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Pacemaker Patients with High Level of Risk

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Abstract: In this paper, Cardiac pacing is a safe and effective therapy for multiple bradyarrhythmic conditions [1]. However, incorrect perceptions about the safety of daily activities (SODA) may impair patients' absolute well-being [2]. Chagas' disease (CD) is a chronic protozoan infection caused by Trypanosoma cruzi. Cardiac compromise occurs in up to 30% of CD patients and can manifest as severe bradyarrhythmias. erforated ICD leads were 7F in six of seven ICD patients, whereas only one 9F ICD was represented in our series. The majority of perforated electrodes were active fixation screw in leads.

Keywords: Pacemaker, Risks, Cardiac, Recorded

I. INTRODUCTION

Pacemaker is medical device which often installed in people who are suffering from irregular heart rhythms or slow heartbeat. Highly symptomatic patients with hypertrophic obstructive cardiomyopathy (HOCM) irresponsive to medical therapy are treated with surgical myectomy, dual-chamber pacing or alcohol septal ablation (ASA) [1]. Based on single-center studies or national registries it seems that both short- and long-term outcomes of ASA are acceptable [2]. The most frequent major complication associated with ASA is the mostly self-terminating complete heart block (CHB) that occurs in 20–50% of patients and requires permanent pacemaker implantation in 9–20% of all ASA patients [2,3]. Accordingly, this retrospective study was undertaken to evaluate the long-term outcome of patients who underwent early permanent pacemaker implantation due to post-ASA CHB.

Transvenous pacemaker implantation in the pediatric patient population has markedly increased in the last decade. The progressive improvements in technology and equipment and the increase in device and procedure complexity have raised the risk of infectious and non-infectious complications. Furthermore, alternative approaches for pacemaker implantation such as subpectoral and subglandular placement have been reported however also these techniques may complicate such as erosion, dehiscence and dislodgment. Consequently, a subset of these patients faces the eventual need for lead extraction. Nowadays, the evolution of transvenous lead extraction (TLE) technology and greater operator experience have improved procedure safety and success. We report the case of leads and device extraction in a 16-year-old girl with erosion of a pacemaker previously implanted in the left subpectoral region. Case description: A 14-year-old woman was diagnosed with a congenital atrioventricular complete block.

Therefore, a dual chamber pacemaker implantation in the left pectoral region was performed through left subclavian vein access with passive right atrial appendage lead fixation and active right septal ventricular lead fixation. A subcutaneous tunnel was created with blunt dissection across the anterior chest and leads were anchored in the left pectoral region. After 3 months, the patient underwent surgical pocket revision for initial pacemaker pocket decubitus.

A comparison of the clinical and echocardiographic characteristics of paced and non-paced patients at follow-up. Among the patients with an implanted pacemaker, 11 (65%) restored AV conduction during follow-up (up to 6 months in all these patients). Ten patients (59%) were on sinus rhythm, one patient (6%) had atrial fibrillation and six patients (35%) were paced at follow-up. Accordingly,

the long-term permanent pacemaker dependency was 4% from all ASA patients. In the non-paced group, three patients (2%) underwent late pacemaker implantation (12–53 months after ASA) for sick sinus syndrome or advanced heart block.

II. RECORDED PARAMETERS

Between 2001 and 2011, 26 patients were identified to have been treated for lead perforation in the Charite departments of cardiology or cardiovascular surgery. Twelve patients were not primarily implanted in our hospital and were referred by other hospitals. During this time period, about 3,000 devices were implanted in our hospital. Baseline characteristics of the cohort and the control group are outlined in Table I. A PM system had been implanted in 19 patients, and seven were treated with an ICD. Six ICDs were implanted for secondary prevention mostly due to coronary artery disease (five patients). One ICD was implanted for sustaining ventricular tachycardia in a congenital heart disease. The PMs were mostly implanted to treat atrioventricular (AV)-block (four patients AV-Block II°, 10 patients AV-Block III°). In five patients, the indication was sick sinus syndrome. Female gender was slightly preponderant. LVEF was pre-dominantly normal in PM patients, but severely reduced in ICD patients. A minority had coronary artery disease, arterial hypertension, or valve disease, respectively.

