QT INTERVAL DURATION AND DISPERSION IN PATIENTS WITH ESSENTIAL HYPERHIDROSIS

Essential hyperhidrosis, a disorder of eccrine sweat glands, has been reported to be associated with sympathetic overactivity. In this study we sought to determine if this sympathetic overactivity alters QT interval duration and dispersion in patients with essential hyperhidrosis.

The 20 hyperhidrotic patients and 20 control subjects were included to study. A 12 leads ECG was obtained from all participants. Maximum QT (QTmax), minimum QT (QTmin) intervals, QT dispersion (QTd) and corrected QT dispersion (QTcd) were calculated on each ECG record. QT and RR intervals in V2 leads (QTV2 and RRV2) were also measured. Baseline demographic properties were similar. QTd and QTcd were significantly higher in hyperhidrotic group and controls. QTV2 and RRV2 were also significantly different in both groups. QT interval duration is prolonged and QTd is increased in patients with hyperhidrosis compared to matched control subjects. This most probably results from increased sympathetic drive passing through T2-3 ganglia.

Key Words: Essential hyperhidrosis, sympathetic overactivity and QT dispersion

INTRODUCTION

Essential hyperhidrosis, excessive sweating of the body parts, mostly of axillae and palms of the hands is a condition of unknown origin. It is mainly a problem of young people in the second or third decade of life, usually starting in puberty. Previous studies have showed that cardiac autonomic function is altered in patients suffering from EH compared to healthy subjects.1-4 Beta-blockers have also been reported to reduce sweating in these patients.5 Blood pressure response to cold test and handgrip in essential hyperhidrosis were lowered by sympatheticolysis.1,6 In addition, an increased ratio of low to high frequency power of heart rate variability has been observed during ortostatic stress and a decrease in the low frequency components of systolic blood pressure and heart rate after sympathectomy have been reported.4 However, no previous study has compared QT interval duration and dispersion in EH patients and matched controls.

The interlead difference of the QT interval in the surface 12-lead ECG, namely, QT dispersion (QTd), has been proposed as a measure of repolarization inhomogeneity.7 It has also been
shown that changes in autonomic nervous system may influence QT interval duration and QTD.8-12 We speculate that sympathetic hyperreactivity may alter QT interval duration and dispersion in patients with EH. Therefore, the objective of the present study was to compare QT interval duration and QTD in EH patients and matched healthy subjects.

METHOD

Eighteen subjects with palmar, axillary hyperhidrosis or both and age-gender matched 20 healthy individuals were included in the study. A complete physical and echocardiographic examination was performed before the study. Diagnosis of essential hyperhidrosis was confirmed by ninhydrin sweat test on the hyperhidrotic regions.13 The subjects with known coronary artery disease, respiratory, neurological or systemic any other disorder that might influence the autonomic function, history of smoking and diabetes mellitus were excluded from the study. No subject was taking medication at the time of study. The 12-lead surface ECG was recorded at a paper speed of 50 mm/s in all study subjects. Three consecutive beats in each lead were measured manually with a caliper. QT interval was measured from the onset of the QRS complex to the end of the T wave, defined as the return to the T-P isoelectric line. If the T wave could not be clearly determined, that lead was excluded. Only recordings with greater than 8 analyzable leads were included. The mean of three consecutive intervals in each analyzable lead was taken for analysis. QTD was defined as the difference between the longest and shortest QT intervals and the rate corrected with Bazett’s formula.14 Two independent observers blinded to clinical details measured the QTD. For measurement of QT interval duration we selected the QT interval in V2 leads (QTV2), since right precordial leads were reported to be the most reliable leads.15 To detect intra and inter-observer mean percentage errors (absolute difference between two observation divided by the mean and expressed as percentage) for maximum and minimum QT interval duration were determined in randomly selected study participants (10 patients with EH subjects and 12 control subjects) and were found to be less than 5% for both maximum and minimum QT interval duration.

