The Prevalence of Echocardiographic Accretions on the Leads of Patients with Permanent Pacemakers

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Background: The aim of this study was to investigate the prevalence and clinical significance of echocardiographic "accretions" on intracardiac leads in patients with permanent pacemakers.

Methods: Two hundred eleven patients with permanent cardiac pacemakers implanted between 1988 and 2005 were called by telephone to participate in this study. The cohort was identified retrospectively and followed prospectively after recruitment. Seventy-five patients who agreed to participate in the study were examined by using transthoracic and transesophageal echocardiography for the detection of pacemaker lead accretions. Blood samples were also obtained for aerobic and anaerobic cultures, high-sensitivity C-reactive protein, erythrocyte sedimentation rate, and complete blood count. The medical records of the patients were analyzed carefully, and patients were called by telephone to investigate mortality and clinical events after 5 years of follow-up.

Results: The initial study group included 28 women and 47 men (mean age, 60 ± 15 years). At least one echocardiographic accretion on the pacemaker leads was identified in 16 subjects (21%) by transthoracic echocardiography and in 21 subjects (28%) by transesophageal echocardiography. All accretions were in the right atrial portion of the leads, whereas the ventricular segments of the leads were free of accretions. Patients with pacemaker lead accretions were significantly younger than those without accretions ($P = .03$). At 5-year follow-up, information could be obtained from 60 of the 75 patients. Among these 60 patients, 28 (46%) had died. There was no difference in mortality between patients who did and did not have lead accretions ($P = .96$). Patients who died during follow-up were older ($P < .001$), had shorter time intervals from pacemaker implantation to study enrollment ($P = .002$), had increased left atrial ($P = .007$) and right atrial ($P = .04$) sizes, and had higher pulmonary artery systolic pressures ($P = .012$) than those who were alive at 5 years. Logistic regression analysis revealed that age and pulmonary artery systolic pressure were independent predictors of mortality.

Conclusions: Accretions on permanent pacemaker leads can be detected by both transthoracic and transesophageal echocardiography. Follow-up data did not demonstrate any effect of these accretions on 5-year survival. (J Am Soc Echocardiogr 2011;24:803-7.)

Keywords: Pacemaker lead, Accretion, Echocardiographic mass

Infective endocarditis of a permanent pacemaker lead is a life-threatening condition that requires intensive antibiotic therapy with or without complete extraction of the pacemaker system.[1] These vegetations might be detected with up to 96% sensitivity by transesophageal echocardiographic (TEE) imaging, which is the gold standard in diagnosis.[2,3] Although the typical echocardiographic appearance of lead vegetation with clinical findings is sufficient for the diagnosis of infective endocarditis, echocardiographic examinations of patients with permanent cardiac pacemakers sometimes reveal thin, relatively homogenous, mobile and fibrillary masses, which do not resemble vegetations.[4,5] These masses, which are particularly observed during TEE examinations of patients with mechanical prosthetic heart valves, are called "accretions."

There are numerous data in the literature on mechanical heart valve accretions and infective endocarditis of permanent pacemaker leads. Although correlates[6,7] and clinical consequences[5,8,9] of prosthetic valvular accretions are well known, there is limited information on patients with pacemaker leads.[10] In this study, we investigated the prevalence and the clinical significance of transvenous lead accretions in patients with permanent pacemakers.

METHODS

Study Group

Two hundred eleven patients who underwent permanent pacemaker implantation in the Kartal Kosuyolu Heart Education and Research Hospital between 1988 and 2005 were telephoned and invited to

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Abbreviations

AV = Atrioventricular

hs-CRP = High-sensitivity C-reactive protein

TEE = Transesophageal echocardiographic

TTE = Transthoracic echocardiographic

participate in this retrospective study. Detailed histories were obtained, and physical examinations were performed at the initial visit. Thirty-nine patients refused to participate in this study, 24 had received either antibiotic or anticoagulant drugs within the past 2 weeks at that time, 27 had active infections, 13 had histories of infective endocarditis or pulmonary embolism, and 33 had declined to undergo TEE examinations. These patients were excluded from this study, and information regarding nonparticipants had no effect with respect to our final analysis. The remaining 75 patients constituted the study population. The indications for pacemaker implantation, the types of leads, and the New York Heart Association functional classes of the patients during pacemaker implantation were recorded. Blood samples were obtained from the antecubital vein for microbiologic and biochemical studies. Each patient underwent transthoracic echocardiographic (TTE) imaging on the first visit day and TEE imaging ≤72 hours after TTE imaging. The study protocol was approved by the institutional ethics committee, and all participating patients gave written informed consent.

Follow-Up

Five years after initial enrollment, each patient or primary contact was called and asked about clinical events. Patients' relatives were asked about the cause of mortality, and health records were investigated. Living patients were invited to the hospital, and echocardiographic screening was performed. All telephone calls were placed by two cardiologists.