Several factors contribute to the high prevalence of CD in our study population (60.8%). The state of Goias, in central Brazil, has a CD prevalence higher than national average [3,6]. Furthermore, most of our patients lived in rural areas since an early age and were subsequently exposed to the CD vector. Finally, selection bias is possible if physicians were more likely to check serology in patients at highest risk for CD. However, a previous study found a similar prevalence of CD (56%) among PMPs in a neighbor Brazilian state [7]. Chagas' cardiomyopathy is characterized by HF, sudden death, arrhythmias, and thromboembolic events [3]. Although we observed a significantly increased CV mortality rate among PMPs with CD, after adjustment for the presence of HF symptoms, there was no difference in CV mortality. Indeed, HF has been shown to decrease survival in CD patients [9]. Interestingly, CD etiology is also associated with decreased survival in HF patients [10]. Our study has limitations. We used a non-validated questionnaire, given that a similar validated tool was not found in the literature. Moreover, the cross-sectional design for QoL evaluation does not allow for determination of causality figure 1.

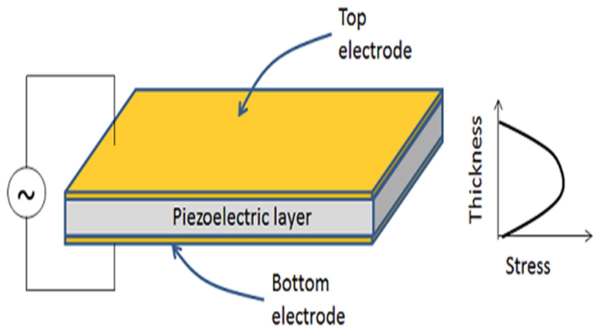

Figure 1: Pacemaker in future

The increasing availabilities of pediatric-compatible transvenous devices with reduced diameter leads and smaller size generators have led to an increasing frequency of transvenous device implants in younger pediatric patients. In such population, esthetic alternative implantations such as subpectoral or inframammary approach may be considered, however also these approaches may complicate with infection or dehiscence of device [19]. Notably, several studies have documented the high incidence of lead failure in pediatric and congenital heart disease patients and lead revisions and replacements may occur several times over the extended lifespan of a patient implanted at a young age. Therefore, knowledge around the process of lead extraction is essential in providing comprehensive care for this group of patients.

III. RISK FACTOR OF PERMANENT PACEMAKER

Permanent pacemakers (PPMs) are increasingly being used for the prevention and treatment of various cardiac rhythm disturbances. According to 1 estimate [1], there were <3 million functioning PPMs worldwide in 2000, and the number of PPM placements has continued to increase. In the United States, there was a 42% increase (from 3.26 per 1000 to 4.64 per 1000) in the cardiac device implantation rate among Medicare beneficiaries from 1990 to 1999 [2].

The rate of PPM infection has been out of proportion to that of device placement [2], and this infection is associated with substantial morbidity, mortality, and financial cost [3,4–5]. The estimated cost of the combined medical and surgical treatment of an infected, pacemaker-defibrillator system in the United States was ~$35,000 [6]. The resultant financial burden necessitates that a better understanding of the risk factors for PPM infection be achieved so that effective preventive strategies may be developed. Several factors have been anecdotally reported [7] to be associated with an increased the risk of PPM infection, including diabetes mellitus, malignancy, operator inexperience, advanced age, corticosteroid use, anticoagulation, recent device manipulation, chronic renal failure, and bacteremia from a distant focus of infection. To date, there have been only 3 risk factor analyses of electrophysiologic device infection reported that included statistical modeling [8], of which combined PPMs with implantable cardioverter-defibrillators (ICDs) in their respective statistical analyses. As demonstrated in a recent study, however, the risk of infection is higher among recipients of ICDs, compared with that in patients with PPMs. Thus, a combined risk factor analysis with both types of electrophysiologic device may not be appropriate on the basis of current knowledge. In the remaining investigation, which examined only PPMs, there were only 6 cases of device infection; this limited the interpretation of statistical modeling results. Therefore, the current case-control investigation was performed using multivariable analysis to better define risk factors of PPM infection.

