Cardiac resynchronisation therapy: results from daily practice in Rijnstate Hospital, Arnhem

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Background. Cardiac resynchronisation therapy (CRT) is an effective treatment to improve the clinical outcome of selected patients with heart failure. Clinical trials have studied clinical outcome and reported clinical improvements, but clinical consequences and results in daily practice are less well known. We evaluated clinical outcome in all patients with CRT implantation in our centre.

Methods. Data of 119 consecutive patients who met the criteria for CRT implantation in Rijnstate Hospital, Arnhem in the period 28 November 2000 until 1 January 2006 were collected. We analysed implantation procedure, hospitalisation for heart failure or other causes, mortality and device-related events.

Results. In total 119 patients (83 men, 36 women; mean age 69 years) were eligible for CRT. Before implantation they had received optimal pharmacological therapy. Implantation was successful in 97% of patients. Procedural-related complications were seen in eight patients. During follow-up, 22 patients (18.5%: 14 men, 8 women) died. Causes of death were heart failure (11 patients), sudden cardiac death (4 patients) and noncardiac death (7 patients). Hospitalisation occurred 81 times, of which 77 for cardiac reasons. In follow-up the estimated five-year cumulative survival was 70%.

Conclusion. This retrospective study from a single centre showed a high procedural success rate, low

prevalence of complications and low mortality in comparison to other studies. Despite better functional capacity, the hospitalisation rate due to heart failure was high. (*Neth Heart J* 2009;17: 6-8.)

Keywords: cardiac resynchronisation therapy, results, Arnhem

Cardiac resynchronisation therapy (CRT) is an established therapy to improve clinical outcome in selected patients with severe heart failure. Several studies have shown it to be effective in clinical outcome in large, well-selected populations.^{1-5,7,8} Clinical consequences of the implantation procedure and results in daily practice are less well studied.

We evaluated all patients with CRT implantation in our centre in the past six years to assess our clinical results.

Methods

In this retrospective study we collected clinical data and follow-up of 119 consecutive patients eligible for CRT in Rijnstate Hospital in Arnhem. All patients met the criteria for CRT implantation: New York Heart Association (NYHA) class III or IV heart failure, left ventricular ejection fraction <30%, a wide QRS complex and/or LV dyssynchrony at echocardiography (measurement of septal to lateral delay on tissue Doppler imaging on top of the signal at echocardiography). Patients with right bundle branch block were excluded.

Data about implantation procedure, hospitalisation for heart failure or other causes, mortality and device-related events were collected. We derived data from the electronic patient chart and general practitioners gave information about mortality.

Results

Patient characteristics

In total 119 patients (83 men and 36 women) with a mean age of 69 years received CRT. At the moment

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of implantation, 85 patients were in sinus rhythm, the other 34 in atrial fibrillation (table 1). To achieve optimal effect of resynchronisation, some of the patients with atrial fibrillation underwent His ablation before resynchronisation therapy. The patients with atrial fibrillation met all the criteria for CRT implantation, such as left bundle branch block (or dyssynchrony at echocardiography), NYHA class III or IV heart failure, and optimal medical therapy. Overall, patients were on optimal pharmacological therapy before CRT was performed. Our data do not allow a comparison between the effect of CRT in sinus rhythm and atrial fibrillation.

Twenty-six patients also received an implantable cardioverter defibrillator (ICD) in the same session, mostly as primary prevention after myocardial infarction causing heart failure.

In the first years of implantation of CRT devices in our centre, programming was not based on echocardiographic criteria but on the length of the QRS complex. The implanted devices could only stimulate the right and left ventricle at the same time. Later on, the newer devices had the possibility to stimulate the right and left ventricle separately. The delay between stimulation of the right and left ventricle was determined on the basis of the duration of the QRS complex as a result of it, striving for the shortest duration.

Procedure characteristics

Implantation in one session was successful in 116 (97%) patients. In three cases implantation with an epicardial electrode via video-assisted thoracoscopy was planned after the first attempt. But during preoperative evaluation it appeared that one of them had an inoperable lung carcinoma, and another one had severe respiratory failure making an operation impossible. The last one received CRT via video-assisted thoracoscopy.

