Advanced Image Supported Left Ventricular Lead Placement in Cardiac Resynchronization Therapy (ADVISE-CRT II trial)

Published: 12-09-2019
Last updated: 15-05-2024

To determine the safety, feasibility and efficacy of targeted left ventricular lead placement with CRT procedures, using the CARTBox software.

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Heart failures
Study type	Interventional

Summary

ID

NL-OMON49313

Source
ToetsingOnline

Brief title
ADVISE-CRT II trial

Condition

- Heart failures
- Cardiac therapeutic procedures

Synonym
Cardiomyopathy, heart failure

Research involving
Human

Sponsors and support

Primary sponsor: Universitair Medisch Centrum Utrecht

Source(s) of monetary or material Support: Ministerie van OC&W

Intervention

Keyword: Cardiac resynchronization therapy, CRT, Image fusion, Image guided intervention

Outcome measures

Primary outcome

Safety: radiation dose during the procedure, (serious) adverse events.

Efficacy: LV lead implantation within target (yes/no).

Secondary outcome

Long-term efficacy: LV end systolic volume reduction assessed by

echocardiography at 6 months after the CRT implantation.

Feasibility: overall CRT implantation procedure duration, time to perform the

placement of the LV lead, preparation time in the Cath lab.

Radiation time during the procedure.

Validation of 2D image registration compared to 3D image registration.

Software usability and feasibility of CARTBox during the lead placement

(questionnaire for the operator on the use of CARTBox before and during the LV

lead implantation).

Measures of acute electrical synchronization (QRS duration, QLVs).

Total cost of procedure and healthcare costs, using a Health Technology

Assessment (HTA) approach (in cooperation with Julius Clinical, UMC Utrecht).

Number of LV leads used, number of LV lead repositioning procedures.

Study description

Background summary

Chronic heart failure is a major cause of morbidity and mortality in the Netherlands. Heart failure accompanied by ventricular dyssynchrony, determined by a wide QRS complex on het electrocardiogram (ECG), is a predictor for worse prognosis. A wide QRS complex (>120ms) is present in about 25-50% of patients with chronic heart failure.

Cardiac resynchronization therapy (CRT) is an important therapy for patients with dyssynchronized heart failure (ventricular dyssynchrony). With a CRT device, a special pacemaker, the heart can be electrically stimulated (via 3 pacemaker leads in the heart) in order to achieve synchronized contraction once more. Unfortunately up to 30-40% of patients do not benefit from CRT. Suboptimal (left ventricular) lead positions are an imporant determinant for CRT non-response.

To place the CRT device the implanting cardiologist currently uses fluoroscopic projections (2D X-ray images) of the heart. With this approach, the optimal pacing site for the pacemaker leads, unfortunately, is not visible. For example, the pacemaker leads can not be placed to close to scarred myocardium since this can result in detrimental effects of the treatment. On the other hand, the left ventricular pacemaker leads should be placed in the latest mechanically activated region.

With a new techniqe we can merge MRI images of the heart (on which myocardial scar tissue and mechanical contraction timing can be identified) with the fluoroscopic 2D-projection made standard during CRT implantation. In order to achieve this fusion we need to perform an additional 3D-Xray scan of the heart (duration approximately 5 seconds). This 3D-Xray scan increases the total radiation exposure of the CRT implantation. Still, this technique potentially allows the physician to perform the therapy much more accurate than before at the optimal pacing location in the heart. Using this patient tailored approach we believe that response to CRT can be augmented. Previous research already demonstrated that targeted therapy (away from scar and toward the latest mechanical contraction) improves patients' symptoms and prognosis.

We have recently demonstrated in a small pilot study that using the CARTBox software, developed by CART-Tech B.V., the optimal location for LV lead delivery can be visualized during CRT implantation (METC number 16/242). The small sample size and study design however prevents us from drawing conclusion about the efficacy, safety and feasibiliy of real-time image-guided CRT implantations. Hence, as a next step, we want toinvestigate in a larger number of patients the feasibility, safety and efficacy of CRT implantations guided by CARTBox compared to standard CRT implantations.

Study objective

To determine the safety, feasibility and efficacy of targeted left ventricular lead placement with CRT procedures, using the CARTBox software.

Study design

Open interventional multi-center study with 30 prospectively included patients

Before CRT implantation, standard/routine cardiac MRI and echocardiography will be acquired. For the present study, MRI imaged will be analyzed with dedicated software. In this way, a 3D-MRI treatment file will be acquired using the CARTBox software. This 3D-treatment file will be fused with live fluoroscopic projections during CRT implantations. Fluoroscopic projections are routine for CRT implantation procedures, yet, in order to be able to fuse the 3D-treatment file with the fluoroscopic projections, an additional 3D-fluoroscopy scan is performed for the study.
With this approach, the CRT device can be targeted towards the pre-precedurally defined (via MRI) optimal pacing site. 6 months after implantation, patients will undergo a cardiac ultrasound to determine echocardiographic response to CRT. This is part of routine care in patients undergoing CRT, however, the follow-up echocardiography needs to take place in the implanting center.