STATISTICAL ANALYSIS

Statistical analysis was performed with SPSS for Windows version 10.0 (SPSS Inc. Chicago, Illinois). Data are presented as mean ± SD. For continuous variables Mann-Whitney U test and for categorical changes chi-square test was used. A p value <0.05 was considered to indicate statistical significance.

RESULTS

Clinical characteristics of two groups are shown in Table 1.

### Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hyperhidrotic patients</th>
<th>Control subjects</th>
<th>p values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number (male/female)</td>
<td>8/12</td>
<td>11/9</td>
<td>NS</td>
</tr>
<tr>
<td>Age, years</td>
<td>27±5</td>
<td>28±6</td>
<td>NS</td>
</tr>
<tr>
<td>Body mass index kg/m2</td>
<td>23±3</td>
<td>24±3</td>
<td>NS</td>
</tr>
<tr>
<td>Systolic blood pressure, mmHg</td>
<td>115±14</td>
<td>114±15</td>
<td>NS</td>
</tr>
<tr>
<td>Diastolic blood pressure, mmHg</td>
<td>68±8</td>
<td>68±9</td>
<td>NS</td>
</tr>
<tr>
<td>Heart rate, beats/min.</td>
<td>72±9</td>
<td>73±8</td>
<td>NS</td>
</tr>
<tr>
<td>Total cholesterol, mg/dL</td>
<td>187±36</td>
<td>183±31</td>
<td>NS</td>
</tr>
<tr>
<td>HDL cholesterol, mg/dL</td>
<td>43±6</td>
<td>42±5</td>
<td>NS</td>
</tr>
<tr>
<td>Triglycerides, mg/dL</td>
<td>139±27</td>
<td>136±25</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS: Statistically not significant
There was no significant difference between two groups in demographics of age, sex, heart rate, and blood pressure and cardiovascular risk factors. On echocardiographic examination no valvular disorders, left ventricular hypertrophy, wall motion abnormalities and clinically significant valvular regurgitation were detected in any of the study subjects. All study subjects had sinus rhythm. The number of the leads in which QT interval duration could be measured was similar in both groups (range 8 to 12 leads). QTmax interval duration was similar but QTmin, QTd and QTcd were significantly different in hyperhidrotic subjects and healthy controls. (Figure-1).

![Figure-1: Comparison of maximum QT (QTmax) minimum QT (QTmin) interval duration and QT dispersion (QTd), corrected QT dispersion (QTcd) in hyperhidrotic group and control group.](image)

QTv2 and RRv2 were also found to be different in hyperhidrotic subjects and controls (Figure-2).

![Figure-2: Comparison of QT in V2 derivation (QTV2) maximum RR duration in V2 (RRV2) in hyperhidrotic group and control group.](image)

**DISCUSSION**

A standard 12-lead surface electrocardiogram provides a summation of the overall electrical activities of the heart and detects regional electrophysiologic differences of the myocardium.4 The QT interval has long been known to vary significantly between the individual 12 leads of surface ECG. Clinical studies have suggested that the interlead variability of the QT interval in standard ECG, defined as QT dispersion, reflects regional differences in ventricular repolarization.7 Previous studies have shown the important influence of the autonomic nervous system on the QT interval in diabetic patients with autonomic neuropathy, and by using pharmacologic agents that block either limb of the autonomic nervous system.8,9 The QT interval has also been reported to be prolonged in patients with primary autonomic failure.10,11 Experimental and clinical evidence indicates that the autonomic nervous system modulates the duration of ventricular repolarization by conditioning ventricular repolarization to alterations in the heart rate and failure of such adaptation mechanism might trigger ventricular arrhythmias. The autonomic nervous system modulates also the
spatial heterogeneity of repolarization; a well known mechanism for cardiac instability. Increased sympathetic and decreased parasympathetic modulations were found to increase the QTd in physically healthy subjects. Therefore, taking into account the effect of autonomic nervous system on QTd we speculated that QT interval duration and QTd could be altered in EH patients compared to healthy controls. Previously, it has been shown that stimulation of left stellate ganglion prolongs QT interval and increases heart rate in patients with hyperhidrosis, while stimulation of right stellate ganglion does not affect QT interval and heart rate significantly. To our knowledge, no previous study have compared QT interval duration and QTd in EH patients and matched healthy controls. Therefore, this study is the first attempt to compare QT interval duration and QTd in patients with essential hyperhidrosis and matched controls.

