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S1Q3T3 Pattern or McGinn-White Sign: Prevalence and Distribution among Apparently Healthy Young Adult Nigerians

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Abstract

Background: S1Q3T3 pattern or McGinn-White Sign is an uncommon but classical electrocardiographic feature of pulmonary embolism. This unique pattern is scarcely reported among healthy individuals.

Objective: This study aimed at determining the prevalence and distribution of S1Q3T3 pattern among apparently healthy young adult population.

Methodology: The study was conducted over a period of one year during which undergraduates within the age range of 15-40 years in a Tertiary Institution in Nigeria were recruited for the exercise as part of the medical screening procedure. The age and sex were obtained and resting standard 12-lead electrocardiogram (ECG) was recorded from each participant in a relaxed atmosphere according to standard protocol. The participants whose ECG exhibited S1Q3T3 pattern were identified using pattern recognition method. The data was analyzed using descriptive statistics.

Result: Out of total of three thousand eight hundred and fifty-eight (3858) young adults (1963 males and 1895 females) who participated in this study, 36 (14 males and 22 females) had S1Q3T3 pattern. The prevalence of S1Q3T3 pattern among apparently healthy young adults was 0.93%. More females (1.16%) were affected than males (0.71%).

Conclusion: The study concluded that S1Q3T3 pattern or McGinn-White sign though described as a classical electrocardiographic sign of pulmonary embolism may occur in apparently healthy young adult.

Keywords: S1Q3T3 pattern, McGinn-White sign, Prevalence, Distribution, Young adults

1. Introduction

Electrocardiogram (ECG) is a useful investigation in clinical practice. It has a lot of applications including screening, diagnostic and monitoring of cardiac and extra-cardiac conditions. Through the use of guidelines and criteria, ECG can be utilized in the diagnosis of cardiac disorders such as myocardial ischaemia and infarction, heart block, pre-excitation syndromes and cardiac arrhythmias [1]. ECG changes in pulmonary embolism include sinus tachycardia, right bundle branch block, right atrial enlargement, right ventricular hypertrophy, right ventricular strain pattern and supraventricular tachyarrhythmia [2-3]. The McGinn-White Sign or S1Q3T3 pattern identified as a unique ECG pattern in pulmonary embolism was first described in 1935 and its relevance in medical practice is not in doubt. Pulmonary embolism is still a major cardiorespiratory cause of hospitalization and death [4].

Pulmonary embolism is often misdiagnosed due to its non-specific clinical features. Hospital admission rate for pulmonary embolism has increased over time in both developed and developing countries[5-7]. Several studies also indicated the relevance of clinical assessment based on the standardized analysis (Well Scores), echocardiographic, electrocardiographic and radiographic findings as crucial step in the diagnostic work up of pulmonary embolism[8-10].In addition, the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED) study revealed that 80-90% patients who presented with at least one major risk factor such as venous stasis, venous wall injury and increased coagulability of blood were more likely prone to pulmonary embolism[11-13].Meanwhile, assessment of pulmonary embolism based on clinical findings was assumed to be unreliable because, symptoms/signs and laboratory data to support the diagnosis were often non-specific/non-sensitive[14]. However, the importance of clinical assessment of pulmonary embolism was further supported by the results of Prospective Investigative Study of Acute Pulmonary Embolism Diagnosis (PISA-PED) study[15].Meanwhile, asymptomatic cases with incidental clinical findings may be discovered by comparing the clinical characteristics of patients with pulmonary embolism and patients suspected of having pulmonary embolism[16].These findings include; dyspnea, tachypnea, and pleuritic chest pain (singly or a combination). Studies have shown that, most of the cases with confirmed pulmonary embolism presented with combination of clinical symptoms and signs mimicking other diseases[16-18].This shows that, very few patients with pulmonary embolism do not have any of the important clinical manifestations of the disease[15,18].The role of S1Q3T3 pattern in the evaluation of pulmonary embolism had been described extensively but data is sparse on the prevalence and distribution of the pattern, if any among apparently healthy young adult population.

2. Materials and Methods

2.1 Study population

This was a cross-sectional descriptive study involving three thousand, eight hundred and fifty-eight (3858) apparently healthy undergraduates of Obafemi Awolowo University, Ile-Ife who were screened with ECG as part of medical screening procedure. The study was conducted over a period of 12 months.

