Left ventricular performance during single chamber atrial, dual chamber and biventricular pacing

Andi Eie Albertsen, MD

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Official opponents: Poul Erik Bloch Thomsen, Peter Søgaard, and Kristian Thygesen.

Supervisors: Jens Cosedis Nielsen, Steen Hvitfeldt Poulsen, and Henrik Egeblad.

Correspondence: Andi Eie Albertsen, Oegårdshoejen 15, 8800 Viborg, Denmark.

E-mail: Andieie@mail.dk

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ABSTRACT

The studies of this PhD dissertation were performed at the Department of Cardiology B, Aarhus University Hospital, Skejby.

Each year almost 3000 patients receive a cardiac pacemaker in Denmark. Patients with sick sinus syndrome are well treated with a single lead inserted in the right atrium (AAI(R)-pacing). However, electrical conduction disturbance between the atria and the ventricles (AV-block) is the most common cause of implanting a pacemaker and these patients need ventricular pacing most of the time. Thus, patients with AV-block receive DDD(R)-pacing through two pacing leads inserted into the right atrium and ventricle, respectively. Yet, experimental and clinical studies have indicated that DDD(R)-pacing can be harmful to some patients because dyssynchronous contraction of the left ventricular (LV) walls may compromise myocardial performance and lead to heart failure.

A new pacemaker type has been developed to treat patients with congestive heart failure, low ejection fraction (EF) and no heart rhythm disturbances. These biventricular (BIV)-pacemakers are connected to leads in the right atrium and ventricle. In addition a third lead is inserted to the LV making it feasible to pace both ventricles at the same time.

In the first study, 50 patients with sick sinus syndrome were randomized to either AAI(R)- or DDD(R)-pacing. Dyssynchrony was more pronounced during DDD(R)-pacing as compared to AAI(R)-pacing after 12 months of pacing. EF decreased significantly in the DDD(R)-group, while no change was observed in the AAI(R)-group.

In the second study, 50 patients with high grade AV-block were randomized to either DDD(R)- or BIV-pacing. Dyssynchrony was more prominent in the DDD(R)-group than in the BIV-group already at the baseline recording obtained within 12 hours of pacemaker implantation and significantly more prominent at the 12 months follow-up. In the DDD(R)-group EF decreased significantly during follow-up, while EF remained unchanged in the BIV-group.

In conclusion, the present PhD dissertation evaluated the impact of conventional DDD(R)-pacing on LV function. Both AAI(R)- and BIV-pacing were superior to DDD(R)-pacing regarding presence of regional LV dyssynchrony and overall LV performance. This PhD dissertation supports a long-term perspective of offering BIV-pacemakers to patients with AV-block eligible for pacemaker treatment, but large-scale trials with clinical endpoints are needed before a general recommendation can be proposed.