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Long term quality-of-life in patients with bradycardia pacemaker implantation ☆,☆☆

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ABSTRACT

Background: Health-related quality of life (HRQoL) values shortly after pacemaker (PM) implantation for bradycardia have been established, however little is known about long-term HRQoL.
Methods: Using the generic SF-36 and the PM specific Aquarel questionnaire, HRQoL was repeatedly measured during a 7.5 year follow-up period in 881 bradycardia PM recipients included in the large scale nationwide Dutch FOLLOWPACE study. HRQoL over time, corrected for age, gender, diabetes, hypertension, heart failure, cardiovascular disease and AV-synchrony, was assessed with a linear mixed model.
Results: Increased scores both on overall SF-36 and on all SF-36 subscales were observed shortly after implantation. Although scores on SF-36 gradually declined over time, scores remained improved over the measured pre-implantation values. Also, scores for almost all subscales remained increased throughout the 7.5 year observation period, except for physical functioning which showed a gradual decline several years after the initial rise. Additionally, higher scores on all Aquarel scales were observed after implantation. Scores on the arrhythmias and chest discomfort subscales improved and remained stable throughout follow-up (FU), whereas the dyspnea at exertion subscale showed a gradual decline during FU to reach pre-implantation values at 5 years.
Conclusions: Increased HRQoL is observed not only shortly after PM implantation, but also after long-term FU.
Clinical Trial Registration: ClinicalTrials.gov Identifier: NCT00135174; http://www.clinicaltrials.gov/ct2/show/NCT00135174.

1. Introduction

Health-related quality of life (HRQoL) represents the individual patient's well-being and functioning in daily life and has become a valuable resource in the recognition of the impact of therapeutic measures on patients' health [1]. Several studies have reported about HRQoL after pacemaker (PM) implantation for conventional reasons [13], showing a clear improvement in HRQoL values measured at several months [2–6] or 1 year after implantation [7,8].

However, PM implantation does not constitute a single intervention, but rather an ongoing treatment with successive device checks, and if required adjustments in pacing settings and repeated surgery for device replacement. PM therapy has an enduring impact on the recipient's life and therefore the assessment of long-term HRQoL after PM implantation matters even more than measurements shortly after implantation. Very few studies, however, report on long-term HRQoL in PM recipients [9].

The nationwide FOLLOWPACE study started in 2003 in the Netherlands, and was designed to evaluate short and long term outcomes in a contemporary, unselected prospective cohort of patients receiving a first PM for conventional bradycardia indications [13]. The aim of the present analysis was to measure the HRQoL during long-term follow-up. These findings can be applied to inform, counsel and reassure patients that undergo a PM implantation.

2. Methods

2.1. Patients

Patients for this HRQoL-substudy were recruited from the FOLLOWPACE study, a prospective nationwide, multicenter cohort study conducted in 23 PM centers in the Netherlands. The design of the FOLLOWPACE study has been published previously [10–12]. In brief, consecutive patients aged 18 years or older, who received a first

Abbreviations: PM, pacemaker; PCS, Physical Component Scale; MCS, Mental Component Scale; PF, physical functioning; RP, role limitations due to physical health problems; GH, general health perceptions; VT, vitality; SF, social functioning; RE, role limitations due to emotional problems; MH, general mental health.

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PM for a conventional reason for chronic pacing [13], were eligible. Patients were not eligible if they were taking any investigational drug or had a non-approved or investigational PM implanted. In addition, patients with diseases at implant that were likely to cause death or severe morbidity during the 1st year after implantation such as active cancer were excluded. All patients provided written informed consent before PM implantation, and were asked to confirm their consent regarding the HRQoL-substudy 2 years after implantation. This study complies with the Declaration of Helsinki and the protocol for this study was approved by the Ethical Commission of the University Medical Center Utrecht. The authors of this manuscript have certified that they comply with the Principles of Ethical Publishing in the International Journal of Cardiology. Inclusion took place from January 2003 till November 2007. Follow-up lasted until 1 November 2010.

2.2. Health related quality of life (HRQoL)

HRQoL was measured before PM implantation, and several times during follow-up, using the generic SF-36 questionnaire (Medical Outcomes Study Short-Form Health Survey) [14,15] and the validated Aquarel questionnaire [6,16], that was specifically developed for PM patients. Questionnaires were sent by postal service to all participants, and a reminder-letter with an additional copy of the questionnaire was sent in case the questionnaire was not returned within 6 weeks. All received questionnaires were classified around 6 month timeframes after PM implantation.

2.3. SF-36

The validated Dutch version of the SF-36 questionnaire was used to assess HRQoL [15,17]. It incorporates two composite scales – the Physical Component Scale (PCS) and the Mental Component Scale (MCS) [18] – derived from eight domains: physical functioning (PF), role limitations due to physical health problems (RP), bodily pain (BP), general health perceptions (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE) and general mental health (MH). All scores are scaled from 0 to 100, with lower scores representing a lower HRQoL.

