Research Article

Comorbidities Vs Age as Major Predictor of Prolonged Length of in-Hospital Stay in Patients Undergoing New Pacemaker Implantation

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ABSTRACT

Traditionally, advanced age has been considered a major factor for increased LOS and healthcare costs. However, recent studies suggest that comorbidity may have an equal, if not greater, effect on LOS and mortality as age in a variety of clinical scenarios. The elderly are the most rapidly growing part of the population in developed countries and pacemakers (PM) are commonly implanted in this population. In this retrospective study, we aimed to evaluate the impact of comorbidity on LOS and mortality, as compared to age, in patients undergoing new PM implantation. 257 elective and non-elective patients that underwent new PM implantation were included in the study. The median follow-up time was 20 (15-25) months. A Charlson comorbidity index (CCI) > 1 resulted to be a significant predictor for the excess of LOS, whereas age did not significantly predict excess of LOS. Elderly patients (age > 75 years) with low comorbidity burden (CCI < 1) showed no significant differences with regards to LOS and mortality when compared to younger patients. Considering the findings of our study, when considering patients for PM implantation, comorbidity burden rather than age should be the driving factor in the approach of indication of PM implantation.

Introduction

Cardiac permanent pacemaker (PM) implantation is a relatively minor surgical procedure associated with minimal patient discomfort [1]. The length of in-hospital stays (LOS) of patients that have undergone PM implantation has been as long as 7 to 10 days in the early years [2]. Advances in pacing technologies and surgical techniques have made cardiac pacing an extremely safe and cost-effective therapy, which is why in recent years LOS decreased continuously. Furthermore, elective same day new pacemaker implantation has shown to be safe and feasible for a selected group of patients and indications [3]. LOS has a crucial impact on healthcare costs, thus a reduction in LOS implies great potential for savings for the healthcare system [3]. Traditionally, advanced age has been considered a major factor for increased LOS and healthcare costs. On the other hand, the elderly and extreme elderly are the most rapidly growing segments of the population in developed countries and pacemakers are commonly implanted in this population [4]. However, recent studies suggest that comorbidity may have an equal, if not greater, effect on LOS and mortality as age in a variety of clinical scenarios [5, 6]. The objective of this study was to evaluate the impact of comorbidity on LOS and mortality, as compared to age, in patients undergoing new pacemaker implantation.

Methods

In this retrospective study, patients that underwent PM implantation (both elective and non-elective) in our centre between January 2017 and June 2018 were admitted for chart-review. In order to limit our cohort to new PM insertions, we excluded patients that underwent PM replacement and lead removal procedures. Furthermore, we excluded patients that underwent other invasive procedures, such as percutaneous coronary intervention, coronary bypass surgery or heart valve surgery,
in order to minimize confounding factors. The Charlson comorbidity index (CCI) was calculated for all patients in order to evaluate their comorbidity burden [7]. Excess in LOS was defined as an in-hospital stay greater than 3 days. Complications included procedure related infections and haemorrhages, pneumothorax and cardiac perforation with pericardial effusion and tamponade [8]. 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]. Univariate and multivariate Cox regression models were generated in order to evaluate the impact of CCI and age on LOS and all-cause mortality. Multivariate regression models allowed inclusion of variables with P value less than 0.10 in the univariate analysis or those of clinical significance. Furthermore, we compared the excess of LOS in elderly patients (i.e. ≥75 years) and low comorbidity burden (i.e. CCI ≤ 1) with younger patients (i.e. < 75 years).

Table 1: Clinical characteristics.

| Características                  | n=257 |
|---------------------------------|-------|
| Age, years                      | 81.4 (±7.9) |
| Sex, male - n (%)               | 151 (57.2) |
| Hypertension - n (%)            | 212 (82.5) |
| Diabetes mellitus - n (%)       | 79 (30.7) |
| Dyslipemia - n (%)              | 118 (45.9) |
| Atrial fibrillation - n (%)     | 99 (38.5) |
| Chronic kidney disease - n (%)  | 46 (18.2) |
| Myocardial infarction - n (%)   | 42 (16.3) |
| Stroke - n (%)                  | 20 (7.9) |
| Peripheral vascular disease - n (%) | 8 (3.2) |
| Dementia - n (%)                | 27 (10.7) |
| Cancer - n (%)                  | 15 (5.9) |
| COPD - n (%)                    | 28 (11.1) |
| CCI, median (IQR)               | 1 (1-3) |
| Type of pacing, DDD - n (%)     | 199 (77.7) |

CCI: Age Independent Charlson Comorbidity Index; COPD: Chronic Obstructive Pulmonary Disease.

Results

A total of 257 patients with a mean age of 81.4 (±7.9) were included in the study. Details on demographic data and comorbidity are summarized in (Table 1). The median follow-up time was 20 (15-25) months. 201 (78%) patients received a dual chamber PM and 169 (66%) of the patients underwent PM implantation in and non-elective setting. Median LOS was 3 (3-5) days and the short-term complication rate (at 4 months of follow-up) was 5.3%. A total of 110 (43%) patients had a LOS of > 3 days, with patients undergoing PM implantation in an emergency setting being significantly more likely to present excess of LOS than patients undergoing elective PM implantations (59% vs 8%, respectively; p < 0.001). In multivariate binary logistic regression models (including CCI > 1, age and type of PM), the presence of CCI > 1 resulted to be a significant predictor for the excess of LOS (HR 4.68, 95% CI: 2.3-9.4, p<0.001). However, age did not significantly predict excess of LOS.

Table 2: Adjusted binary logistic regression models and Cox regression models.

| Predictors | HR (95% CI) P- value |
|------------|----------------------|
| Excess in LOS* |                       |
| - CCI >1    | 4.68 (2.3-9.4)<0.001    |
| - Age       | 1.0 (0.6 – 2.2)0.69      |
| Excess in LOS* |                       |
| - CCI >1    | 7.3 (3.1-17.3)<0.001    |
| - Age       | 1.15 (1.1-1.2)0.59      |

CCI: Age Independent Charlson Comorbidity Index; CI: Confidence Interval; HR: Hazard Ratio; LOS: Length of in-Hospital Stay. 
*LOS > 3 días; Adjusted binary logistic regression models, **Adjusted Cox regression models; Covariates for all models: CCI >1 (dichotomous), Age, Type of pacing (dichotomous)

Discussion

The current study investigates the predictive value of comorbidity burden as assessed by CCI regarding LOS and mortality in patients undergoing new PM implantation. The main findings of our study can be summarized as followed: 1) High comorbidity burden, but not age is a significant predictor for excess of LOS in patients undergoing new PM implantation. 2) Neither age, nor CCI predict short-term device related complications. 3) Patients with low comorbidity burden have a similar risk for excess of LOS and mortality as younger patients. Our findings are in line with previous studies that found a higher mortality for patients with a CCI > 1 in elderly patients undergoing implantable cardioverter defibrillator (ICD) implantation and elderly patients that underwent PM implantation [4, 5]. We extend these findings to LOS and compared the results of elderly patients to the outcomes of younger patients. Our study results suggest that elderly patients with a low comorbidity burden and younger patients may have comparable outcomes with regards to LOS, device related complications and mortality. Previous studies have found that PM implantation improves quality of life in the elderly [9]. Thus, advanced age should not be a limiting factor for the indication of PM therapy. Considering the findings of our study, when considering patients for PM implantation, comorbidity burden rather than age should be the driving factor in the approach of indication of PM implantation.

Funding

None.

Conflicts of Interest

None.
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