Research Paper

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Study of Ecg Derived Indices Qt and P Wave Dispersion and its Relation to Ventilatory Functions in Chronic Obtrutive Pulmonary Disease Patients

Medical Science

KEYWORDS : chronic obstructive lung disease, QT dispersion , P wave dispersion

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ABSTRACT

Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death, affects more than 10 million people in the United States and about 2.7 million people in India. COPD is highly prevalent disease affecting lungs as well as cardiovascular system. A recent large epidemiologic study revealed increased cardiovascular mortality particularly in patients younger than 65 years with COPD. Previous studies also reported that COPD patients are at increased risk of cardiac arrhythmias. Electrocardiography is the standard method for diagnosing cardiac arrhythmia. QT dispersion (QTd) calculated from 12 lead ECG have been proposed as non invasive predictor of cardiac arrhythmia in COPD patients. The aim of the present study is to evaluate ECG derived indices like QT interval, corrected QT interval, QT dispersion, P wave dispersion in COPD patients and also to correlate QT dispersion and P wave dispersion with various spirometric parameters like FEV1, FEV1/FEV, FEF (25-75). QT dispersion is found to be prolonged in COPD patients both smoker & non smoker groups compared to healthy control group making them vulnerable to develop ventricular arrhythmias and sudden cardiac death due to inhomogenous ventricular repolarisation.P wave duration and P wave dispersion is not much affected

Introduction

QT dispersion is the range of QT interval duration in all measurable ECG leads. It means it is the difference between longest and shortest QT interval. Many studies including large prospective evaluations used the so-called "corrected QT dispersion (QTc dispersion)", i.e., the dispersion of the QT intervals corrected for heart rate by some formulas.

Bazett's formula, the most accepted one, is the correction of QT interval range dividing by the square root of the R-R interval.

QT DISPERSION IN CARDIAC DISEASE

Majority of studies have shown that increased QT dispersion can be seen in various cardiac diseases. These are post-MI patients, patients with left ventricular hypertrophy (LVH) of various origin, patients with heart failure, including idiopathic dilated cardiomyopathy, patients with acute MI, patients with long QT syndrome of various genotype, hypertensive patients and patients with aortic stenosis.

QT DISPERSION IN NON-CARDIAC DISEASE

Many studies have shown clinical and prognostic importance of increased QT interval and QT dispersion in various non cardiac diseases. These are type I and type II diabetes mellitus (DM), anorexia nervosa, carbon-monoxide poisoning, rheumatoid arthritis, dialysis patients, patients with electrolyte imbalance, ankylosing spondilitis, LVH of professional athletes, severe burns and recipients of renal transplantation.

P WAVE DISPERSION

P wave dispersion is a new electrocardiography (ECG) index. It is defined as the difference between the longest and the shortest P wave duration recorded from multiple different surface ECG leads.

Clinical situations associated with P wave dispersion

Ionic imbalance and dialysis itself may cause changes in P dispersion in non diabetic patients with end stage renal failure on chronic hemodialysis.

In chronic obstructive pulmonary disease patients, presence of AF was significantly related to the prolongation of P wave dispersion.

P wave dispersion is greatest on day 2 and 3 after open- heart surgery, finding that coincide with the time of greatest risk for AF.

QT DISPERSION

QT dispersion is defined as the difference between the maximum and the minimum QT interval in all leads of ECG

Normal value of QT dispersion is 30 to 60 msec.

The QT interval duration varies between leads on the standard ECG leads, and body surface potential maps. These interlead differences, called QT interval dispersion or QT range. It was proposed as an index of the spatial dispersion of the ventricular recovery time. this measurement was an attempt to distinguish heterogeneity between myocardium which was accompanied by increased dispersion of the ventricular recovery times and prolongation of repolarisation.

P WAVE DISPERSION

P wave dispersion:

P wave dispersion is defined as the difference between longest and shortest P wave duration.

Normal value of P wave dispersion is 28-52 ms.

Lkeda K et al (1985) evaluate the P wave changes in the electrocardiogram (ECG) in chronic lung diseases, they concluded that the rightward shift of the axis of the P wave was a characteristic of obstructive lung disease and that it was mainly caused by the overinflation of the lung. This P wave change was not observed in interstitial pulmonary fibrosis.

