Ventricular Ectopy in Children without Known Heart Disease

Laura West, MD[1], Lee Beerman, MD[2], and Gaurav Arora, MD[2]

Objective To describe the presentation and clinical course of patients with ventricular ectopy (VE) without known heart disease seen at a single institution.

Study design Patients with VE were identified from the cardiology database. Patients with known hemodynamically significant heart disease or systemic diseases were excluded.

Results A total of 219 patients constitute the study population, with 59% male and median age of diagnosis 11.3 years. A total of 138 patients had follow-up data. Median duration of follow-up was 3.1 years (n = 138, range 0-21 years) for a total of 587 patient-years. Simple VE was found in 83%, and 17% had ventricular tachycardia. Most patients were asymptomatic at presentation (77%) At presentation, echocardiograms were performed in 164 patients, with 98% normal. Of the 36 patients with sequential echocardiograms, 32 (88%) remained normal, 3 (9%) had abnormal echocardiograms which normalized, and 1 (3%) had progressive left ventricular dysfunction. On sequential Holter data (n = 48), 54% showed stable or decreased VE, 40% showed resolution, and 6% showed worsening. No cases of death or resuscitated sudden death occurred.

Conclusions Most patients were asymptomatic. There were rare cases of progression of VE and development of left ventricular dysfunction but the majority had stable findings. No deaths occurred. *(J Pediatr 2015;166:338-42)*.

Ventricular ectopy (VE), particularly isolated premature ventricular contractions (PVCs), is not uncommon in the pediatric population. Isolated PVCs can occur in up to 15% of infants, and 35% of children and adolescents without heart disease.[1] Although VE is a common condition in children, there is no uniform approach to evaluation and management of VE. Although VE generally is considered benign in children with no structural or electrical heart disease, few large studies document the course and prognosis of VE in children, and previous natural history studies have followed fewer than 165 patients.[2-6] Studies that specifically document the natural history of ventricular tachycardia (VT) in children also have been limited, including fewer than 100 patients.[7-12] The aim of this study was to describe the presentation and clinical course of patients with VE without known heart disease seen at a single institution. The hypothesis of this study was that VE in children with structurally normal hearts is unlikely to be associated with significant adverse events during follow-up.

Methods

This study was a retrospective chart review approved by the institutional review board of the University of Pittsburgh. Patients with a VE diagnosis were identified from the Children's Hospital of Pittsburgh of University of Pittsburgh Medical Center cardiology database. The departmental cardiac database includes all patients evaluated in the Cardiology Department at this institution since 1965 (approximately 103 000 patients). Patients with structurally normal hearts and documentation of VE on electrocardiography (ECG), 24-hour Holter monitor, or stress test were included in the study. Patients were excluded if any of the following were documented at time of presentation: hemodynamically significant congenital heart disease; cardiac tumor; electrical heart disease, including channelopathies such as long QT syndrome and Brugada syndrome; catecholaminergic polymorphic VT; chest wall trauma; systemic illnesses that could affect outcome (eg, HIV, cystic fibrosis). All patients with hypertrophic or dilated cardiomyopathy and PVCs were excluded if the initial diagnosis of cardiomyopathy preceded the discovery of PVCs. Patients were included if the date of last follow-up occurred before January 1, 2012.

The following data were collected from historical paper–based records and electronic medical records for a total of 219 patients with VE and structurally normal hearts: symptoms at diagnosis; test results including ECG, exercise stress test, cardiac magnetic resonance imaging (MRI), Holter monitor, event monitor, and echocardiogram; electrophysiology studies; last follow-up; cardiac events during follow-up; medications for VE; resuscitated sudden death; and date and cause of death.

ECG	Electrocardiography
LVPF	Left ventricle posterior fascicle
MRI	Magnetic resonance imaging
PVC	Premature ventricular contraction
RVOT	Right ventricular outflow tract
VE	Ventricular ectopy
VT	Ventricular tachycardia

From the [1]Children's Hospital of Pittsburgh of University of Pittsburgh Medical Center and [2]Children's Hospital of Pittsburgh of University of Pittsburgh Medical Center Heart Institute, Pittsburgh, PA

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Of this group of 219 patients, 81 had only a single cardiology evaluation. We included these patients in this study because their data add to our presentation database and add valuable information about initial echocardiographic, Holter, ECG, and stress test findings.

