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Research Article

Pacemaker Therapy in the Elderly and Very Elderly

Alexander Marschall*, Andrea Rueda Liñares, Belen Biscotti Rodil, Montserrat Torres Lopez, Carmen Dejuan Bitriá, Cristina Fraile Sanz, Juan Duarte Torres, David Martí Sánchez, Miguel Rubio Alonso and Hugo del Castillo Carnevali

Department of Cardiology, Central Defense Hospital, Madrid, Spain

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ABSTRACT

Background: The number of elderly patients undergoing pacemaker (PM) implantation is constantly growing. However, information on survival and prognostic factors of this particular patient group is scarce. The objective of this study was to determine the survival of elderly and very elderly patients undergoing PM implantation, as well as to investigate prognostic factors of mortality.

Methods: This is a retrospective observational study of a single center. Patients $\geq$ 80 years of age, that underwent PM implantation between January 2017 and December 2018 in our center, were included for chart review. Very elderly patients were defined as those with $\geq$ 90 years of age.

Results: A total of 269 patients were included in the study with a mean age of 85 ($\pm$4.1) years. 53 patients were $\geq$ 90 years of age. 52% of the patients were male. 24.5% of the elderly patients and 41.5% of the very elderly patients received a single chamber PM. Median follow-up time was 28 (14-30) months, with no significant differences between the two groups of patients. The mortality rate for elderly patients was 15.7% for the elderly and 32.1% for the very elderly (p = 0.002). Generating multivariate Cox regression models, the following parameters showed to be significant predictors of all-cause mortality: Age (1.37 (1.02-1.29), p = 0.005), chronic kidney disease (5.57 (2.47-12.56), p<0.001), COPD (3.74 (1.19-11.55), p = 0.023) and cancer (3.57 (1.02-12.51), p = 0.046). In the group of the very elderly only age (1.58 (1.10-2.27), p = 0.014) and cancer (3.76 (2.38-4.18), p = 0.003) significantly predicted mortality.

Conclusion: Our study shows a good life expectancy of elderly and very elderly patients that underwent PM implantation, with a survival rate that is comparable to the general population. The primary prognostic factors were non-cardiological and comorbidities, such as chronic kidney disease, cancer and COPD, had a stronger association with mortality than age.

Introduction

Cardiac permanent pacemaker (PM) implantation is a relatively minor surgical procedure associated with minimal patient discomfort [1]. The elderly and very elderly are the most rapidly growing segments of the population in developed countries and pacemakers are commonly implanted in this population [2]. However, little is known about the survival and prognostic factors of this particular subgroup of patients. Traditionally, the assumption is that the benefit of PM implantation in the elderly and especially in the very elderly is small, given that the decrease in cardiovascular arrhythmic mortality may be largely outweighed by non-cardiological death. However, the ESC guidelines

do not consider any specific age limit for PM therapy [1]. The objective of this study was to determine the survival of elderly and very elderly patients undergoing PM implantation, as well as to investigate prognostic factors of mortality.

Methods

This is a retrospective observational study of a single center. Patients $\geq$ 80 years of age that underwent PM implantation (both elective and non-elective) in our center between January 2017 and June 2018 were admitted for chart-review. Very elderly patients were defined as those with $\geq$ 90 years of age. In order to limit our cohort to new PM insertions,

*Correspondence to: Alexander Marschall, M.D., Department of Cardiology, Central Defense Hospital, Paseo de la Reina Cristina 26, 2B, 28014, Madrid, Spain; Tel: 0034640655742; E-mail: marschall.alexander@gmx.de

we excluded patients that underwent PM replacement and lead removal procedures. Indication for PM implantation was made according to the current European guidelines on Cardiac pacing and Cardiac resynchronization therapy. Implantation was performed according to our center's standard operating procedure, in agreement with standard transvenous techniques [1]. The procedure was carried out by a multidisciplinary team, including experienced interventional cardiologists, heart surgeons and anaesthesiologists. Intraoperative blood pressure was documented in the intraoperative anaesthesia record for all cases. Data analysis was performed in order to determine survival in the groups of elderly and very elderly patients. Furthermore, univariate and multivariate Cox regression models were generated in order to determine prognostic factors of mortality. Multivariate regression models allowed the inclusion of variables with P-value less than 0.10 in the univariate analysis or those of clinical significance. The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki, as reflected in a priori approval by the institution's human research committee.