CORRELATION BETWEEN ECG PARAMETERS AND PULMONARY FUNCTION TEST IN COPD PATIENS.

Singh V K et al (1989) studied the effects of air flow limitation on ECG in COPD patients and found that there is reduction of FEV_1/FVC, increase in Residual Volume and air trapping. Hypoxaemia, hypercapnia, blood gas derangement indicates right sided cardiac involvement.

Francis I.Carid et al (2004) studied ECG findings and its relation to ventilator functions in COPD patients and shown that P pulmonale and electrocardiographic evidence of right ventricular hypertrophy are uncommon until the FEV_1 is less than 45%

Zulli et al (2006) found increased QT dispersion is a negative prognostic finding in chronic obstructive pulmonary disease and showed significant relationship between QTd and QTc with respiratory function parameters like FEV_1 FEV_1/FVC etc. Maximal QT interval, QTc interval and QT dispersion appear to be independent predictors of cardiovascular and respiratory mortality. They observed significant incidence of cardiac sudden death COPD patients.

Jeremy et al 2007 studied the pathogenesis of pulmonary vascular disease in COPD which is multifactorial and related to alterations in gas exchange and vascular biology, as well as structural changes of the pulmonary vasculature and mechanical factors. And found coexistence of COPD and coronary artery disease which occur now a days with reduction of FEV_1 in COPD patients.

MATERIAL AND METHODS

Study Design:

We performed cross sectional comparative study in the Department of Physiology, in collaboration with Department of Chest and TB and Department of Medicine. Sample size:

1) Control Group-50 healthy age and sex matched individuals
2) Study Group-50 diagnosed COPD Patients, age and sex matched including smokers and non-smokers
3)For Comparison-

GroupI: 50 COPD patients and 50 age and sex matched healthy individuals.

(These 50 COPD patients were grouped into smokers and non smokers).

Group II: COPD Smokers (n=25) and COPD Non smokers (n=25) compared with

Control group as follows:

COPD smokers and control

COPD non smokers and control

COPD smokers and non-smokers

Shows correlation between QT dispersion and spirometric parameters in COPD patients and control group.

Parameters	COPD		Control	
	r value	p value	r value	p value
FEV_1 (Litres)	-0.874	<0.0001**	-0.058	>0.05
FEV_1/FVC (%)	-0.903	<0.0001**	-0.178	>0.05
$FEF_{(25-75)}$ (L/sec)	-0.715	<0.0001**	-0.066	>0.05

Significant at p<0.05* Highly significant at p<0.001** Not significant at p>0.05

-QT dispersion negatively correlates with FEV_1, FEV_1/FVC and $FEF_{(25-75)}$.

QT interval is decreased in COPD patients (302.8 ± 8.18 vs 322.72 ± 25.99, p<0.001) as compared to control group.

QT dispersion (QTd) is found to be significantly increased in COPD patients (65.2 ± 4.5 vs 37.34 ± 5.33, P value <0.0001) as compared to control group. Previous study done by Pinar Yildiz [11] et al have shown that development of ventricular arrhythmia in Chronic Obstructive Pulmonary Disease (COPD) patients is associated with QT dispersion.

Prolonged P wave duration (115.2 ± 8.62 vs. 90.2 ± 12.53, P <0.0001) and prolonged P wave dispersion (43 ± 12.16 vs. 37.2 ± 8.09, p<0.05) in COPD patients compared to control group respectively.

Significantly reduced spirometric parameters i.e. FEV_1 (1.80 ± 0.69 vs 2.63 ± 0.46, p<0.0001), FEV_1/FVC (77.06 ± 6.97 vs 88.18 ± 5.73, p<0.01) and FEF_{25-75} (2.78 ± 0.59 vs 3.33 ± 0.90, p<0.05) in COPD patients compared to control group respectively. This finding indicates obstructive nature of pulmonary involvement in COPD patients. [51,52,53,54]

Positive correlation of QT dispersion with Heart Rate (r=0.555, p<0.0001), Systolic Blood Pressure (r=0.969, p<0.0001) in COPD patients as compared to control. It indicates autonomic imbalance in COPD patients compared to control group. [76]

Mean values of FEV_1 (1.76 ± 0.75 vs 2.75 ± 0.43, p<0.0001) FEV_1/FVC (75.06 ± 8.52 vs 89.73 ± 6.15, p<0.0001), $FEF_{(25-75)}$ (2.66 ± 0.31 vs 3.47 ± 1.04, p<0.05) in non smoker COPD and control group. Mean values of FEV_1, FEV_1/FVC and $FEF_{(25-75)}$ is significantly less in non smoker COPD group compared to control group. These parameters indicate obstructive nature of pulmonary involvement in non-smoker Chronic Obstructive Pulmonary Disease (COPD) patients.

