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Correlation between P Wave Dispersion, QRS Duration & QT Dispersion in Hospital Events in Cases of Acute Coronary Syndrome

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Discussion

Acute coronary syndrome (ACS) refers to any group of symptoms attributed to obstruction of the coronary arteries. The most common symptom prompting diagnosis of ACS is chest pain, often radiating to the left arm or angle of the jaw, pressure-like in character, and associated with nausea and sweating. Acute coronary syndrome usually occurs as a result of one of three problems: ST elevation myocardial infarction (30%), non ST elevation myocardial infarction (25%), or unstable angina (38%) [123].

These types are named according to the appearance of the electrocardiogram (ECG/EKG) as non-ST segment elevation myocardial infarction (NSTEMI) and ST segment elevation myocardial infarction (STEMI). There can be some variations as to which forms of myocardial infarction (MI) are classified under acute coronary syndrome [124].

ACS should be distinguished from stable angina, which develops during exertion and resolves at rest. In contrast with stable angina, unstable angina occurs suddenly, often at rest or with minimal exertion, or at lesser degrees of exertion than the individual's previous angina "crescendo angina". New onset angina is also considered unstable angina, since it suggests a new problem in a coronary artery.

Though ACS is usually associated with coronary thrombosis, it can also be associated with cocaine use [125].

Patients presenting with chest pain and nondiagnostic electrocardiograms (ECG) in the emergency department (ED) often pose a challenge to physicians, Atrial fibrillation (AF) is a frequent complication of acute myocardial infarction (AMI), with reported incidence of 7% to 18%. The incidence of congestive heart failure, in-hospital mortality, and long-term mortality is higher in AMI patients with AF than in AMI patients without AF. P wave duration on signal-averaged ECG (PWD) and P wave dispersion on standard ECG (Pd) are noninvasive markers of intra-atrial conduction disturbances, which are believed to be the main electrophysiological cause of AF [120].

P wave dispersion, detected from the surface ECG, has been thought to reflect left atrial enlargement and altered conduction [126]. 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 non-homogeneous and discontinuous atrial conduction [127,128]. P wave dispersion was defined as the difference between the longest and the shortest P wave duration recorded from multiple surfaces ECG leads [127]. The clinical significance of P wave duration has been demonstrated in many clinical conditions, especially in paroxysmal atrial fibrillation [127,129]. 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 [130].

At present, no definitive cut-off value has been determined as to the diagnosis of high-risk patients [131].

This study was undertaken to find out the correlation between the P wave dispersion in hospital events in patients with acute coronary syndrome (ACS).

In Table 3 there was no significant relationship between P wave duration in the studied groups ($p > 0.05$).

A meta- analysis study, found that P_d, P_{max}, and P_{min} span a wide range of values in healthy individuals. Seemingly, abnormal values were often reported in healthy adults. The high variability of P-wave parameters in healthy individuals, and overlapping of the results with those reported for patients with increased risk for atrial fibrillation, might suggest that this technique has limited sensitivity and specificity. The variability between studies may stem from methodological issues and, therefore, there is a definite need for methodological standardization of Pd measurements [131]. This study agreed with our study as PWD alone couldn't predict AF.

But, this study disagreed with Dilaveris et al. [132] who said that Prolonged P wave duration and PD have been reported to represent increased risk of atrial fibrillation in patients with acute coronary syndromes.

This study found that (case report):

Only One patient developed AF on the 3rd day in failed thrombolysis group, this patient was male, 66 years, diabetic, smoker, with typical chest pain, had significant ECG changes, P wave was measured on observing him 5 days in the intensive care unit (ICU), as following: PWD1= 20, PWD2= 40, PWD3 = 0 .0 (AF), PWD4= 0.0(AF) and PWD5= 0.0(AF) milliseconds, he died on the 5th day.

Prolonged QRS duration, and the presence of intraventricular conduction abnormalities, usually indicates the presence of changes in the myocardium due to underlying heart disease. Prolonged QRS duration is often associated with depressed ejection fraction or enlarged left ventricular volumes, but several studies have demonstrated that this simple ECG measure provides independent prognostic value, after adjusting for relevant clinical covariates [133].

