Comparative Study of Basal Galvanic Skin Response (GSR) and GSR during Head Up Tilt (HUT) Testing in Male Generalised Anxiety Disorder (GAD) Patients

Jai Kumar[1], Deepti Aggarwal[2], CMS Rawat[3], Vimal Singh Gusain[4]

[1]Associate Professor, [4]Professor,
Department of Physiology, VCSG Government Institute of Medical Sciences & Research, Srinagar (Garhwal), Uttarakhand - 246174
[2]Senior Resident, Department of Physiology, PGIMS, Pt. B. D. Sharma University of Health Sciences, Rohtak, Haryana - 124001
[3]Professor, Department of Community Medicine, VCSG Government Institute of Medical Sciences & Research, Srinagar (Garhwal), Uttarakhand - 246174

Corresponding Author: Vimal Singh Gusain

ABSTRACT

Background: Generalised anxiety disorder is one of the debilitating mental health problems all over the world. And association of generalised anxiety disorder with cardiovascular morbidity is a well known fact. There are invasive and non invasive methods of autonomic cardiac function tests. Out of these galvanic skin response and postural challenge test in the form of head up tilt testing are two noninvasive methods.

Objective: We did this study to detect the early changes in autonomic activity among generalised anxiety disorder patients.

Methodology: The study was carried out on 30 patients of Generalised Anxiety Disorder of 18-45 years of age of male gender. The subjects and patients were divided into the following two groups: group I of thirty normal healthy subjects and group II of thirty male generalised anxiety disorder patients diagnosed as per ICD-10 guidelines with Hamilton Anxiety Scale score of 28 (i.e. moderate anxiety).

Results: The galvanic skin response was reduced among generalised anxiety disorder patients at basal level as well as upon head up tilt testing as compared to the normal healthy subjects. The decrease in galvanic skin response pointed towards the increased sympathetic activity among the generalised anxiety disorder patients though the result was statistically not significant.

Conclusion: Our study showed the decreased basal galvanic skin response and on head up tilt testing but the result was not statistically significant. We concluded that galvanic skin response alone can not be used as a reliable tool for early detection of autonomic imbalance among generalised anxiety disorder patients.

Key Words: GAD (Generalised Anxiety Disorder), GSR (Galvanic Skin Response), HUT (Head Up Tilt), Autonomic Nervous System, Cardiovascular morbidity

INTRODUCTION

The prevalence of mental health problems in modern world was already soaring peak in this cut throat competition of modern world. Now this COVID-19 has done nothing good but added on the numbers. Credit of 14% of global disease burden goes to mental health disorders. Out of these anxiety contributes 4.7%[1,2]. Anxiety disorders have been associated with increased risk of cardiovascular morbidity and mortality. Several studies have predicted the increased risk of coronary artery disease (CAD) in patients with generalized anxiety disorder (GAD) or panic disorders[3]. This association has been found to be due to dysregulation of autonomic nervous system control activity[4-

[6]. Possible mechanism of association of GAD with coronary vascular disease include changes in autonomic tone- either as decreased vagal or increased sympathetic tone[7,8].

Association of Generalized Anxiety Disorder (GAD) with cardiovascular morbidity is well known. There has been many studies regarding the effect of GAD on autonomic cardiac function tests, especially Heart Rate Variability (HRV), postural challenge tests, valsalva manoeuvre, sustained hand grip tests & pseudomotor function tests. But there has been no or very minimal studies comparing the autonomic function activity via basal Galvanic Skin Response (GSR) and GSR along with postural challenge test.

GALVANIC SKIN RESPONSE

It is a type of an electrodermal response that represents a change in the electrical activity of the skin due to increase in sweat gland activity. It measures the skin conductivity from fingers. When a person becomes anxious, activity of sweat glands in response to sympathetic stimulation increases the level of conductance which is measured from the fingertips[9].

Sympathetic stimulation and emotional arousal has a linear relationship. Skin conductance changes with the emotional arousal and it increases proportionally with the mental effort and especially in stressful condition.

GSR measures the resistance of skin to the passage of small electric current. It has been postulated that relaxation techniques lead to a rise in skin resistance. High and low resistance indicate relaxation and stress respectively[10].

HEAD UP TILT TESTING

Head up tilt (HUT) testing is designed to evaluate how the body regulates blood pressure in response to postural stress. Cardiovascular response to upright tilt constitutes a useful test for assessing the cardiovascular reflex status. Cardiovascular response to upright tilt constitutes a useful test for assessing the cardiovascular reflex status. The immediate cardiovascular responses resulting due to passive HUT signifies a function of cardiopulmonary and arterial baroreceptors. Abnormality of the cardiovascular responses indicates impairment of HUT. The tolerance to postural stress may be altered by stressful conditions[11].

