Original Research Paper Medical Science

The Comparative Study of The Deep Breathing Test in Major Depressive Disorder Patients & Healthy Controls

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ABSTRACT

The present study was carried out to compare the effect of deep breathing (DBT) between 50 newly diagnosed Major Depressive Disorder (MDD) patients and age matched controls. The purpose of this study is to understand the interplay between autonomic nervous system (ANS) and cardiovascular system (CVS) in the patients of MDD. First baseline recording of ECG was taken for 1 minute. After that DBT was performed for 1 minute. Difference between maximum heart rate during inspiration & minimum heart rate during expiration were calculated & expressed as maximum: minimum difference. Statistical analysis was done by unpaired t test. Results indicated that there was significant decrease in Deep Breathing Difference in case group compared to control group ($p<0.05$) suggestive of decreased parasympathetic activity as compared to controls pointing towards cardiac autonomic modulation in MDD cases.

KEYWORDS Major Depressive Disorder, autonomic nervous system, cardiovascular system, deep breathing test.

INTRODUCTION

It is believed by the researchers and social scientists that MDD will be the second leading cause of burden of disease worldwide by 2030[1] attributable to 4.1% of Disability Adjusted Life Year (DALY) [2] MDD has profound implications on the health and well-being not only of the individuals but also of their families and entire community.

As per DSM-IV-TR [3], MDD is characterized by one or more major depressive episodes (MDE) without a history of manic, mixed, or hypomanic episodes. The essential feature of a MDE is presence of at least one of the two core symptoms which have to be present most of the day for a period of at least two weeks:

Depressed mood
Loss of interest or pleasure.

Exposure to prolonged emotional stress is associated with numerous adaptations in neurobehavioral response affecting both central nervous system and autonomic nervous system (ANS). Cardiovagal responses work in close association with ANS. MDD can be associated with autonomic dysfunction which can act as an independent risk factor in development of coronary artery disease [4,5]. Heart rate variability (HRV) is a reflection of cardiovagal interaction allowing quantitative estimation of ANS function.

The purpose of this study is quantitative measurement of cardiovagal activity and to investigate the influence of MDD on ANS.

METHOD

The present study was conducted in the Department of Physiology & Department of Psychiatry. Before commencement of the project, approval was taken from the Institutional Ethical Committee.

The study design involved 100 individuals which can be divided in two groups.

Group I –Diagnosed patients of MDD as per HAMD Scale (n=50) Group II –Age & sex matched healthy controls (n=50)

A detailed recording of medical, personal and family history and clinical examination of the subject was carried out and the subjects who met the criteria were selected for the study. Written informed consent was taken before doing the clinical examination of the subject.

Inclusion criteria

1. Age group 18-45 years.

2. Healthy controls including both males & females.

3. Diagnosed patients of MDD.

Exclusion criteria

1. Subjects other than age group of 18-45 years.

2. Subjects with history or symptoms suggestive of hypertension, hypotension, cardiovascular diseases e.g. (myocardial infarction, ischemic heart disease), respiratory diseases, Diabetes Mellitus, sleep disorders, hyperthyroidism, hypothyroidism, neurological disorders e.g.(epilepsy, stroke)

3. Subjects with history of addiction to tobacco and alcohol and drug abuse.

Procedure

The subjects were asked to refrain from ingesting any beverages containing caffeine and alcohol for at least 12 hours prior to the study. They were asked to have adequate sleep at night and they were asked to report between 10a.m-12p.m. in the lab with light breakfast.

Each subject was asked to rest for 30 minutes in a quiet room to ensure full relaxation. Then his/her Pulse rate, Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were recorded. The subject was instructed about the test. It was explained that breathing should be smooth, slow & deep. The subject was given hand signal to maintain the rate & timing of the breathing. For 6 cycles per minute, inspiration is done for 5 seconds & expiration for 5 seconds. If cycles were not appropriate, it is repeated again.

First baseline recording of ECG was taken for 1 minute. After that DBT was performed for 1 minute. Difference between maximum heart rate during inspiration & minimum heart rate

during expiration were calculated & expressed as maximum: minimum difference.