Post-infarction patients with prolonged QRS duration have a significantly increased risk of mortality, although data associating QRS prolongation specifically with sudden death is less supportive. In non-ischemic cardiomyopathy, there is no evidence that QRS duration has prognostic significance in predicting mortality or sudden death. Prolonged QRS duration, and especially presence of left bundle branch block, seems to predict a benefit from cardiac resynchronization therapy in both ischemic and non-ischemic cardiomyopathy patients. Therefore, QRS duration and morphology should not only be considered a predictor of death or sudden death in patients after myocardial infarction, and in those suspected of coronary artery disease, but also as a predictor of benefit from cardiac resynchronization therapy in patients with heart failure, whether of an ischemic or non-ischemic origin [134].

This present study agreed with Bryneo et al. [134] , as evaluation of the presenting electrocardiogram in Alexandria University Hospitals intensive care patients (n=60) showed that there was no significance difference between QRS duration in the three groups (unstable angina, successful thrombolysis and failed thrombolysis respectively with mean value (73.7 ± 14.02, 76.2 ± 10.88, 72.36± 8.81) ($p> 0.05$) Table 4 & the correlation between the QRS duration and the development of complications was non-significant in this study, $t_p = 0.104$ [Table 9].

However Petrina et al. found the contrast which discovered that QRS prolongation-particularly in the setting of LBBB-is an independent predictor of in-hospital and 1-year mortality [133].

The QT interval represents the total duration of ventricular depolarization and repolarization. QT interval is calculated from the onset of the QRS complex to the point of return of the T wave to the isoelectric line. The normal value of QTc is up to 0.39 second in men and 0.44 seconds in women. The difference in the QT intervals between the derivations from ECG leads as "QT dispersion" (QTD) and noted that it represents the degree of the repolarization heterogeneity. "QTD" is defined as the difference between the maximum and minimum QT intervals, occurring in any of the 12 leads. Prolonged QTD is associated with an increased risk of serious ventricular arrhythmias in patients with long QT syndrome, hypertrophic cardiomyopathy, chronic heart failure or myocardial infarction (Suzuki et al. [135]).

Experimental work has shown that increased dispersion of electrical recovery after activation is a key factor in the development of serious and fatal arrhythmias associated with ischemia (Janse & Wit. [136]).

This agreed with our study, 53 patients had QTD (mean= 79.95) millisecond with no complications, however 7 patients who developed complications, had QTD between 28 and 190 Millisecond respectively, Table 3.

Table 9, showed that there was a highly significant correlation between QTD duration and prediction of complications, $t_p = 0.022$* which is agreed with Pekdemir et al. [122] who described the same results in his study which showed that QTD can help identify patients with acute coronary syndrome who present with chest pain and a non-diagnostic initial ECG. However, poor operator characteristics of QT dispersion could limit its value as a diagnostic test in the clinical setting.

Regarding the complications, it had been found that all of them had occurred in patients with failed thrombolysis therapy, in comparison to the other two groups, 7 patients (35%), ($p<0.05$) (Table 9).

In the present study ICU length of stay was longer (>3 days) in patients with failed thrmbolysis (13 patients) in comparison with the other two groups, 11 patients with successful thrmbolysis, and one patient with unstable angina stayed more than 3 days in ICU ($p<0.05$) (Table 6). This is an agreement with Craig et al. [137] who found that lower mortality is associated with shorter lengths of stay. Only part of these associations could be attributed to following best practice guidelines and lower rates of preventable complications.

Soon after resuscitation and intensive care was done to acute coronary syndrome patients, it was claimed that survivors mostly would return to their homes. In the present study it was found that percent of patients with favourable outcomes in unstable angina and in patients successfully thromboylsed 100% respectively compared with failed thrombolysis patients (80% survived and 20% died) (Table 10).This is also an agreement with Craig et al. [137].