Intervention

CRT procedure (conventional), but carried out under guidance of CARTBox software (new)

Study burden and risks

All patients will undergo an MRI scan. In rare cases (<1/1000) an allergic reaction can occur, such as an itch, nausea or small bumps on the skin. In the vast majority of cases these symptoms pass quickly. In extremely rare cases acute allergic reactions can occur, usually in subjects with known contrast allergies. Therefore, these subjects are excluded from participation in this study.
Recently nephrogenic systemic fibrosis (NFS) has been linked to administration of gadolinium-based contrast agents in subjects with renal failure. Therefore, subjects with renal failure are excluded from an MRI scan. No cases of NFS have been documented in patients without renal failure. The benefit of the Cardiac MRI is the knowledge of scar tissue, detailed description of LV function, and visualization of the LV region with late contraction where the LV lead has to be placed. For the patient, the additional burden of the MRI is the extra visit to the hospital and claustrophobic patients may not be able to undergo the assessment.

The risk and/or complications of the CRT implantation itself are not additional

to the study, as the CRT implantation with a quadripolar lead is a standard procedure in the UMC Utrecht. Cardiac MRI scan will be performed before CRT implantation.

During implantation a 3D fluoroscopy rotational scan is made. This is currently necessary to perform fusion of the MRI scan with fluoroscopy. In the ADVISE-I pilot study we measured there is an average 12% increase in radiation burden using the 3D rotational scan during CRT implantation. Detrimental effects of radiation, occur at a dose area product larger than 40 000 cGy/cm2. Whereas the threshold dose for skin erythema is 20 000 cGy/cm2. However in the ADVISE-I pilot study the total radiation dose remained well below these thresholds.

Importantly, because we want to get rid of the 12% additional radiation burden, we will test (see secondary objectives) if a new developed registration method based on 2D images instead of 3D images can replace the 3D rotational scan . For this reason we have developed a 2D registration method for fusing MRI with fluoroscopy. In the present study we will validate the performance of 2D registration with respect to 3D-rotational scan based registration in the first 5 patients. If this is successful we can use the 2D registration in the last 25 patients, this will omit the 3D rotational scan and 12% additional radiation burden in these patients. The total radiation burden will then likely be less compared to a normal/conventional CRT implantation.

The study can increase the response of patients to CRT. By fusing MRI images with fluoroscopy during LV lead positioning, the implanting physician can choose the most optimal position (out of scar and towards delayed contraction) for implanting the CRT device. A lead position away from the infarct area, and closest to or in the latest activated area will improve LV pump function. An improved response to CRT can improve quality of life and prognosis of heart failure patients. Especially patients with myocardial infarction and/or coronary artery stenosis (ischemic cardiomyopathy), since these patients are more often non-responders to CRT.

The study may also improve the procedure itself. With increased knowledge of an optimal lead position during implantation, future procedures can be conducted more easily. The implanting physician can choose a target vessel for optimal lead position. It can therefore shorten the procedure and prevent potential complications of prolonged procedures.

Contacts

Public
Universitair Medisch Centrum Utrecht

Heidelberlaan 100
Utrecht 3584 CX
NL
Scientific
Universitair Medisch Centrum Utrecht

Heidelberlaan 100
Utrecht 3584 CX
NL

Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

An indication for cardiac resynchronization therapy according to the current international evidence based guidelines for CRT (the 2013 European Society of Cardiology Guidelines for cardiac pacing and cardiac resynchronization therapy)
- Chronic heart failure;
- New York Heart Association functional class II, III, IV (ambulatory);
- QRS duration *120ms;
- Optimal pharmacological therapy;
- Left ventricular ejection fraction *35%;

Exclusion criteria

- Contraindications for implantation of a CRT device;
- Age <18 years or incapacitated adult;
- Pregnancy; if there is anamnestic doubt regarding postmenopausal state (<1 year since last menstruation), a urine hCG test (Alere) will be performed.
- Subjects with impaired renal function (severe renal insufficiency, GFR < 30 ml/min/1.73m2);

- Atrial fibrillation or atrial fibrillation during MRI
- Lactation;
- Documented allergic reaction to gadolinium;
- Documented allergic reaction to contrast agent;
- Impossibility to undergo a MRI scan (determined by using the standard contraindications for MR imaging as used for clinical purposes).
- Participation in another clinical study that prohibits or influences any procedures other than standard.

Study design

Design

Study type: Interventional

Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Treatment

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	05-12-2019
Enrollment:	30
Type:	Actual

Medical products/devices used

Generic name:	CARTBox
Registration:	Yes - CE outside intended use

Ethics review

Approved WMO

Date:	12-09-2019
Application type:	First submission
Review commission:	METC NedMec

Approved WMO

Date:	06-04-2020
Application type:	Amendment
Review commission:	METC NedMec
Approved WMO Date:	06-07-2020
Application type:	Amendment
Review commission:	METC NedMec

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

ID: 23393
Source: NTR
Title:

In other registers

Register	ID
CCMO	NL67885.041.19
OMON	NL-OMON23393