MATERIAL AND METHODS

The present study was conducted in Department of Physiology in collaboration with Department of Psychiatry, Pt. B. D. Sharma University of Health Sciences, Rohtak. The study was carried out on 30 patients of Generalised Anxiety Disorder (GAD) of 18-45 years of age of male gender. The normal age and sex matched 30 subjects were selected from our staff members, medical students and healthy attendants accompanying the patients to the institute. The subjects and patients were divided into the following two groups:

GROUP I - 30 male normal healthy subjects.

GROUP II - 30 male GAD patients diagnosed as per ICD-10 guidelines with Hamilton Anxiety Scale score of 28 (i.e. moderate anxiety).

EXCLUSION CRITERIA- The patients with the following history were not included in the study:

1. History of any other major illness (like diabetes, hypertension, myocardial infarction and hyperthyroidism) in the previous one year.

2. History of drug intake for any other ailments in last one month.

TESTS CONDUCTED- In each individual basal GSR was recorded. Then Head Up Tilt (HUT) was done and GSR was recorded before, during and after (for 5 min.) each procedure.

APPARATUS USED

Recording of GSR was done by digitalised polygraph (POLYRITE D system, supplied by RMS India PVT. Ltd. Chandigarh). Individual customization of data was done after acquiring. The data was stored in hard

disc and analysed offline. Finally the printed report was generated for future reference.

The following recommendations were followed to make the results reliable and interpretable.

Sampling Rate- The sampling rate in our machine was 256 Hz.

Filters- The machine was provided with different filters. Appropriate filters were chosen for GSR since the baseline shifting may affect the spectrum analysis.

Filter For GSR

 High Filter-2 Hz

 Low Filter- 0.05 Hz

Sensitivity- Sensitivity knob was set on moderate high sensitivity (50µV).

 Sweep speed- The screen speed was 30 mm/sec.

 Head Up Tilt testing- For HUT a wooden tilt table was used to avoid any electromagnetic disturbances. The table was prepared especially for manual tilting from horizontal position to 90 degrees upright.

PRELIMINARY PREPARATION

The subjects were informed about the whole procedure in detail in their own language to allay any fear or apprehension. Consent was taken from every individual to undergo the whole procedure. All the experiments were conducted in a particular time period (from 10 AM to 1 PM) to avoid the diurnal variations.

PROCEDURE

All the subjects and patients were tested under similar laboratory conditions. They were allowed to get familiar with the experimental and environmental conditions of the laboratory to allay any apprehension. After performing physical examination they were asked to lie down in supine position on wooden tilt table. For recording GSR, two copper lined electrodes were attached on the palmar aspect of distal digit of the thumb and index finger of right hand after applying the conduction jelly. Then basal recording of GSR was taken for 5 minutes.

Then for Head up Tilt testing, the subjects were ensured proper safety by putting safety belt on waist area. The table was slowly tilted to a 70 degree head up tilt and maintained at this position for 60 seconds. GSR was recorded during the head up tilt. Now the table was brought back to horizontal position and again the same parameters were recorded for 5 minutes (post HUT recording).

STATISTICAL ANALYSIS OF DATA:

The quantitative data was analysed using SPSS version 20.0. For interpretation of the results the data set of each group was analysed statistically and compared by unpaired student t test. The comparison was done among groups I & II. Significance of result was predicted based on the p value.

RESULTS

Following observations and results were drawn from present study:

**Table 1: Comparison of basal GSR among Normal Healthy Males (Group I) and Male GAD Patients (Group II)**

PARAMETER	GROUP I (MEAN ± SD)	GROUP II (MEAN ± SD)	P VALUE
GSR (µ Mho)	2.135 ± 2.242	1.813 ± 1.959	0.555

The table 1 & figure I shows decreased GSR in group II as compared to group I but the difference is not statistically significant. The results show that there is not significant difference of GSR between group I and group II.

TABLE 2: Comparison of GSR of Normal Healthy Male (Group I) and Male GAD Patients (Group II) during Head Up Tilt

PARAMETER	GROUP I (MEAN ± SD)	GROUP II (MEAN ± SD)	P VALUE
GSR (µ Mho)	2.154 ± 2.725	1.3125 ± 1.726	0.158

The table 2 & figure II shows reduced GSR among group II as compared to group I but difference was statistically not significant enough during head up tilt testing.