Statistical analysis:
Statistical analysis of the observations was carried out using Graph Pad Prism 6. The data was expressed in terms of mean and standard deviation and statistics was determined using unpaired t test. Statistical significance was tested at 5% & expressed in terms of 'p' value with p<0.05 = statistically significant

Table no.1 **showing comparison of age, height, weight, and BMI of subjects.**

Parameter	Case Mean ±SD	Control Mean ±SD	P value
Age (yrs)	30.42 ±6.32	30.38± 6.26	>0.05 (NS)
Height (m)	1.58 ± 0.05	1.57 ± 0.04	>0.05(NS)
Weight (kg)	54.14±7.02	54.06± 5.42	>0.05(NS)
BMI (kg/m2)	21.94 ±2.33	21.66± 1.54	>0.05(NS)

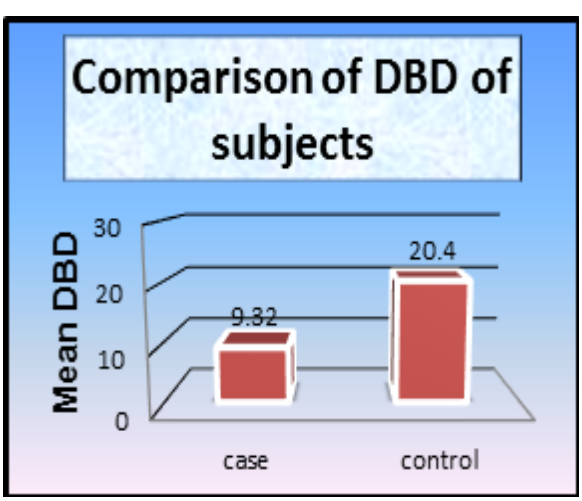
P >0.05 = non significant (NS)

Table no.2 **showing comparison of deep breathing difference of subjects.**

	Case Mean±S.D	Control Mean± S.D	P VALUE
DBD	9.32±2.12	20.4±3.90	<0.05*

0.01 to 0.05 Significant *

FIG 1: show bar diagram comparing deep breathing difference in case & control.



DBD- deep breathing difference.

RESULTS :
Table 1 shows the comparison of baseline parameters like age, height, weight , body mass index in MDD & healthy controls.

P value between the two groups is >0.05, that means there is non significant difference in two groups, hence the two groups are comparable.

Table 2 shows comparison of deep breathing differences in MDD & healthy controls .

There was significant decrease in Deep Breathing Difference in case group compared to control group (p<0.05).

DISCUSSION:
We found statistically significant difference between case and control (p<0.05) showing reduced reactivity of MDD patients to DBT.

The finding of the present study is in accordance with the earlier studies by, Salvador et al (1995)[6], Agelink et al 2002[7] ,Udupa et al 2007[8] , Kikuchi et al 2009[9], Tonhajzerova et al 2009[10] .

It is well known that patient with heart disease have lower respiratory heart rate variations than normal and diminished variation in heart rate are associated with increased risk of cardiac death. During deep breathing, changes in heart rate occur primarily because of alterations of vagal-cardiac activity. An impairment of this system can lead to depressed heart rate variability [11,12]. The changes in heart rate associated with respiratory activity are mediated by a combination of changing levels of efferent cardiac vagal and sympathetic activity and mechanically induced sinus node stretch with each respiration [13]. The degree of the contribution from each of these components is related to the frequency and amplitude of the respiratory signal, the mean level of vagal and sympathetic activity, and the mechanical state of the airways, indicating that the respiratory sinus arrhythmia is the quantitative measurement of mean cardiac vagal efferent activity [11].

Patients with abnormally low vagal tone had reduced heart rate variability as measured during deep breathing, or quantitatively heart rate variability <10 beats/min during 6 deep respirations [14] .

Deep breathing difference describes magnitude of respiratory sinus arrhythmia. The respiratory mediated heart rate changes are small during quiet breathing; therefore deep breathing test is more convenient to evaluate RSA magnitude.

Tonhajzerova et al (2009) [10] observed significant deep breathing difference (p=0.021) in adolescent MDD girls. Central Autonomic Network and specific medullary areas act as a direct input to the sino-atrial node which is responsible for the complex variability that characterizes a healthy and adaptive cardiac time series. These areas overlap with brain regions involved in presumed neuroanatomical basis of depression. Therefore he concluded that abonormalities in these centres along with other potential pathomechanisms may be responsible for decreased cardiac autonomic regulation in MDD patients.

Salvador et al (1995) observed that it may be due either increased symapathetic activity or decreased zparasympathetic activity [6].

Agelink et al (2002) [7], Udupa et al (2007) [8], and Kikuchi et al(2009) [9] stated that reduced deep breathing difference may be due to lower modulation of cardiovagal activity.

In our study decrease in deep breathing difference is mainly due to decreased vagal tone.

CONCLUSIONS
Major Depressive Disorder patients had decreased parasympathetic activity than did controls. Decreased deep breathing difference shows impaired vagal activity which could be due to defective baroreflex functioning. Very few studies have used Deep Breathing Test (DBT) in Major Depressive Disorder. Our study is one of the pioneer studies which can be used as reference for further research.

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