Sentinel results collected from 2 different large databases (National Hospital Discharge Survey and Medicare) in the United States are congruous; contemporary rates of electrophysiologic cardiac device infection are strikingly out of proportion to the rates of device placement, and this difference in rates has accelerated in recent years [2]. In 1 survey, there was a 49% increase in the number of new device implantations from 1996 to 2003. This observation is understandable, because indications for the use of these devices have expanded. In contrast to the number of device placements, the number of hospitalizations of patients with device infection increased by <3-fold during the same period. Interestingly, the increased infection rates differed for patients with PPM infection (2.8-fold), compared with that of patients with ICD infection (6-fold).

IV. DISCUSSION

This is the first study of its kind, characterizing the electrophysiological substrate in patients with hereditary LQTS. Noninvasive ECGI made it possible to map with high resolution the entire ventricular epicardium of the intact heart in unanaesthetized patients. The panoramic mapping was essential for the characterization of the substrate.

The results indicate that there is significant prolongation of the action potential on the ventricular epicardium of congenital LQTS patients compared with normal control. The prolongation is consistent with the clinical phenotype of long QT interval on the body-surface ECG. Although the epicardial activation was normal in all types of LQTS studied (LQT1, 2, 3, and 5), there was a marked increase in heterogeneity of ventricular recovery on the epicardium which caused significant delay in repolarization in certain

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regions. These regions were located in close proximity (<10 mm) to regions with earlier recovery, resulting in abnormally large differences (>100 ms) in recovery time and ARIs on the epicardium. This is in marked contrast with the normal heart,21 where the mean left ventricular apex-to-base ARI dispersion was only 42 ms and average left ventricular ARI exceeded RV ARI by only 32 ms. With ARI being the surrogate for local APD, these findings reflect spatially heterogeneous prolongation of the action potential, causing the formation of regions with steep dispersion of repolarization.

Compared to published registry data representing unselected PM patients, the study cohort was remarkably younger. Although the sample contained a minority of ICD patients, who are known to have a lower mean age, we would have anticipated an average age in the mid-70s as PM patients constituted the vast majority in the study. Hence older age, according to our results, cannot be regarded a specific risk factor for lead perforation, contrary to what had been postulated in previous publications. Female gender was slightly more frequently represented in our perforation group compared to registry data from unselected populations. In 2012, for comparison in our hospital 62% of patients undergoing device implantation were male.

Three previous studies showed that concomitant S-AFA also increases the risk for PPM requirement in a group of patients referred for S-AFA. 5e7 Pecha et al 5 studied 594 patients who underwent S-AFA and found that the rate of PPM implantation was 6.9% at 30 days. Similarly, Worku et al 7 reported retrospective data on 701 patients who underwent S-AFA that showed a 7.6% risk for postoperative PPM implantation. These 2 descriptive studies did not include comparison cohorts, as did ours. A study by Gammie et al 6 showed that S-AFA increases the risk for postoperative PPM implantation in patients who undergo S-AFA at the time of MV surgery. This study did not describe the risk for PPM implantation when S-AFA was done concomitantly with CABG or CABG and valve surgery. RA ablation appears to increase the risk for PPM requirement. A superior vena cavaeinferior vena cava line can potentially damage the sinus node, while a tricuspid valve isthmuseinferior vena cava line can approach the atrioventricular node limb and increase the risk for atrioventricular block. Others have shown that RA lesions might increase the postoperative risk for PPM implantation. Although the risk for PPM requirement was more than 2.5 times higher in patients who underwent biatrial ablation compared with isolated LA ablation (6.76% vs 2.56%), the difference was not statistically significant (p ¼ 0.225). This is probably due to the small number of patients requiring pacemakers.

V. CONCLUSION

female gender appears to put patients at slightly increased risk for postoperative lead perforation. By contrast, and despite meticulous radiological evaluation, wall thickness did not predict perforation. Chest pain, phrenic stimulation, or exit block early after PM implantation must prompt radiological and echocardiographic evaluation. By contrast, sensing over a perforated lead is frequently preserved and cannot exclude
perforation.

BMI and misperceptions about the SODA were found to be determinants of impaired QoL in our population of PMPs. Our findings suggest that health care professionals should provide PMPs with culturally and socially appropriate education regarding the SODA. in non-paced patients undergoing the first ASA procedure, a permanent pacemaker was implanted in 10% of cases and there were no significant differences in i) long-term survival, ii) outflow pressure gradient at the most recent examination and iii) NYHA functional class at the most recent examination between patients with and without a post-ASA implanted pacemaker for procedure-related CHB.

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