# PREVALENCE AND CLINICAL CORRELATES OF VENTRICULAR ARRHYTHMIAS ON 24-HOUR AMBULATORY ELECTROCARDIOGRAPHIC MONITORING

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## Abstract

### Background

Premature ventricular complexes may occur in normal individuals. Its clinical significance depends on whether it is frequent and the presence of risk factors for coronary artery disease. Studies have shown that frequent ventricular ectopic activity coupled with significant risk factors for coronary heart disease carry adverse prognostic implication in healthy individuals without obvious structural heart disease. This study examined the prevalence and clinical correlates of ventricular arrhythmias in individuals without apparent heart disease.

### Method

24-Hour ambulatory electrocardiogram was recorded in 60 apparently healthy subjects with normal echocardiography findings. Premature ventricular complex was analyzed and quantified in each subject.

### Results

Premature ventricular complex was present in 27 (45%) subjects. None of the subjects had ventricular couplets or non-sustained ventricular tachycardia. The observed premature ventricular complexes were all unifocal and infrequent (< 30 PVC/hour).

### Conclusion

This study suggests that frequent premature ventricular complexes are not uncommon in healthy individuals without clinical evidence of organic heart disease and obvious risk factors for coronary artery disease. However, further studies are needed to further confirm the implications of these findings.



**Keywords**: *premature ventricular complex, ventricular arrhythmias, Holter monitor, Electrocardiography*.

## Introduction

Premature ventricular complexes (PVCs) are the most common of all arrhythmias. The greatest hazards of PVCs, in contrast to atrial premature complexes (APCs), are ventricular tachycardia and ventricular fibrillation.

PVC is almost universal in patients with structural heart disease particularly ischemic heart disease and chronic heart failure [1-7]. Their occurrence in these groups of patients has been linked with the high incidence of sudden death which has been documented in these conditions [8-11]. In the hope of preventing sudden deaths, anti-arrhythmic agents were given in the Cardiac Arrhythmic Suppression Trial (CAST) to patients who had acute myocardial infarction. The mortality in the treatment group of that trial was found to be significantly higher than the control group [12.] The occurrence of PVCs increases the risk of sudden deaths in patients with structural heart disease[1-2]. However as a risk marker for sudden death, PVC is sensitive but not specific because many patients with PVCs in the setting of acute myocardial infarction still survive. There are suggestions that the increased mortality noted in the CAST trial may have been due to the exposure of a large number of patients, with otherwise innocuous ventricular arrhythmias, to the dangerous side effects of anti-arrhythmic agents[13]. It is therefore imperative to differentiate patients with innocuous ventricular arrhythmia from those in whom ventricular arrhythmia portends a grave risk.

As a way of solving this problem, Lown and Wolf [14] suggested a model for gradation of PVCs mostly based on empirical experience with subjects with acute myocardial infarctions. They characterised PVCs based on frequency and complexities. This has to a large extent helped in identifying high risk patients.

Several studies have also shown that ventricular arrhythmias are common in healthy subjects [15-16]. During checkups of otherwise healthy individuals, physicians are frequently faced with the problem of determining the clinical relevance of this arrhythmia. To solve this dilemma, studies have been carried out in healthy subjects to determine the prevalence, significance and prognosis of PVCs in normal individuals. Most of these studies were carried out on Caucasians[17-21]. The prevalence of PVC among individuals without apparent heart disease in our environment remains unknown. In this study, twenty four hour ambulatory electrocardiograms were used to determine the prevalence, frequency and characteristics of ventricular arrhythmia in 60 subjects without apparent heart disease.

## Method

### Study Design

This cross sectional study was carried out in the Cardiology Unit of the Department of Medicine, Lagos State University Teaching Hospital, Ikeja from November 2008 to May 2009 on 60 apparently subjects without apparent structural heart disease. The subjects were drawn from patients who visited the general outpatient clinic for minor non cardiac related conditions. Inclusion criteria were: normal clinical cardiovascular evaluation, normal serum sodium, potassium, urea, creatinine, fasting blood sugar and normal echocardiography evaluation.

Ethical clearance was obtained from the Lagos State University Teaching Hospital Ethics Committee and subjects gave informed written consent before recruitment into the study.

### Clinical Evaluation

History was obtained from each of the subjects. Enquiries about the presence of symptoms of cardiovascular disease and past medical history were obtained. A comprehensive physical examination was also performed on all subjects. Venous blood samples were taken at rest for assessment of fasting blood sugar, electrolyte (sodium and potassium), serum urea and creatinine.

### Echocardiography

Standard M-mode and 2D imaging was performed with vivid e-echocardiography machine as recommended by the America Society of Echocardiography [22].

### Ambulatory Electrocardiographic Monitoring

Twenty four-hour ambulatory electrocardiography was obtained from all subjects according to America College of Cardiology (ACC)/ America Heart Association (AHA) guideline [23], during normal unrestricted out of hospital activity with a two channel LP103 Holter recorder using a bipolar $V_1$-$V_5$ lead system. All recordings were analyzed semi automatically using the cardio line A D 35 and a digital Sony Multiscan 100ES computer.

All types of PVCs were printed on the paper and interpreted manually by cardiologists (Authors). Where less than 24 hours of recording were available for analysis, the tapes are rejected. In each patient, the total numbers of episodes of PVCs were analysed. The arrhythmias were graded with the Lown Grading System for ventricular arrhythmias.

