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Prolonged P Wave Dispersion in Patients with Acute Ischemic Stroke

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Abstract: The aim of this study is to show the prolonged P Wave Dispersion (PWD) in patients with acute ischemic stroke. Researchers compared PWD in patients with acute ischemic stroke (n = 50) with age-matched healthy subjects (n = 46) as controls. Twelve-lead electrocardiograms of all patients were obtained and PWDs were measured. Left ventricular diameters and functions were also obtained by transthoracic echocardiography. The demographic properties of the study population were similar between two groups. P wave dispersions were significantly longer in patients with acute ischemic stroke than control subjects (77±26 and 63±21 m sec, respectively p = 0.007). The left ventricular end-systolic, end-diastolic diameters and ejection fraction were similar between two groups. The interventricular septal diameter and left atrial diameter were significantly higher in patients with acute ischemic stroke than those in control group. This study demonstrates that prolonged PWD has a relationship with acute ischemic stroke. Prolonged PWD may be a predictor of ischemic stroke.

Key words: P wave dispersion, ischemic stroke, cardiology, patients, stroke, Turkey

INTRODUCTION

P Wave Dispersion (PWD) is defined as the difference between the longest and shortest P wave duration recorded from surface Electrocardiogram (ECG) leads. The relationship between PWD and chronic diseases such as hypertension, hypertrophic cardiomyopathy, mitral stenosis, Wolf-Parkison-White syndrome, hypertyroidism, chronic renal disease and Wilson disease were demonstrated in previous studies (Dilaveris *et al*., 1999; Kose *et al*., 2003; Ozer *et al*., 2005; Aytemir *et al*., 2004; Aras *et al*., 2005; Szabo *et al*., 2002; Arat *et al*., 2008). Atrial Fibrillation (AF) and atrial flutter are the most frequent cardiac arrhythmia and they are causes of all strokes for about 10% and cardioembolic strokes for about 50% (Wolf *et al*., 1991, 1978). PWD is useful for the prediction of idiopathic, paroxysmal and recurrent atrial fibrillation (Dilaveris *et al*., 1998, 2000; Dilaveris and Gialafos, 2001; Poli *et al*., 2003).

The purpose of the study was to demostrate the relationship between acute ischemic stroke and prolonged PWD that associated with atrial fibrillation.

MATERIALS AND METHODS

The study was approved by the ethical review board of Firat University. All patients were informed about the study and their written consent forms were obtained.

Study population: In this study, researchers screened 50 consecutive acute ischemic stroke patients diagnosed by computed brain tomography or diffusion magnetic resonance imaging (stroke group) and 46 age-matched control subjects (control group). Exclusion criteria were acute myocardial infarction, chronic kidney disease, history of previous pulmonary thromboembolism, coronary artery disease, valvular heart disease, previous any cerebrovascular disease, heart failure, atrial fibrillation and cardiomyopathy.

Electrocardiography: All of the measurements were performed by a cardiology specialist blind to the subject's clinical status. Twelve-lead ECGs of all patients at rest, with 1 mV cm^{-1} amplitude and 50 mm sec^{-1} rate were obtained. All ECG recordings were carried out during the 1st day of hospitalization. Researchers measured the maximum P wave duration (P maximum) and the difference between the maximum and the minimum P wave duration (P dispersion) from the 12 lead surface electrocardiogram of all study subjects. The P wave onset was defined as the first atrial deflection from the isoelectric line and the offset was the return of the atrial signal to baseline. In all patients whose measurements could not be performed in at least 8 derivations were exluded from the study. Researchers repeated the measurements 3 times and calculated average values.

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Echocardiography: The echocardiographic examinations were carried out by a cardiology specialist in the Echocardiography Laboratory in the Cardiology Department. The echocardiography was performed by Vivid 3 instruments (GE Medical Systems, Milwaukee, WI, USA) with a 2.5 MHz transducer and harmonic imaging. All echocardiographic measurements were obtained during the 1st day of hospitalization. All echocardiographic examinations were performed with the patient lying in the left lateral decubitus position and two-dimensional images were recorded and measured at the apical 4 chambers, 2 chambers and parasternal long axis views according to the recommendations of the American Society of Echocardiography (Lang *et al*., 2005). Left ventricular end-systolic diameter, left ventricular end-diastolic diameter, interventricular septal thickness and posterior wall thickness at end-diastole were measured by M-mode echocardiography. Left atrial diameters were measured at parasternal long axis views. Left ventricular ejection fractions were assessed using the modified biplane Simpson's Method.

