Physiology

To Observe the Relationship between Frontal Alpha Asymmetry and Depression in Young Patients with Major Depressive Disorder

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Original Research Article

Abstract: Frontal alpha asymmetry (FAA) has frequently been reported as a potential discriminator between depressed and healthy individuals, although contradicting results have been published. The aim of the current study was to observe relationship between FAA in major depressive disorder (MDD). It is observed that unstable anterior EEG asymmetry in depressed patients may derive from the fact that other clinical symptoms, which often accompany mood disorders, but do not represent core symptoms of depression, could also have an impact on asymmetric brain activation. In particular, different forms of anxiety are associated with different patterns of asymmetric hemispheric activation, thereby raising the issue that a comorbidity of depression and anxiety may conversely affect EEG topography. It is conceivable, that different clinical symptoms obscure EEG literalities and vary over time. However, it was beyond the scope of this study to investigate the influence of possible mediator variables like different forms of anxiety.
Keywords: Depressive Disorder, Frontal Alpha Asymmetry & Young Patient

INTRODUCTION

Depression is a mood disorder that causes great distress and impairs cognitive, social, and occupational performance. Due to its high prevalence, it is also one of the most relevant public health problems worldwide. Uncovering the neurobiological aspects of depression is essential not only to expand knowledge on how the brain works in health and disease, but also to support the development of strategies that can restore patterns of activation in depressed patients [1,2].

Diagnostic Criteria for Major Depressive Disorder and Depressive Episodes DSM-IV Criteria for Major Depressive Disorder (MDD)
- Depressed mood or a loss of interest or pleasure in daily activities for more than two weeks.Mood represents a change from the person's baseline.
- Impaired function: social, occupational, educational.
- Specific symptoms, at least 5 of these 9, present nearly every day:
- Depressed mood or irritable most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful).
- Decreased interest or pleasure in most activities, most of each day.
- Significant weight change (5%) or change in appetite.
- Change in sleep: Insomnia or hypersomnia.

- Change in activity: Psychomotor agitation or retardation.
- Fatigue or loss of energy.
- Guilt/worthlessness: Feelings of worthlessness or excessive or inappropriate guilt.
- Concentration: diminished ability to think or concentrate, or more indecisiveness.
- Suicidality: Thoughts of death or suicide, or has suicide plan.

MATERIAL & METHOD

Ethical clearance from the institutional ethics committee was obtained before starting the study.

CONDUCT OF STUDY

The study was jointly conducted in the Department of Physiology & Psychiatry of N.S.C.B. Medical College, Jabalpur M.P.

DURATION OF STUDY

The study was conducted from March 2016 to August 2017 for data collection, after which data was Analysed.

SAMPLE SIZE

In this study the sample size is 100 (N= 60 depressive patients and N= 40 controls).

SELECTION CRITERIA OF SUBJECTS

The participants in this study had been offered to voluntarily participate in the study and they had to give the written informed consent before enrolment in the study. The study was carried out on a group of 60 patients with major depressive disorder and 40 age-matched control subjects. The diagnosis of Depression was established by an experienced Psychiatrist and those already diagnosed patients were recruited from the Department of Psychiatry, NSCB Medical College to the Department of Physiology. Subjects with non-psychotic depressive disorder as defined by ICD-10 criteria and determined by 17-item Hamilton Depression Rating Scale (HAM-D) score higher than 14 were eligible.

Forty adults with no psychiatric, alcohol/drug abuse or dependence history (assessed with non-patient version of the SCID [SCID-IV-I/NP]), and no history of seizures or brain trauma were tested. Controls were included only if they scored ≤13 on the Beck Depression Inventory, had no Psychiatric history and no psychiatric history in first-degree relatives.

- **INCLUSION CRITERIA**
  - Patients of average adult age (18-60yrs) of either gender.
  - Both new and old diagnosed outpatients of Depression.
  - Patients who gave written informed consent.
  - Patients with good physical health as determined by physical examination
  - Controls who are physically, mentally and socially healthy with no past medical history and scored <13 on the Beck Depression Inventory-II.