2.2 Procedure

The research was carried out at the ECG unit of Obafemi Awolowo University, Ile-Ife. The participants were asked to keep materials such as wristwatch, jewelry, coins, and mobile phones off from their body in order to reduce electromagnetic interference and improve the quality of the ECG. The ECG were recorded with Nihon Kohden Cardiofax S electrocardiograph and its operational accessories. The chest and the limbs were exposed and each of the participants assumed a supine position on the couch. The ECG electrode were placed according to internationally approved protocol. The chest lead (V1-V6) recordings were obtained by the attachment of six electrodes to the anterior chest wall according to the conventional method; V1 at 4th intercostal space right sternal edge, V2 at 4th intercostal space left sternal edge, V3 at the point midway between V2 and V4, V4 at 5th intercostal space left midclavicular line, V5 and

V6 at the same horizontal line with V4 at left anterior axillary line and left mid-axillary line, respectively. The six limb leads (I, II, III, aVF, aVL, and aVR) were recorded by the aids of four electrodes attached to the distal end of the limbs (one electrode per limb) according to the standard protocol for limb electrode placement. The standard paper speed was 25 mm/s. The results were printed out. Using pattern recognition technique and ECG interpretation skill, ECG that demonstrated the S1Q3T3 pattern (prominent S wave in lead I, presence of Q wave and inverted T wave in lead III) were selected as cases.

2.3 Statistical Analysis

The data was analysed using descriptive and inference statistics. Statistical Package for Social Sciences 17.0 software version was used to analyse the data and the results obtained was expressed as mean±standard deviation (SD) while the difference between two groups was analyzed using Chi square. A p value of <0.05 was taken statistically significant.

3. Results

Three thousand eight hundred and fifty-eight (3858) young adults (1963 males and 1895 females) participated in the study (Table 1). The age range of the participants was 15-40 years. Out of the 3,858 participants, 36 (14 males and 22 females) had S1Q3T3 (Fig.1). All the 36 participants with S1Q3T3 pattern were asymptomatic and had heart rate within normal limits. The average heart rate was 76.97±13.71beats per minutes. The prevalence of S1Q3T3 pattern among apparently healthy young adults was 0.93%. The prevalence among females was 1.16% while that of males was 0.71%.

Table 1: Pattern of distribution of S1Q3T3 pattern among males and females young adult Nigerians males and females with regards to S1Q3T3 pattern

Sex	$S_1Q_3T_3$ Pattern		Total
	Present	Absent	
Males	14(0.36%)	1949(50.52%)	1963(50.88%)
Females	22(0.57%)	1873(48.55%)	1895(49.12%)
Total	36(0.93%)	3822(99.07%)	3858(100.00%)

$\chi^2 = 2.091$, p = 0.148

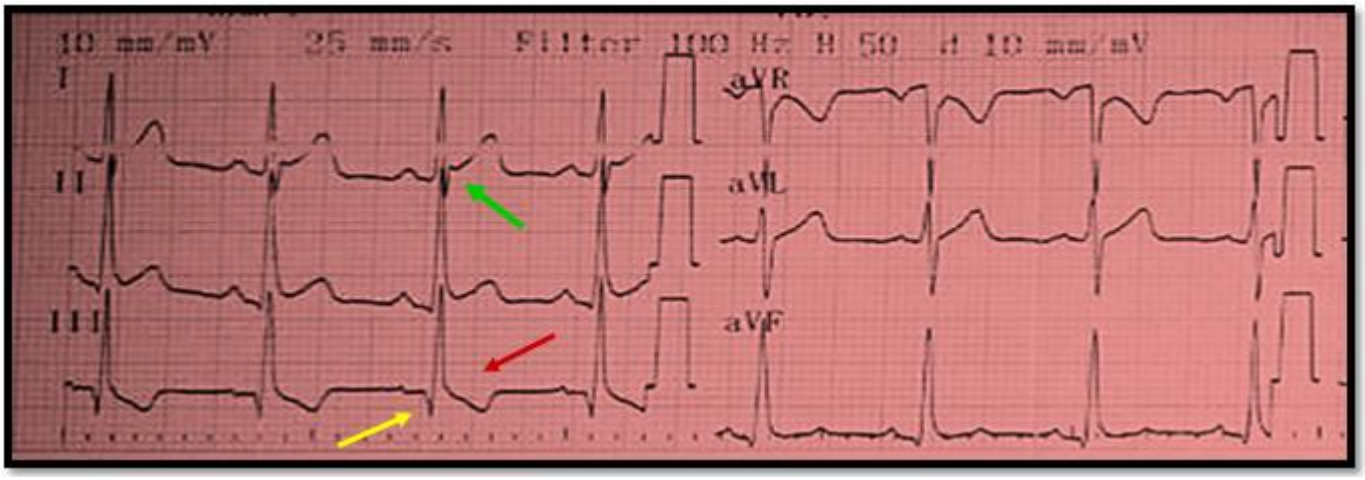

Figure 1.a : S1Q3T3 pattern in a 26-year old male Nigerian without any symptom.
The ECG showed S1Q3T3 pattern; S wave in lead I (green arrow), Q wave in lead III(yellow arrow) and inverted T wave in lead III (red arrow)