Statistical analysis: Statistical analyses were performed with the use of SPSS Software, Version 15.0 (Version 15, SPSS Inc., Chicago, IL, USA). Continuous variables were presented as means±SD and categorical variables as percentages. Differences between study groups in baseline characteristics were assessed with the use of two-sided Fisher's Exact tests and Chi-square (χ^2) tests for categorical variables and Student's t-tests for continuous variables. All p-values were two-tailed and values of <0.05 were considered to indicate statistical significance.

RESULTS

The demographic properties of patients such as age, gender, history of hypertension, diabetes mellitus, hyperlipidemia and smoking were similar between two groups (Table 1). In stroke group, the family history of stroke was significantly higher than the patients in control group (11 patient (22%) in stroke group and 2 subject (4%) in control group, p = 0.01).

In the echocardiographic evaluation; the values of left ventricular end-systolic, end-diastolic diameters, posterior wall thickness and left ventricular ejection fractions were similar in two groups (Table 2, p>0.05). The values of Interventricular Septal Thickness (IVST) and Left Atrial Diameters (LAD) were significantly higher in patients in the stroke group than those in the control group (IVST; 11.5±1.9 and 10.6±1.9, respectively p = 0.02 and LAD; 36±4 and 33±3, respectively p = 0.003).

Table 1: Baseline demographic properties of study patients

Parameters	Stroke group (n = 50)	Control group (n = 46)	p-value
Age (years, mean±SD)	62±13	58±12	0.40
Gender (male)	58%	63%	0.50
Hypertension	66%	48%	0.20
Diabetes mellitus	22%	11%	0.10
Hyperlipidemia	30%	30%	0.80
Current smoke	30%	41%	0.20
Family history	22%	4%	0.01

Data expressed as mean±SD or percentage. p<0.05 was accepted as statistically significant

Table 2: The electrocardiographic and echocardiographic properties of subjects in two groups

Properties	Stroke group (n = 50)	Control group (n = 46)	p-value
LVEDD (mm)	45.0±4.00	46.0±3.00	0.800
LVESD (mm)	28.0±4.00	29.0±3.00	0.800
IVST (mm)	11.5±1.90	10.6±1.90	0.400
PWT (mm)	10.1±1.50	9.7±1.40	0.400
LVEF (mm)	56.0±4.00	58.0±3.00	0.500
LAD (mm)	36.0±4.00	33.0±3.00	0.003
PWD (m sec)	77.0±26.0	63.0±21.0	0.007

Data expressed as mean±SD or percentage. p<0.05 was accepted as a statistically significant. LVESD = Left Ventricular End-Systolic Diameter, LVEDD = Left Ventricular End-Diastolic Diameter, IVST = Interventricular Septal Thickness, PWT = Posterior Wall Thickness, LVEF = Left Ventricular Ejection Fraction, LAD = Left Atrial Diameter, PWD = P Wave Dispersion

P wave dispersions were found significantly higher in patients with acute ischemic stroke than control subjects (77±26 m sec in stroke group and 63±21 m sec in control group, p = 0.007).

DISCUSSION

In the present study, longer value of PWDs were found in patients with acute ischemic stroke. Previously, prolonged PWD was demonstrated in patients with subarachnoid haemorrhage (Hanci *et al*., 2010). This is the first study demonstrating longer P wave dispersions in patients with acute ischemic stroke.

Atrial fibrillation and atrial flutter were important risk factors for cerebrovascular events and stroke. Paroxismal AF is the most underlying mechanism of cryptogenic stroke and the importance of diagnosing paroxysmal AF as a reason of cryptogenic stroke was well known. But it was not easy to show paroxysmal AF in patients with stroke. Periodic holter monitoring could not show even one third of paroxysmal AF attacks. PWD can be used to diagnose patients with a high risk for developing atrial fibrillation (Dilaveris *et al*., 1998; Dilaveris and Gialafos, 2001). Researchers showed longer PWD values in patients with acute ischemic stroke than age-matched control subjects. So, longer PWD values may show an increased risk of ischemic stroke in subjects >55 years old.

In the opinion, people >55 years old have higher risk of stroke than younger subjects and an electrocardiogram should be performed in every people in this population without any symptom. PWD should be calculated and subjects with longer PWD should be accepted as a candidate for stroke and should be followed closely with an antithrombotic agent.

CONCLUSION

This study demonstrated longer PWDs in patients with acute ischemic stroke and prolonged PWD may be an predictor of acute ischemic stroke.

LIMITATIONS

Present study's main limitation was the small number of patients with acute ischemic stroke. Therefore, large and long-term follow-up studies are needed.

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