P wave dispersion negatively correlates With FEV_1 (r= -0.50, p<0.05), FEV_1/FVC (r= -0.41, p<0.05) and $FEF_{(25-75)}$ (r= -0.42, p<0.05) in smoker than nonsmoker, FEV_1 (r= -0.07, p>0.05), FEV_1/FVC (r= -0.08, p>0.05) and $FEF_{(25-75)}$ (r= -0.12, p>0.05). It indicates that air way obstruction is more in smoker than non-smoker which affects the conduction of sinus node leading to atrial fibrillation.

QT dispersion, calculated from QT interval is an important maker gives an idea about cardiac action potential. Prolonged QT dispersion indicate inhomogenous ventricular repolarization.

Smoking alone is responsible for prolonged QT dispersion even in the absence of COPD.

In the present study we have emphasized the importance of left ventricular involvement in the form of prolonged QT dispersion leading to ventricular tachyarrythmia and sudden cardiac death.

Therefore, routine ECG recording should be advised in COPD patients so that ventricular arrhythmia and sudden cardiac death can be prevented.

SUMMARY

QT interval is decreased in COPD patients compared to control group but significantly increased corrected QT interval (QTc) after correction with heart rate.

QT dispersion (QTd), P wave duration and P wave dispersion id increased in COPD patients than control group.

There is drastic reduction in lung function parameters like FEV_1 FEV_1/FEC & $FEF_{(25-75)}$ in COPD patients compared to healthy control group.

QT dispersion is negatively correlates with spirometric parameters Like FEV_1 FEV_1/FVC and $FEF_{(25-75)}$

QT dispersion is found to be prolonged in COPD patients both smoker & non smoker groups compared to healthy control

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group making them vulnerable to develop ventricular arrhythmias and sudden cardiac death due to inhomogenous ventricular repolarisation.

P wave duration and P wave dispersion is not much affected in group II.

CONCLSION

Though smoking is an important risk factor for development of COPD, exposure to occupational hazards, biomass fuel, indoor and outdoor air pollution are also and equally important risk factors.

Prolonged QT dispersion in COPD is associated with generation of life threatening rhythm disturbances and sudden cardiac death.

QT dispersion, is a non invasive marker of arrhythmogenicity so, analysis of routine ECG is an important, non invasive, inexpensive, bedside diagnostic tool to detect early arrhythmias in COPD patients.

There is intriguing relationships between the QT dispersion and functional respiratory parameters.

Greater the severity of COPD, greater will e the prolongation of QT dispersion.

So, we recommend that, all COPD patients should undergo ECG recordings for early diagnosis as well as prevention of cardiac arrhythmia.

These findings suggest the need for a global and multidisciplinary risk assessment in COPD patients. Therefore, special attention in the diagnostic work-up of these patients is needed, coming to a more integrated pulmonary and cardiovascular care.

REFERENCE

1.reilly jj,jr, silverman EK, Shapiro SD .chronic obstructive pulmonary disease. | Harrison"s,principles of internal medicine .18th Edition.Mc Graw Hill; volume 1, | 2012:pg 2151-59 | 2.Salvi SS,Barne P J. chronic obstructive pulmonary disease in non smokers. | Lancet. 2009:663(374): 733-43 | 3.Agarwal RL, Kumar D, Gurpreet, Agarwal D K and chabra GS .Diagnostic Values of ECG in COPD. COPD Lung INDIA.2008 APR-JUN:25(2):p 78-81 | 4.Burros b ,kettle lj, niden ah, rabinowitz m, diener cf. patterns of cardiovascular dysfunction in chronic obstructive lung disease .N ENGL J MED 1972:286