Figure I: GSR of Normal Healthy Male (Group I) and Male GAD Patients (Group II)

Figure II: GSR of Normal Healthy Male (Group I) and Male GAD Patients (Group II) during Head Up Tilt
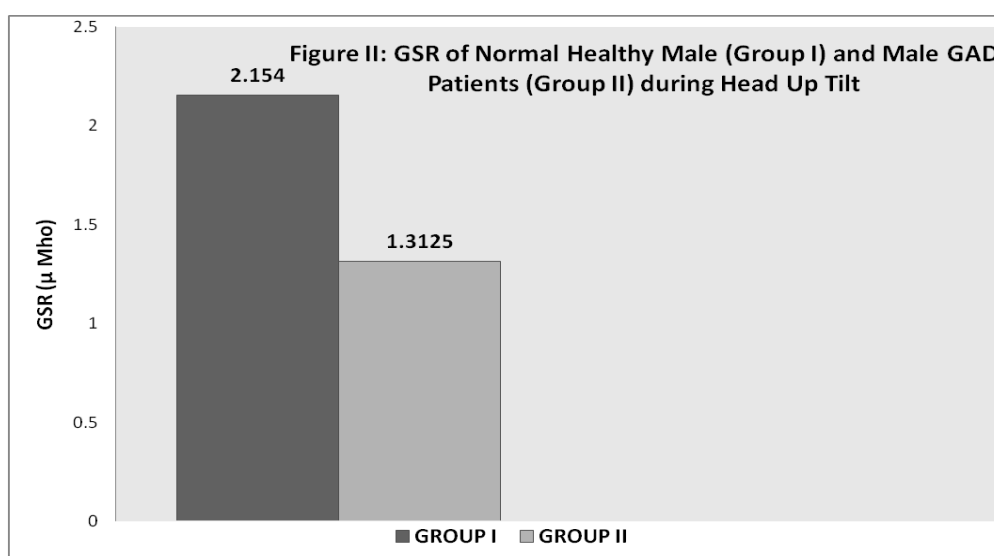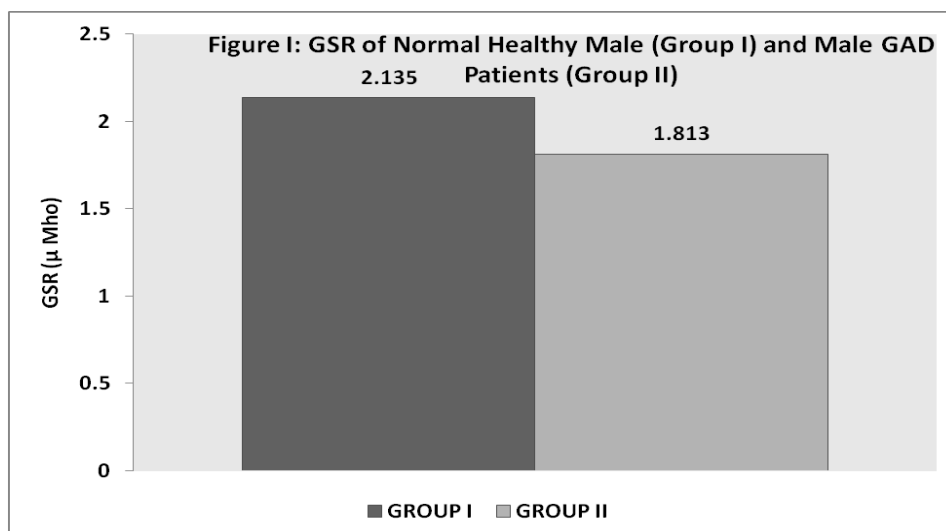
In present study there is reduced GSR among group II as compared to group I in the basal GSR (Table 1 & Fig. I). During HUT, GSR does show reduction in Group II as compared to Group I as shown in Table 2 & Fig. II, though the difference is statistically not significant.

DISCUSSION

In a clinical situation an abnormality of the cardiovascular responses indicates impairment of Head up tilt (HUT) testing. It is designed to evaluate how the body regulates blood pressure in response to postural stress. Cardiovascular response to upright tilt constitutes a useful test for assessing the cardiovascular reflex status. The test produces a predictable set of circulatory changes due to peripheral venous pooling[12]. The immediate cardiovascular responses resulting due to passive HUT signifies a function of cardiopulmonary and arterial baroreceptors[11].

The present study was conducted to evaluate the effect of anxiety on basal galvanic skin response & galvanic skin response during head up tilt testing. 60 subjects of the age group 18-45 were included in the study. The individuals were divided into two groups of 30 each (Group I- Controls & Group II- GAD patients. The results of the study indicated that GSR is reduced in male generalised anxiety disorder patients as compared to normal male controls. This reduced GSR signifies the increased sympathetic tone among generalised anxiety disorder patients

compared to normal individuals. And head up tilt testing further reduced the galvanic skin response among the generalised anxiety disorder patients. Since HUT will immediately bring the cardiovascular reflexes into play due to venous pooling of the blood. The resultant effect will be increased sympathetic tone. And this increased sympathetic tone is reflected in the reduced GSR among GAD patients upon head up tilting. Though the reduction in GSR is statistically not significant. This statistically insignificant difference points that further studies need to be done with more pooling of subjects in the study.

CONCLUSION

We conclude that further extensive studies need to be done with inclusion of female GAD patients as well before coming to any final conclusion. Till that early detection of risk of cardiovascular morbidity due to autonomic imbalance in patients of generalised anxiety disorder and other psychosomatic disorders, galvanic skin response (GSR) can not be used as a reliable diagnostic tool.

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