Results

From January 2017 to June 2018, a total of 269 elderly patients were included in the study. The mean age was 85 ($\pm$4.1) years and 53 patients were $\geq$ 90 years of age. A total of 52% of the patients were male. 24.5% of the elderly patients and 41.5% of the very elderly patients received a single chamber PM. The median follow-up time was 28 (14-30) months, with no significant differences between the two groups of patients. There were no significant differences with regards to the baseline clinical characteristics and comorbidities. See (Table 1) for details. During follow-up, a total of 34 (15.7%) patients of the elderly group and 17 (32.1%) patients of the very elderly group died ($p = 0.002$). We found no statistically significant differences with regards to mortality between patients that received PM therapy for symptom relief and those with a prognostic indication ($p = 0.571$).

Table 1: Clinical baseline characteristics.

Clinical characteristics	Elderly (total), n=216	Very elderly, n=53	P value
Age	86.4 (4.2)	92.8 (1.9)	< 0.001
Sex - male - %	53	50	N/S
Arterial hypertension - %	85	90	N/S
Diabetes mellitus - %	34	37	N/S
Dyslipidemia - %	47	50	N/S
Atrial fibrillation - %	43	47	N/S
Chronic kidney disease - %	22	39	N/S
History of Myocardial infarction - %	18	27	N/S
Moderate- Severe aortic stenosis - %	4	0	N/S
Moderate – Severe Mitral regurgitation - %	9	7	N/S
Stroke - %	8	18	N/S
Peripheral vascular disease - %	3	4	N/S
Dementia - %	13	14	N/S
Cancer - %	7	7	N/S
COPD - %	8	7	N/S
Charlson	4 (4-6)	5 (4-7)	N/S

Furthermore, we did not find significant differences regarding the survival rate between patients that underwent PM implantation on an ambulatory basis and those that were admitted through the emergency department for urgent PM implantation ($p = 0.518$). However, patients with implantation in an emergency setting were significantly more likely to present excess of the length of in-hospital stay (LOS) than patients undergoing elective PM implantations (59% vs 8%, respectively; $p < 0.001$). Generating multivariate Cox regression models, the following parameters showed to be significant predictors of all-cause mortality: Age (1.37 (1.02-1.29), $p = 0.005$), chronic kidney disease (5.57 (2.47-12.56), p<0.001), chronic obstructive pulmonary disease (COPD) (3.74 (1.19-11.55), $p = 0.023$) and cancer (3.57 (1.02-12.51), $p = 0.046$). In the group of the very elderly only age (1.58 (1.10-2.27), $p = 0.014$) and cancer (3.76 (2.38-4.18), $p = 0.003$) significantly predicted mortality. See (Table 2) for more details.

Table 2: Adjusted Cox regression models for the prediction of all-cause mortality.

Prognostic factors – HR (95% CI)	Elderly (n=216)	p-value	Very elderly (n=53)	p-value
Age	1.37 (1.02-1.29)	0.005	1.58 (1.10-2.27)	0.014
CKD	5.57 (2.47-12.56)	< 0.001	-	-
Dementia	-	-	-	-
COPD	3.74 (1.19-11.55)	0.023	-	-
Cancer	3.57 (1.02-12.51)	0.046	3.76 (2.38-4.18)	0.003

CKD: Chronic Kidney Disease; HR: Hazard Ratio; COPD: Chronic Obstructive Pulmonary Disease.

Discussion

The current study investigates the survival of elderly and very elderly patients post PM implantation. The main findings of our study can be summarized as followed: 1) The life expectancy of elderly and very elderly patients that underwent PM implantation is good. 2) The survival rate is actually comparable to the general population. 3) The primary risk factors for mortality were non-cardiological. Due to the increased life expectancy, implantation of PM in the subgroups of elderly and very elderly patients has become more common recently [2]. However, clinical evidence on the outcomes of these patients is scarce since these patients are mostly excluded from large clinical trials due to their age. Traditionally, the assumption is that the benefit of PM implantation in the elderly and especially in the very elderly is small, given that the decrease in cardiovascular arrhythmic mortality may be largely outweighed by non-cardiological death. We showed an actually good survival rate of elderly patients, which is in line with previous studies performed in elderly patients in a population-based study [3].

In addition to age, other factors showed to be significant prognostic factors for mortality, such as chronic kidney disease, COPD and cancer. These findings are expected and the non-arrhythmic causes of death may attenuate the possible benefit of reduction in cardiovascular arrhythmic mortality in elderly patients [4]. However, given the good life expectancy of elderly and very elderly patients found in our study, PM therapy proves to be beneficial for these subgroups of patients. Our study shows a good life expectancy of elderly and very elderly patients that underwent PM implantation, with a survival rate that is comparable to the general population. The primary prognostic factors were non-cardiological and comorbidities, such as chronic kidney disease, cancer and COPD, had a stronger association with mortality than age.

Declaration

All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

Conflicts of Interest

None.

Funding

None.

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