2.4. Aquarel

The Aquarel (Assessment of QUality of life And RELated events) questionnaire was developed as a disease specific extension to the SF-36, for patients with cardiac rhythm disorders requiring chronic pacing. It consists of 23 additional questions related to cardiac complaints or rhythm disorders. The results of these questions can be summarized into three subscales: chest discomfort, dyspnea at exertion, and arrhythmias, each scaled from 0 to 100, with lower scores representing a lower HRQoL. The Aquarel is translated and validated in several languages [19,20].

2.5. Data analysis

We analyzed the HRQoL values during the entire follow-up using a linear mixed model [21]. An important advantage of these models is their robustness for dealing with missing follow-up measurements and different numbers of follow-up measurement across patients [21]. Further, to account for dependency across the repeated HRQoL measurements within the same patients we included an autoregressive residual (i.e. GEE type) covariance matrix [22,23], and a random intercept for individual differences in HRQoL between patients. As most HRQoL scales showed a skewed distribution, we used robust standard errors to estimate confidence intervals and to perform Wald tests [24]. The HRQoL values over time were corrected for the influences of gender, age, the presence of diabetes, hypertension, congestive heart failure, retained AV-synchrony (AAI/DDD opposed to VVI), and a history of cardiovascular disease (i.e. cardiac surgery, cardiac valve disease, coronary artery disease and prior stroke).

Additionally, we examined the determinants for long term HRQoL using the same linear mixed model. Statistical analyses were performed using SPSS for Windows (version 17; SPSS, Chicago, IL, USA) and SAS (version 9.2, SAS Institute Inc., Cary, NC, USA).

3. Results

1067 (70%) patients provided informed consent for the HRQoL substudy, at time of implantation. Of these, 16 patients withdrew their informed consent and 76 patients died before completing a second HRQoL questionnaire. Seven patients were incapable of returning a second HRQoL questionnaire due to dementia, 3 patients were lost-to-FU, and 84 patients did not respond to repeated reminders.

This resulted in 881 (82%) patients having at least 2 HRQoL measurements during follow-up that could be included in the analysis. Mean age at time of first implant was 72 years (SD 10.7) and there were 516 (59%) males (Table 1). Main indication for PM implantation was atrioventricular conduction disturbances in 364 (41%), sick sinus syndrome (SSS) or bradyarrhythmias in 304 (35%), and atrial fibrillation with slow ventricular response in 161 (18%), and a PM was implanted in 52 patients (6%) for other indications (e.g. hypersensitive carotid sinus syndrome). Most implanted PM systems were dual chamber devices (76%).

A total of 3221 HRQoL questionnaires were received during the 7.5 year observation period between first implantation in 2003 and the end of follow-up in November 2010. During follow-up, after the completion of a second HRQoL questionnaire, 175 (20%) patients died, and 20 (2%) patients at some point withdrew their informed consent, mostly reporting to be unable to fill out subsequent questionnaires because of age related problems, e.g. dementia or visual impairment. 72 (8%) patients did not respond to repeated reminders.

3.1. SF-36

The overall SF-36 and the MCS and PCS improved after PM implantation (Fig. 1, panel A). The largest increase in HRQoL was observed in the overall SF-36, and although scores gradually declined over time, values remained improved compared to pre-implantation values throughout our 7.5 year observation period. Scores on the MCS were improved as well, and scores remained stable during subsequent follow-up. Scores on the PCS however, only showed improved values during the first 2 years after implantation, followed by a slow decline to scores comparable to pre-implantation values thereafter.

3.2. SF-36 subscales

Higher values for all SF-36 subscales were observed one year after implantation compared to pre-implantation values, with the exception of GH scores (Fig. 1, panels B and C). Observed values for GH throughout the first 4 years were comparable to pre-implantation values, whereas slightly lower scores were observed thereafter. Similarly, observed scores for the PF scale were higher during the 1st year after

Table 1
Baseline characteristics of the 881 patients with multiple measurements of health related quality-of-life (HRQoL).

	n	%
Male	516	58.6
Age[a]	72.2 (10.7)	
Body mass index[a]	26.4 (3.6)	
History		
Atrial tachy-arrhythmias	330	37.5
Cardiac surgery (CABG or valve surgery)	151	17.1
Coronary artery disease	168	19.1
Cardiac valve disease	178	20.2
Congestive heart failure	92	10.4
Prior cerebrovascular accident	80	9.1
Diabetes	125	14.2
Hypertension	537	61.0
Use of anticoagulant drugs (ASA or coumarins)	524	59.5
Use of antiarrhythmic drugs	145	16.5
Main indication for implantation		
Atrio-ventricular conduction disturbances	364	41.3
Sick sinus syndrome, brady-tachycardias	304	34.5
Atrial fibrillation with slow ventricular response	161	18.3
Other	52	5.9
Implantation and PM related characteristics		
Vena subclavia used for venous access	803	91.1
Vena cephalica used for venous access	78	8.9
Single chamber system AAI(R)	15	1.7
Single chamber system VVI(R)	197	22.4
Dual chamber system	669	75.9
Passive atrial lead fixation	193	21.9
Passive ventricular lead fixation	627	71.2
Pacing mode at discharge		
Dual	637	72.3
Ventricular	205	23.3
Atrial	39	4.4

Data are presented as counts with percentages unless otherwise specified.
CABG: coronary artery bypass grafting; ASA: acetylsalicylic acid.
[a] Mean with SD.