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# P Wave Dispersion Detected from the Surface Electrocardiography and Atrial Fibrillation

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## ABSTRACT

P wave dispersion is defined as the difference between the longest and the shortest P wave duration recorded from multiple different surface electrocardiogram leads. P wave dispersion, detected from the surface electrocardiography, have been though to reflect left atrial enlargement and altered conduction. P wave dispersion and P wave maximal duration reflects the activation of atrial muscle and depends primarily upon the mass of tissue excited. These two parameters have been used in the assessment of the risk for atrial fibrillation which is characterized by nonhomogeneous and discontinuous atrial conduction. P wave dispersion has been showed to be influenced by the autonomic nervous system activation, which induces changes in left atrial size and the velocity of impulse conduction. The clinical significance of P wave dispersion has been demonstrated in many clinical conditions, especially in paroxysmal atrial fibrillation. The purpose of this review is to investigate the association between P wave dispersion and atrial fibrillation.
**Key Words:** Electrocardiography; P wave dispersion; atrial fibrillation

## Yüzey Elektrokardiyografiden Saptanan P Dalga Dispersiyonu ve Atriyal Fibrilasyon

## ÖZET

P dalgası dispersiyonu; farklı yüzey elektrokardiyogram derivasyonlarından kaydedilen en uzun ve en kısa P dalgası arasındaki fark olarak tanımlanmaktadır. Yüzey elektrokardiyogramından ölçülen P dalgası dispersiyonu, sol atriyal genişlemeyi ve bozulmuş iletiyi yansıtmaktadır. P dalgası dispersiyonu ve maksimal P dalgası süresi atriyal kasın aktivasyonunu göstermektedir ve temel olarak uyarılan doku miktarına bağımlıdır. Bu iki parametre, homojen olmayan ve süreksiz atriyal iletimle karakterize olan atriyal fibrilasyon gelişimi riskinin değerlendirilmesinde kullanılmaktadırlar. P dalgası dispersiyonunun; sol atriyum boyutlarında ve uyarı iletim hızındaki değişime neden olan, otonom sinir sistemi aktivasyonundan etkilendiği gösterilmiştir. P dalgası dispersiyonunun klinik anlamlılığı başta paroksismal atriyal fibrilasyon olmak üzere birçok klinik durumda gösterilmiştir. Bu derlemenin amacı P dalgası dispersiyonu ile atriyal fibrilasyon ilişkisini incelemektir.
**Anahtar Kelimeler:** Elektrokardiyografi; P dalgası dispersiyonu; atriyal fibrilasyon

## INTRODUCTION

Atrial fibrillation is the most frequently diagnosed arrhythmia and affects millions of people in the world. Its prevalence increases with age[1]. Atrial fibrillation is found to be associated with increased rates of death, stroke and other thrombo-embolic events, heart failure and hospitalizations, degraded quality of life, reduced exercise capacity and left ventricular dysfunction[1]. Having so many and important consequences, prevention and treatment of atrial fibrillation is very essential. Following conditions and diseases are associated with atrial fibrillation; ageing, hypertension, symptomatic heart failure, tachicardiomyopathy, valvular heart diseases, cardiomyopathies, atrial septal defect and other congenital heart defects, coronary artery disease, thyroid dysfunction, obesity, diabetes mellitus, chronic obstructive pulmonary disease, sleep apnea and chronic renal disease[1]. Screening patients in these risk groups, via predictors of atrial fibrillation, may have a key role in prevention of atrial fibrillation.

This arrythmia is characterized by disorganized atrial electrical activity leading to loss of effective contraction[1]. Atrial fibrillation is electrophysiologically explained by both focal mechanisms and multiple wavelet hypothesis. There are many predictors defined for predicting atrial fibrillation[2-7]. Several non-invasive predictors such as left atrial size on echocardiography, premature atrial contractions on Holter monitoring of atrial fibrillation have been identified[2,3].

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Also, P wave dispersion on the 12-lead resting surface electrocardiogram, is used in the evaluation of patients for atrial fibrillation[4-7]. P wave dispersion is defined as the difference between the longest and the shortest P wave duration recorded from multiple different surface electrocardiogram leads[5]. P wave dispersion, is a very low cost and easy technique, detected from the surface electrocardiography, have been though to reflect left atrial enlargement and altered conduction[6]. P wave dispersion and P wave maximal duration, reflects the activation of atrial muscle and may depend primarily upon the mass of tissue excited, have been used in the assessment of the risk for atrial fibrillation which is characterized by nonhomogeneous and discontinous atrial conduction[5,7]. Many researchs have shown the relation between atrial conduction abnormalities and paroxysmal atrial fibrillation[8-10].

Kumagai et al.[8] demonstrated that in patients with paroxysmal atrial fibrillation, interatrial conduction time from the high right atrium to basal right atrium was significantly higher compared to controls and different paced cycle lenghts were obtained also. In those patients, extrastimulus may prolong interatrial conduction and produce repetetive atrial firings which may lead to patients. P wave dispersion, a predictor of patients, has shown significant correlations with the longest duration of the right atrial electrograms, the maximal number of their fragmented deflections and the repetitive atrial firing zone[9]. Heterogenity of structural and electropysiologic properties of the atrial myocardium, leading to inhomogenous propagation of sinus impulses, and also may cause, initiation of reentry because of the increased likelihood of undirectional block of sinus node impulses[10]. Intra and interatrial conduction heterogenity can be detected in the electrocardiogram, as different P wave durations, which also means, greater P wave dispersion values.

Dilaveris et al.[5] demonstrated that P wave dispersion was significantly higher in 60 patients with paroxysmal atrial fibrillation than in 40 healthy controls (49±15 ms vs 28±7 ms, $p<0.0001$). According to the same study P wave dispersion values ≥40 ms, had a sensitivity of 83%, a specifity of 85%, and a positive predictive value of 89% for the identification of patients with history of paroxysmal lone atrial fibrillation[5]. And patients with P wave dispersion ≥40 ms had a relative risk of an atrial fibrillation recurrence during a 12 month follow up period[5]. According to an another study, by Weber et al.[11], in post-operative coronary bypass surgery patients, P wave dispersion was significantly higher in atrial fibrillation developing patients than nonatrial fibrillation developing patients (49±12 ms vs. 41±12 ms, $p=0.0009$)[11].

As a predicting value of P wave dispersion in maintenance of sinus rhythm after external cardioversion of atrial fibrillation is also investigated. Although studies in this area have only found a correlation between high P wave dispersion and atrial fibrillation recurrence, the low P wave dispersion values are found to be independent predictor of sinus rhythm maintenance. Perzanowski et al.[12] demonstrated that P wave dispersion higher than 80 ms is correlated with high risk of atrial fibrillation recurrence after cardioversion.

P wave dispersion has been showed to be influenced by the autonomic nervous system activation, which induces changes in left atrial size and the velocity of impulse propagation[13-17]. Tükek et al.[18] demonstrated effect of Valsalva maneuver on patients with a known history of paroxysmal atrial fibrillation, and on healthy controls. They found that, in the first group, Valsalva maneuver normalized increased values of P wave dispersion and duration, on the other hand it increased P wave dispersion and duration in the second group. This may be because of Valsalva maneuvers effects on atrial size and electrophysiology, which may decrease the heterogenity of atrial impulse propagation.

In conclusion, P wave dispersion, is a very low cost and easy technique, detected from the surface electrocardiography to reflect left atrial enlargement and altered conduction. P wave dispersion and P wave maximal duration have been used in the assessment of the risk for atrial fibrillation.

## CONFLICT of INTEREST

The authors reported no conflict of interest related to this article.

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