Echocardiographic Examination

TTE and TEE examinations were performed using Vivid 3 Expert equipment (GE Vingmed Ultrasound AS, Horten, Norway) with a conventional 1.7-MHz phased-array TTE probe and a multiplane 5-MHz TEE probe. Left ventricular dimensions were measured using two-dimensional guided M-mode echocardiography; left ventricular ejection fraction was measured using the modified biplane Simpson method according to the guidelines of the American Society of Echocardiography.[11] Right heart chambers, pulmonary artery, and pacemaker leads were evaluated from the parasternal long-axis and short-axis, apical four-chamber, and subcostal views according to the guidelines of the American Society of Echocardiography.[12] Pulmonary artery systolic pressure was estimated using continuous-wave Doppler in the apical four-chamber view from tricuspid regurgitation jet velocity with the addition of right atrial pressure, assuming a right atrial pressure of 3 to 5 mm Hg.[13]

TEE examinations were performed ≤72 hours after TTE examinations, under sedation and after a fasting period of ≥4 hours. Premedication consisted of lidocaine spray and intravenous sedation with midazolam. According to the criteria of the American Society of Echocardiography,[14] a comprehensive evaluation of the right heart chambers and leads was performed using a set of upper, middle, and lower esophageal and transgastric cross-sectional views. Images were enlarged (in most cases 3 to 5 times) at the time of the study using conventional zoom features, recorded on VHS videotape, and reviewed later. All echocardiographic examinations were performed by two skilled echocardiologists.

Blood Samples

Three sets of blood samples, each from a separate vein, were obtained during the 24 hours before TTE procedures. Thirty milliliters of blood were sampled each time for two aerobic and one anaerobic blood culture, and the cultures were incubated in bloody agar, sheep bloody agar, and eosin methylene blue agar using the BacT/ALERT 30/60 device (bioMérieux, Inc., Durham, NC). The cultures were incubated for ≥5 days in the media. Patients with negative blood cultures during the 5-day period were labeled as culture negative.

Additional 10-cm^3 blood samples were obtained for hemogram, erythrocyte sedimentation rate, and high-sensitivity C-reactive protein (hs-CRP) measurements. For hs-CRP measurements, the blood samples were kept in citrated tubes and were evaluated using nephelometry (Beckman Coulter, Inc., Brea, CA). Values between 0 and 0.8 mg/dL were considered normal for hs-CRP. For hemogram analysis, samples were collected in tubes with ethylenediaminetetraacetic acid and analyzed automatically using a Sysmex-XT 2000I (Sysmex, Kobe, Japan) device. Values of 3,000 to 10,000 for leukocyte count, 36% to 50% for hematocrit, and 11 to 18 mg/dL for hemoglobin were accepted as the normal limits.

Definitions and Classifications of Lead Accretions

Fibrillary accretions on the pacemaker leads were evaluated as described by Freedberg *et al.*[9] Three types of lead accretions were identified: (1) thin, mobile, filamentous projections 1 to 2 mm in width and a few millimeters in length that were attached to the pacemaker leads were defined as fibrillary accretions; (2) immobile, circular, echo-dense structures that caused localized thickening on the pacemaker leads were defined as sessile accretions; and (3) the existence of both kinds of accretions over a single pacemaker lead was defined as mixed-type accretions.

Accretion type, number, and localization in each patient were recorded. The distinction of lead accretions from Eustachian valve remnants or Chiari networks, which can be seen in the right atrium, was performed by monitoring the accretions using different TEE angles and visualizing a clear attachment of the accretion to the lead.

Statistical Analysis

Statistical analysis was performed using SPSS version 11.0 (SPSS, Inc., Chicago, IL). Data are expressed as mean ± SD. Continuous variables were compared using unpaired Student *t* tests. Chi-square statistics were used to compare proportions. Fisher exact tests were applied when the expected value of at least one cell was <5. Logistic regression analysis was used to identify independent predictors of mortality from the clinical and echocardiographic parameters. P values $< .05$ were considered statistically significant.

RESULTS

The initial study group included 28 women and 47 men (mean age, 60 ± 15 years). Permanent pacemaker indications were complete atrioventricular (AV) block secondary to progressive degeneration of the conduction system (23 patients [30.5%]), complete AV block after heart valve surgery (12 patients [16%]), sick sinus syndrome (14 patients [18.5%]), coronary artery disease (10 patients [13%]), atrial fibrillation with slow ventricular rate (12 patients [16%]), complete AV block after surgery for AV cushion defect (1 patient [1.5%]), complete AV block after cardiac echinococcal cyst surgery (1 patient [1.5%]), hypertrophic cardiomyopathy (1 patient [1.5%]), and symptomatic sinus bradycardia in 1 patient (1.5%) with systemic sclerosis. Complete blood counts, erythrocyte sedimentation rates, and hs-CRP levels of all patients were within normal limits, and blood cultures were negative. None of the patients had hematuria on