Essential hyperhidrosis is a well known but poorly understood dermatologic, neurologic and social anxiety disorder. Interruption of the sympathetic chain at T2-T4 level by thoracoscopic intervention is considered an effective and safe treatment for essential hyperhidrosis refractory to conventional local, systemic, or other treatments. Sympathetic fibers to eccrine glands of palms of the hand arise from stellate and upper thoracic ganglia which also innervate lung, heart, and blood vessels of the upper limb. Therefore it would be expected that cardiac autonomic modulation could be affected in EH patients. Accordingly, Shih et al. reported that patients with denervation of T2-3 ganglia because of palmar hyperhidrosis showed altered sweating response on the whole body during physical exercise compared to normal subjects and patients suffering from palmar hyperhidrosis. Hyperhidrotic subjects with intact ganglia also showed less bradycardia in response to the Valsalva maneuver, and a higher degree of cutaneous vasoconstriction in response to finger or cold immersion. The authors suggested an over-functioning of sympathetic fibers running through T2-3 as the cause of palmar hyperhidrosis, which leads to generalized autonomic dysfunction. Other authors suggested that palmoplantar hyperhidrosis is only secondary to the hyperresponse to the mental and emotional stimulation of the sympathetic nervous system, and instead originates in cerebral cortex. Noppens et al. reported a higher peak heart rate in subjects with focal hyperhidrosis at physical exercise, which normalizes after sympatholysis. The authors concluded that sympathetic overactivity relevant to cardiac function in hyperhidrosis is only evident during sympathetic stimulation. Wiklund et al., using power spectral analysis of heart rate variability, have also assessed the immediate and long-term effects of endoscopic thoracoscopic sympathectomy on autonomic modulation of the heart rate in patients with hyperhidrosis. These authors have concluded that patients with palmar hyperhidrosis have a sympathetic overactivity but also compensatory high parasympathetic activity and sympatholysis results in initial sympathovagal imbalance with a parasympathetic predominance, which is restored on a long-term basis. On the other hand, Koniga et al. investigated effects of thoracic sympathectomy of T2-T4 on hemodynamics and baroreflex control of the heart and found that thoracic sympathectomy decreased mean heart rate and mean blood pressure, but autonomic function test outcomes did not alter, although measurable changes in cardiovascular control appeared, particularly in total peripheral resistance. Similarly, Bimer et al. found no evidence of cardiac sympathetic dysfunction, but observed parasympathetic dysfunction at autonomic stimulation in hyperhidrotic subjects compared to normal subjects. Together with these aforementioned studies our results suggest that EH may be a complex autonomic dysfunction also involving cardiac conduction system. However, it is difficult to claim that the patients suffering from hyperhidrosis are under risk as to cardiac rhythm disturbances only depending on the increased QTd. Most of our study subjects had already no significant cardiac symptoms such as chest discomfort, palpitation or dyspnea to be associated with serious rhythm disturbances. Moreover, poor reproducibility and measurement errors of QT measurement technique limit the clinical implication of
our results. Thus the observed results should be interpreted with caution.
In conclusion, we found that QT interval duration was prolonged and QTd was increased in patients with hyperhidrosis compared to matched control subjects. This most probably results from increased sympathetic drive passing through T2-3 ganglia. However, whether the increased QTd may leave the patients with EH prone to arrhythmias in the future warrants further large scale studies and long term follow-up.

REFERENCES