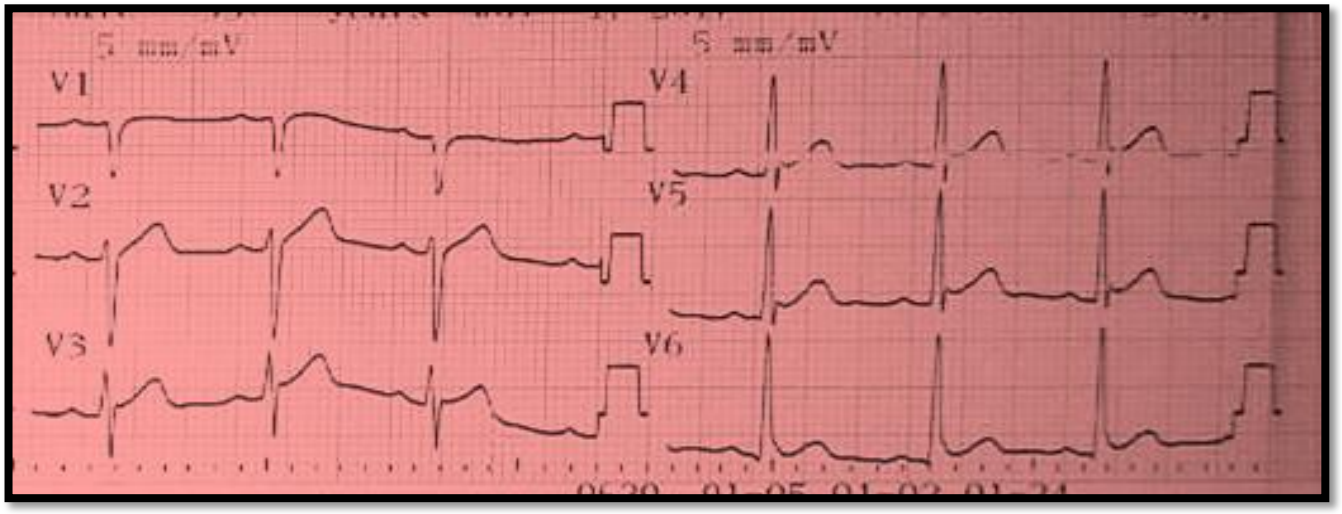

Figure 1.b : Precordial leads of ECG of a 26-year old male Nigerian (Fig.1a) without any symptom.

4. Discussion

ECG is useful in the evaluation of pulmonary embolism. ECG is the cheapest, available, non-invasive measure of pulmonary embolism reflected in its characteristics changes referred to as S1Q3T3 pattern (S wave in lead I, Q wave and inverted T wave in lead III). This unique pattern had been associated with acute massive PE leading to cor pulmonale [19-20]. There should be high index of suspicion of pulmonary embolism especially when the classical electrocardiographic pattern (S1Q3T3) is observed in patient at risk. It had been reported that S1Q3T3 pattern may be observed in some other clinical conditions such as chronic cor pulmonale, acute myocardial infarction, pneumothorax, cardiac tamponade, aortic dissection and bronchospasm [21-23]. According to De Miguel-di'ez et al in 2014, there was an increasing rate of hospitalization due to pulmonary embolism. The proportion of patients with cancer who also developed pulmonary embolism increased significantly throughout from 11.8% in 2002 to 17.5% in 2011 revealing the relationship between pathological conditions and the occurrence of pulmonary embolism [24-26]. Also, a six-year observational study by Cheng and Chung in 1999 showed that the most common presenting features of pulmonary embolism were shortness of breath, tachycardia and chest pain. Also, among the 22 patients with pulmonary embolism, 13 females and 9 males, with age ranging from 39 to 84 years, 9 of them were above age 70 years. Five patients were bed ridden/ immobile before the incidence of pulmonary embolism while nine patients (40.9%) had deep venous thrombosis prior to hospitalization [26-27]. This is a pointer that pulmonary embolism is more prevalent among females, immobile patients that are over 40 years. This present study showed that asymptomatic young adults could have S1Q3T3 pattern which is also more prevalent in females. However, among the participants in this study, the electrocardiographic pattern was associated with normal heart rate unlike the clinical cases of pulmonary embolism usually characterized by tachycardia [28-31]. The finding of S1Q3T3 pattern among healthy young adults in this study was surprising because it is rarely reported in literature. This may be due to lack of large population study focusing on this unique ECG pattern among young adult population within and outside Nigeria. The physiological and clinical importance of this unique ECG pattern in healthy young adults should be a subject of further exploration. In conclusion, S1Q3T3 pattern or McGinn-White sign though remarkably described as a classical ECG sign of pulmonary embolism may occur in apparently healthy young adult and its existence is without tachycardia.

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