH setting produced many tetrahedral and therefore more accurate results.

Conclusions: The simulation of the combination of transesophageal LA pacing with RA sensed biventricular pacing is possible with the Offenburg heart rhythm model. The new temporary 4-chamber pacing method may be additional useful method in CRT non-responders with long interatrial electrical delay.