Procedural-related complications were coronary sinus dissection in four patients, a large haematoma of the area around the pacemaker pocket after implantation in two patients, pneumothorax in one and respiratory failure leading to intubation during the procedure in one patient. The complication rate remained the same during the six-year study period.

Follow-up

Follow-up was complete in all patients with a mean follow-up of 18 months (range 0.3 to 60.9 months). During follow-up 22 patients (18.5%: 14 men, 8 women) died. Causes of death were heart failure in 11 patients, sudden cardiac death in four patients and noncardiac death (sepsis and cancer) in seven patients (table 2 and figure 1). The four patients who died a sudden death did not have an ICD. In follow-up the estimated one-year cumulative survival percentage was 85.6%, for two years it was 78.9% and for 60 months 69.9 % (figure 1).

Table 1. Patient characteristics.

Patient characteristics

Patients (n)	119
Male (n)	83
Female (n)	36
Mean age (years)	69
Range (years)	38-88
Medication	
- Spironolactone (%)	68
- ACE inhibitors (%)	92
- Anticoagulation (%)	96
- β -blockers (%)	86
Heart rhythm	
- Sinus rhythm (n)	85
- Atrial fibrillation (n)	34

Table 2. Mortality at a mean follow-up of 18 months.

Mortality at 18 months	n	%
Heart failure	11	9.2
Sudden cardiac death	4	3.4
Noncardiac death	7	5.9
Total	22	18.5

Figure 1. Kaplan Meyer curve for survival in the Arnhem population (119 patients).

There were 81 hospitalisations, 77 of which for cardiac reasons (table 3). The largest cause of hospitalisation was heart failure, followed by tachyarrhythmias. In a number of cases, pacemaker-related hospitalisation consisted of upgrading to CRT and IDC, because of

Table 3. Reasons for hospitalisation at a mean follow-up of 18 months.

Reasons for hospitalisation	N
Heart failure	32
Atrial tachyarrhythmia	15
Ventricular arrhythmia	5
Upgrading to CRT-D	7
Device-related complications	13
Other cardiac reasons	5
Noncardiac reasons	4
Total	81

CRT-D=cardiac resynchronisation device and implantable cardiac defibrillator.

ventricular tachycardia. Other pacemaker-related hospitalisations were due to diaphragm stimulation, end of life of the battery, dislocation of the LV lead, left subclavian vein thrombosis and recall by the pacemaker company.

Discussion

This single-centre study shows a high primary success rate of 97% for CRT treatment for heart failure. In other studies, the primary success rate was 92%.² This difference can be explained by the single-centre nature of our study with one operator in the first years of implantation. Furthermore, a proper comparison can be made with only a few studies because the clinical consequences (complications, device-related problems) of the implantation procedure and results are not well studied and described in the literature. No mortality due to the implantation was seen in our study. In the literature more serious complications such as bradycardia, hypotension or asystole and perforation of the coronary sinus requiring pericardiocentesis have been mentioned.^{2,3} But the complications of implantation procedures are not often described in the literature either. The remarkable low rate of ICD implantation is explained by the absence of a license to implant ICDs in our centre until June 2004

In this study the death rate from all causes was 18.5% with a mean follow-up of 18 months which matches well with the literature. All-cause mortality was seen in up to 20% with a follow-up period of 29 months.^{1,4,5} Hospitalisation due to heart failure seems to be high in our observation but in other studies this is quite similar, with a hospitalisation percentage of 39%.^{1,4,5,9}

Limitations

In the future it is important to describe all the steps of the implantation procedure and their consequences for a better evaluation of clinical practice. In this study we evaluated retrospective data on endpoints such as hospitalisation, mortality and device-related problems. We did not study the effects of the therapy given by a six-minute walk test or Vo_2 max. Nor did we evaluate quality of life.

Conclusion

This retrospective study from a single centre shows a high procedural success rate, a low prevalence of complications and a relatively low follow-up mortality in comparison with other studies. Despite cardiac resynchronisation therapy, the hospitalisation rate due to heart failure was high. ■

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