All ECGs were reviewed by 2 pediatric electrophysiologists to confirm the VE diagnosis and to determine the origin of the VE. Simple VE was defined as isolated ectopic beats, couplets, or triplets. VT was defined by VE runs of greater than 3 beats. If the QRS morphology reflected a left bundle branch block morphology in the precordial leads, with an inferior axis on chest leads, the site of origin was classified as right ventricular outflow tract (RVOT). If the QRS morphology was a right bundle branch block in the precordial leads, with a superior axis in the chest leads, the site of origin was considered left ventricle posterior fascicle (LVPF). If the QRS morphology was sufficient to characterize but matched neither of these locations, it was labeled as "other." Finally, if the site of origin could not be adequately determined from the available data due to limited VE, it was classified as "data insufficient."

Medication use and response to medication was analyzed in this study. Medication prescribed for VE management was considered to have a positive impact on VE if a physician documented a decrease in VE symptoms or a decrease in VE burden by Holter monitor during the course of prescribed treatment.

Results

A total of 501 patients with a diagnosis of VE were identified from the cardiology database search. Two hundred thirteen patients were excluded via the exclusion criteria outlined previously. Of the remaining 288 patients, medical record-derived patient data were available for 219 (76%), which constitutes the study population. A total of 130 patients (59%) were male. Median age at first visit was 11.3 years with a range of 0-26 years. Median follow-up duration was 3.1 years with a range of 0-21 years. There was a total of 587 patient-years follow-up. Eighty-three percent of patients had isolated VE, and 17% had VT.

Modes of presentation included irregular heartbeat heard on physical examination (51%), incidental findings (22%), chest pain (9%), palpitations (7%), miscellaneous (4%), syncope (3%), and shortness of breath (2%). Incidental findings included incidental ECG finding (13%) or murmur (9%). No presentation data were available for 6 patients (3%). No patients presenting with PVCs were found to have dilated cardiomyopathy or hypertrophic cardiomyopathy at time of presentation. Patients categorized in the "miscellaneous" category included 3 patients noted to have an irregular heartbeat on fetal ECG monitor, 2 patients seen by cardiology for attention deficit hyperactivity disorder medication clearance, 2 patients referred from another pediatric cardiology center for consultation, 1 patient with elevated blood pressure readings, and 1 patient with an abnormal chest radiograph obtained immediately after a febrile seizure.

The following diagnostic tests were obtained at presentation: ECG in 211 (96%), echocardiogram in 164 patients (75%), 24-hour Holter monitor in 153 (70%), and exercise stress test in 74 (34%). A small proportion of patients received a cardiac catheterization procedure (13%), cardiac MRI (5%), or had an event recorder (6%). All patients without an initial ECG had PVCs documented by stress test or Holter monitor.

A total of 164 patients had an echocardiogram within 6 weeks of presentation. Normal cardiac anatomy and function was demonstrated in 162 (98.8%), and 2 echocardiograms (1.2%) showed mild diminished left ventricular systolic function. All patients who were discharged from follow-up after initial evaluation had normal echocardiograms.

A total of 153 patients had Holter monitoring performed at time of presentation. These data are presented in **Figure 1** (available at www.jpeds.com). Twenty of these patients (13%) had VT, and 133 (87%) had isolated VE at time of diagnosis. The burden of ectopy ranged from 0% in some patients to 73% with a median of 10%. VT morphology was 75% monomorphic and 25% polymorphic. PVC morphology was 86% uniform and 14% multiform.

A total of 107 exercise stress tests were performed. These studies showed: suppression of VE or no VE with exercise (83%), unchanged VE with exercise (10%), and VE only in recovery (5%). Only 2% had appearance or worsening of VE with exercise.

A total of 24 electrophysiology studies for patients with VE were performed. Thirteen patients with VT had a diagnostic electrophysiology study in conjunction with a hemodynamic cardiac catheterization done to rule out underlying heart disease. No ablations were attempted in this group. Four biopsies were performed in this group, and all of these showed mild myocyte hypertrophy and/or fibrosis. There was no evidence of acute inflammation suggestive of myocarditis, and the findings were thought to be clinically nonspecific and not indicative of a true cardiomyopathy. Three of the 4 had follow-up imaging (echocardiogram/MRI) performed at least 5 years after biopsy with no evidence of cardiomyopathy.

Ablation was attempted in the other 11 patients who had electrophysiology studies. The results of the ablation attempts were as follows: 4 (36%) were successful at eliminating the focus of VE, 6 (55%) were unsuccessful at eliminating the VE focus, and in 1 patient with VT (9%) VE was eliminated successfully but PVCs persisted during follow-up.

A total of 138 patients had follow-up data. Of these, 27 (19.6%) had symptoms during the course of follow-up. Symptoms in follow-up included palpitations (11.6%), chest pain (5.8%), dizziness or near syncope (4.3%), syncope (2.9%), shortness of breath (1.4%), and fatigue (1.4%). All 4 episodes of syncope in follow-up were thought to be vasovagal based on clinical evaluation.