**Statistical Analysis**

Data were analyzed using SPSS version 16.0 (Statistical Package for Social Sciences, Inc., Chicago, Ill). Proportions and percentages were calculated for categorical variables. Descriptive statistics (minimum, maximum, mean, and standard deviation) were appropriately applied in the course of analysis. Independent Student's t – test (a parametric inferential statistical procedure) was used to assess the significant difference between the means of male and female controls with PVC. P-value less than 0.05 were considered to be statistically significant (95% confidence level).

**Results**

The clinical characteristics of the subjects of this study are listed in Table 1. Premature ventricular complexes were recorded in 27 (45%) of the subjects. The mean PVC per 24hour was 79.33 ± 75.6. The minimum PVC per 24hour was 1 while the maximum was 212. The mean PVC per hour was 5.80 $\pm$ 2.178. All the 27 subjects had infrequent PVCs (< 30 PVC per hour). Neither a ventricular premature couplet nor ventricular tachycardia was seen in the 24hr recording of any of the subjects. Table 2 shows PVC classified according to Lown [13].

**Gender and PVC**

There were 42 males (70%) and 18 females (30%) participants. PVCs were seen in 17(63%) male subjects and 10(37%) female subjects. There was no significant gender difference in the prevalence of PVC (p value 0.28).

**Age and PVC**

The mean age of the subjects was 53.87±11.93 year. The minimum and the maximum ages were 24 years and 70 years respectively. The mean age of the male subjects was 54.81±9.98, while the mean age of the female subjects was 51.67±15.71.There was no significant difference in the mean age of the male and female subjects (p value 0.35). Half of the subjects were 60years or older, twelve subjects (20%) were in the age bracket 24-45years. There were 18(30%) subjects in the age bracket 45-59years. The prevalence of PVC significantly increases with age (p value 0.006, Figure 1).

## Discussion

In this study, we demonstrated that PVCs are common in healthy individuals with no apparent heart disease. The PVCs recorded were unifocal and infrequent (< 30 PVCs/hour). Age appears to influence the occurrence of PVC as there was a significant increase in the prevalence of PVC in subject ≥60years old. PVCs, which are uncommon in healthy 7 to 11 years old [24], become more common in adolescent boys, and by age of 14 to 16 years they occur with a frequency similar to that in a young adult population [15]. This tendency for the prevalence of PVC to increase with age continues through the adult age groups, so that by 65 years of age they occur in 80 percent of the population [25]. The findings of our present report are similar to those of some earlier reports [15, 16]. However, there are differences in the frequency and grades of PVCs that were recorded in our study. Joan Clarke et al noted 10 subjects (12%) who had complex ventricular arrhythmias including frequent PVCs, multifocal PVCs and non-sustained ventricular tachycardia [16]. Jean-Pierre et al [26] studied 50 elderly subjects aged over 80 years. The numbers of PVCs exceeded 10 per hour in 32% and were multifocal in 18%. There were couplets in 5% and a run of 6 PVCs in 1 subject (2%).

The risk profile of the subjects may be responsible for the difference in the complexities and frequency of PVCs observed in our study. Ahmad Sajadjeh et al demonstrated that frequent PVCs are associated with poor prognosis in subjects with high risk factors for coronary artery disease[27]. In their study, middle aged and elderly subjects with no apparent cardiac disease and ≥ 30 PVCs/ hour have a > 2.5 fold increase risk for death and acute myocardial infarction over 5 years. This was mostly evident in men and subjects with Framingham risk scores greater than average. They proposed that increased ventricular ectopic activity in apparently healthy subjects may be due to subclinical ischemic heart disease. The “benign” nature of the PVCs recorded in our subjects could be due to the lack of obvious risk factors for coronary artery disease. However our study was not structured to focus on these risk factors. Therefore further studies are needed to confirm the pattern of ventricular arrhythmia in normal individual with below average Framingham risk score.

## Conclusion

PVCs may be seen in healthy individuals. Their prevalence increases with age and they are infrequent and of low grade when there are no obvious risk factors for coronary artery disease.

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**Table 1: Clinical characteristics of the Subjects**

| | Subjects with PVCs N=27 (mean ±SD) | Subjects without PVCs N=33 (mean ±SD) | P-value |
|---|---|---|---|
| Fasting blood sugar(mg/dl) | 86.78±9.73 | 90.91 ± 8.72 | 0.09 |
| Sodium(mmol/l) | 138.41 ± 1.31 | 138.52 ± 1.87 | 0.80 |
| Potassium (mmol/l) | 4.46 ± 051 | 4.32 ± 0.43 | 0.26 |
| Urea (mg/dl) | 25.52 ± 6.07 | 27.24 ± 5.55 | 0.26 |
| Creatinine (mg/dl) | 0.84 ± 0.17 | 0.84 ± 017 | 0.92 |
| Systolic blood pressure(mmHg) | 114.37 ± 13.51 | 118.48 ± 17.57 | 0.45 |
| Diastolic blood pressure(mmHg) | 74.37 ± 6.92 | 76.52 ± 9.56 | 0.61 |
| Height (metre) | 1.66 ± 0.06 | 1.66 ± 0.87 | 0.75 |
| Weight (kilogram) | 66.25 ± 6.97 | 65.12 ± 13.54 | 0.70 |

**Table 2: Premature Ventricular complex classified according to Lown**

| Grades | Number and % of patients |
|---|---|
| O (None) | 33 (55%) |
| 1 (Unifocal PVC< 30/hr) | 27 (45%) |
| 2 (Unifocal PVC ≥ 30/hr) | 0 (0%) |
| 3 (Multiform PVC) | 0 (%) |
| 4a (2 consecutive PVCs) | 0 (%) |
| 4b (≥ 3 consecutive PVCs) | 0 (%) |

**Fig.1: Relationship between Age (Years) and Occurrence of Ventricular Arrhythmia**