Review Article

Interventional Cardiology

Mystery pacemaker-induced cardiomyopathy

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Introduction

Recently, the largest prospective study regarding Pacemaker-Induced Cardiomyopathy (PICM) in 55 outpatient clinical patients was published, in which an improvement of the left ventricular function after receiving an upgrade to Cardiac Resynchronization Therapy (CRT) was analyzed. CRT upgrade in outpatient clinic patients with PICM, even with an age>80 years, can improve left ventricular function, patients` functional capacity and is associated with an acceptable complication rate [1].

A stringent analysis of the literature on PICM shows that, contrary to the first assumption, we still know far too little about this common complication of a pacemaker therapy. In the following study we want to summarize what is known about the PICM and especially which open questions exist.

Keywords: Pacemaker induced cardiomyopathy • Cardiac resynchronization therapy

Review Pacemaker-Induced Cardiomyopathy

What we know

Applying the usual PICM definition (drop in LVEF>10%, resulting in an LVEF<50%), its prevalence is estimated in between 10%-20% [2]. The pathophysiological substrate is a right ventricular pacing (rv pacing) induced electromechanical desynchrony. Older age, male gender, RV-pacing >40%, long QRS duration, and impaired LVEF are recognized predictors of PICM [3]. CRT upgrade is the therapy of choice for PICM and the responder rates (70%-90%) are higher than in other cardiac entities [4]. The complication rate of CRT upgrades is low in clinical practice [5], and a CRT upgrade in PICM can also be successfully performed in older patients (>80 years) [1].

What we don't know

Why do 80%-90% of patients with right ventricular pacing and consecutive asynchrony not develop PICM? According to the disappointing results of the PROSPECT trial, the echocardiographic asynchrony measurement in the PICM does not have convincing scientific evidence [6]. Are the measurement methods too poor or have we not properly understood the pathophysiology of the disease yet? Why do patients develop PICM within the first year of pacing and others after many years? On average, the time interval between the start of pacemaker therapy and the diagnosis of PICM is 4.3+3.9 years [7]. Why is the interindividual variability of the course of LVEF before and during PICM that high? The spectrum ranges from a sudden to continuous decline or a stabilized LVEF at a reduced level [1].

Why do we know so little?

The awareness of this disease is still too low. Although PICM is a common complication of pacemaker therapy, it is not explicitly mentioned in the 2021 ESC guidelines on cardiac pacing and resynchronization therapy [8]. The diagnosis is difficult because

it is an exclusion diagnosis that requires a high diagnostic effort and overlaps with other cardiac diseases are possible. However, scientific studies on PICM only make sense if all patients in whom other diseases may also have led to the reduced LVEF consequently be excluded. In our recently published PICM registry [1], despite a high volume center, we only succeeded in making a stringent diagnosis of PICM (LVEF<45%) in 66 patients within 4 years. Such a low patient number significantly limits the validity of each study. We are therefore only aware of two prospective studies on PICM [9]. All other published trials have a retrospective design.

What should we do?

The current state of knowledge on PICM can only be improved if we establish a multicenter CRT registry. Only with a multicenter design can the patient numbers be reached to answer the above questions. Placebo-controlled studies in PICM are not feasible due to ethical reasons, since both, drug optimization and CRT upgrading, are seen as a standard of care in PICM.

Conclusion

Without multicenter studies, the PICM will continue to be a mystery in many parts. Until there is no better understanding of this disease, the only option is to proceed as other authors have suggested and perform echocardiography at least once a year after pacemaker implantation, especially for patients with symptoms of heart failure. According to the guidelines, drug optimization should be carried out after the diagnosis of PICM. A CRT upgrade should be performed if the LVEF an NYHA class do not improve.

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