Effect Of Acute Stress On Rat ECG
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Citation

Abstract
Rat ECG is commonly used parameter for various cardiovascular studies. The rat ECG resembles essentially human ECG with minor differences. Stress is common in day to day life. Stress affect hypothalamus-pituitary-adrenal axis resulting alteration in various physiological functions of body esp cardiovascular system. Studies regarding effect of acute stress on rat ECG are lacking, hence it was planned to study the effect of acute stress on rat ECG. Albino rats (n=15) of either sex weighing 200 to 300 gm were used. Acute stress in the form of 5 hr. immobilization was given to the experimental animals. Pentobarbital in subanesthetic dose (25 mg/kg I.P.) was administered to immobilize the rats in supine posture. Within 45 mts of pentobarbital administration animal regained consciousness and control ECG was recorded. Five hr. after immobilization ECG was again recorded, changes in ECG were noted in respect of HR, PR interval, QRS complex, QT interval and changes in amplitude of waves. Acute stress of 5 hr. immobilization produced changes in atrial and ventricular depolarization and repolarization.

CONCLUSION: Acute stress affect atrial and ventricular depolarization – repolarization significantly in albino rats.

INTRODUCTION
Stress is common in day to day life, and affect HPA axis\(^1\) resulting alteration in various physiological functions of the body. Cardiovascular system is more prone to be affected by stress, directly or indirectly\(^2,3\).

ECG is commonly used parameter for various cardiovascular studies in human and in animal. Rat ECG resemble essentially to human ECG with minor differences\(^4\). Studies regarding effect of acute stress on rat ECG are lacking. Hence with the prior approval from Institutional Ethical Committee, the present study was planned to evaluate the effect acute stress on rat ECG.

MATERIAL & METHODS
Animal - Albino rats of either sex (200-300 g) were used. They were housed in plastic cages at an ambient temperature of 26±2C and 45 to 55% relative humidity with a standard 12 h light or dark cycle. They had free access to food and water and were acclimatised for at least one week before experimentation. National Research Council guidelines for the care and use of laboratory animals were followed throughout the study.

Procedure- The study carried out on albino rats (n=15) of either sex weighing 200 to 300 gms. Acute stress in the form of 5hr. immobilization was given to the experimental animals. Pentobarbital in subanesthetic dose (25 mg/kg I.P.) was administered to immobilize the rats in supine posture with extended limbs\(^5\). Within 45 mts of pentobarbital administration animal regained consciousness and control ECG was recorded. Five hr. after immobilization ECG was again recorded. Changes were noted in respect of HR, PR interval, QRS complex, QT interval and changes in amplitude of wave.

RESULTS & DISCUSSION
Total 30 electrocardiovascular recorded and studied of 15 animals (each rat 2 ECG, one before stress and one after stress). The mean of various measurements are tabulated in Table1 and Table 2.

After stress the heart rate (BPM) reduced from 391± 8.96 to 380±9.86 NS, PR interval (sec) raised from 0.043±0.001 to 0.45±0.002 p<0.05, QRS complex (sec) increased from 0.025±0.002 to 0.035±0.002 p<0.01 and QT interval
increased from 0.073±0.001 to 0.078±0.005 p<0.01.

The amplitude of QRS complex (mm) reduced from 5.68±0.214 to 4.18±0.223 p<0.05 in lead I, reduced from 10.36±0.36 to 8.66±0.436 p<0.01 in lead II, reduced from 7.06±0.213 to 6.96±0.21 NS in lead III. Similarly the amplitude of QRS complex (mm) reduced from 7.16±0.28 to 5.26±0.19 p<0.01 in aVR, reduced from 10.49±0.24 to 9.56±0.16 in aVF and in aVL the amplitude of QRS complex (mm) raised from 2.09±0.12 to 3.02±0.13 NS. In chest lead the QRS complex (mm) raised from 5.58±0.26 to 7.18±0.13 p<0.05 in V_1, reduced from 6.23±0.21 to 5.96±0.17 NS in V_3 and reduced from 9.86±0.26 to 7.16±0.12 p<0.01 in V_5.

**Figure 1**

**TABLE – 1 HR, PR INTERVAL QRS COMPLEX AND QT INTERVAL NOTED BEFORE STRESS (CONTROL) AND AFTER STRESS (MEAN±SE)**

<table>
<thead>
<tr>
<th></th>
<th>Before Stress</th>
<th>Control</th>
<th>After Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (Beats/min)</td>
<td>391±9.96</td>
<td>0.045±0.0001</td>
<td>0.055±0.002</td>
</tr>
<tr>
<td>PR Interval</td>
<td>0.25±0.002</td>
<td>0.025±0.002</td>
<td>0.075±0.005</td>
</tr>
<tr>
<td>QRS Complex</td>
<td>5.68±0.214</td>
<td>10.36±0.26</td>
<td>7.06±0.213</td>
</tr>
<tr>
<td>QT Interval</td>
<td>7.28±0.12</td>
<td>9.56±0.18</td>
<td>7.16±0.12</td>
</tr>
</tbody>
</table>

Values mean ± SEM.

Note significance was found out by student t-test.

p value *p<0.05, **p<0.01 NS – Not significant p>0.05.

Comparison in same table.

Stress reduced the HR insignificantly but increased the PR interval (sec), QRS complex (sec) and QT interval (sec) significantly (Table-1). Hans Selye’s defined stress as the reaction of an organism to various stimuli. Stressful stimuli may influence the onset and progression of a number of disorders in human being leading to hypertension, diabetes, stroke, cancer depression etc. Acute immobilization stress is both physical and emotional and affect the organism in the same way, according to Selye. Concept of the “General Adaptation Syndrome”. The GAS articulate stress an event; which elicits there stages of reaction, include 1 Alarm stage, 2 stage of resistance and 3 stage of exhaustion.

The multicenter Cardiac Arrhythmia Pilot Study (CAPS) reported increased cardiac arrest and mortality associated with decreased heart rate reactivity, major depression, and type-B behaviour in a study population with recent myocardial infarction and substantive ventricular ectopy.

Electrocardiography (ECG) shows prolonged QT intervals and diffuse T wave inversion, and Cardiac enzyme concentrations are raised only slightly in most cases. This syndrome, referred to as stress cardiomyopathy or takutsubo cardiomyopathy (named after the Japanese fishing pot use to trap octopuses that resembles the shape of the stunned left ventricle).

In this present study this is concluded that acute stress of five hour immobilization affect atrial and ventricular depolarization – repolarization significantly in albino rats.

**References**

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