- **EXCLUSION CRITERIA**
  - Patients who do not give informed consent for participation in the study.
  - Patients who received Lithium as medication.
  - Patients unable to respond to verbal questions.
  - Patients with a history of Bipolar disorder, Schizophrenia, alcohol or drug dependence within last 5 years or significant suicidal ideation.
  - BDI point < 10

RESULTS

Table– 1: Alpha power for f_1

Variable	Descriptive statistics (Frontal asymmetry-spectra power)				
	Valid N	Mean	Minimum	Maximum	Std. Dev.
F_1	40	2.356	0.501	5.791	1.616

Table – 2: Alpha power for f_2

Variable	Descriptive statistics (Frontal asymmetry-spectra power)				
	Valid N	Mean	Minimum	Maximum	Std. Dev.
F_2	40	2.081	0.478	6.272	1.447

Table – 3: Alpha power for (left, right)

ALPHA POWER for frontal region (F_1-F_2)	Results	Higher cortical activity in
Left	2.35	
Right	2.08	Left hemisphere
$\dfrac{Power\ (Left) - Power\ (Right)}{Power\ (Left) + Power\ (Right)}$	0.06	

DISCUSSION
Alpha Asymmetry

Alpha activity is traditionally defined as a sinusoidal rhythm occurring over posterior regions of the brain, which attenuates with eyes open.

Alpha waves originate in the posterior portions of the brain stem and oscillate up through the occipital, temporal, parietal and then frontal lobes. Thus, the frontal lobes are one of the last portions of the brain which receive alpha signals. Alpha waves are also harmonious and synchronized between the left and right hemispheres

The focus on the alpha band derives from the evidence indicating an association between increased alpha activity and decreased cerebral activation. In other words, the activity within the alpha range (typically 8–13 Hz) may be inversely related to underlying cortical processsing, since decreases in

alpha are observed when cortical systems are engaged in active processsing.

The frontal lobes of the human brain are a processing center for emotional reactions. Electroencephalographic (EEG) research has revealed that increased relative right frontocortical activity tends to emerge during the processing of negative information and emotions, while greater relative left fronto-cortical activity is associated with positive affective information processing [3]. In the same direction, Davidson *et al*. theorized that the frontal lobes are differentially involved in positive versus negative affective states and corresponding motivated behaviors, with left frontal areas of the brain mediating the experience of positive emotions (e.g., joy, happiness, etc.) and approach behaviors, while the right frontal areas mediate the experience of negative emotions (e.g., fear, sadness, etc.) and withdrawal behaviors. Moreover, patterns of frontal electroencephalogram (EEG) asymmetry may serve as an index of risk for a variety of emotion-related disorders, including depression and anxiety[4,5].

MDD tends to be characterized by relative left frontal hypoactivity (increased alpha activity) and right frontal hyperactivity (reduced alpha activity)[6].

Asymmetry scores conceptually simplify certain analyses, such as those involving correlations between frontal asymmetries (as a difference score) and other individual difference measures (e.g., behavioural activation. Additionally, difference scores based on alpha power asymmetries tend to show high internal consistency and acceptable test-retest reliability, dispelling fears about reduced reliability attributable to difference scores[7].

The results for alpha asymmetry are presented after computing and analyzing an asymmetry index, typically a difference score, usually by subtracting the natural log of left hemisphere alpha power from the natural log of right hemisphere alpha power (log [right alpha] –log [left alpha]).

CONCLUSION

It is observed that unstable anterior EEG asymmetry in depressed patients may derive from the fact that other clinical symptoms, which often accompany mood disorders, but do not represent core symptoms of depression, could also have an impact on asymmetric brain activation. In particular, different forms of anxiety are associated with different patterns of asymmetric hemispheric activation, thereby raising the issue that a comorbidity of depression and anxiety may conversely affect EEG topography. It is conceivable, that different clinical symptoms obscure EEG literalities and vary over time. However, it was beyond the scope of this study to investigate the influence of possible mediator variables like different forms of anxiety.

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