ISSN 2515-8260 Volume 10, Issue 2, 2023

TO EVALUATE THE ROLE OF FDG PET CT SCAN TO DIFFERENTIATE SCHIZOPHRENIA AND BIPOLAR AFFECTIVE DISORDER- A COMPARATIVE STUDY FROM A TERTIARY CARE CENTRE

Dr. Biswajit Malas, Senior Resident, Dept. Of Psychiatry, Nilratan Sircar Medical College & Hospital, Kolkata.

Dr. Asish Mukhopadhyay, Professor & Head, Dept. Of Psychiatry, Nilratan Sircar Medical College & Hospital, Kolkata. (Corresponding Author)

Dr. Sayanti Ghosh, Associate Professor, Dept. Of Psychiatry, Nilratan Sircar Medical College & Hospital, Kolkata.

ABSTRACT

Introduction: Schizophrenia and bipolar affective disorder are two major psychiatric illnesses, each affecting approximately 1% of the population. Schizophrenia is a primary psychotic disorder, affecting 20 million people worldwide. Bipolar disorder is a primary mood disorder, affects about 45 million people worldwide. Schizophrenia is a chronic debilitating mental disorder in which the person's emotions, thinking, judgment, and grasp of reality are so disturbed that his or her functioning is seriously impaired.

Aims: To find out the comparison between schizophrenia and bipolar disorder on the basis of PET CT findings.

Materials and Methods: The present study was a cross sectional, hospital based, single centered observational study. This Study was conducted from One Year (After approval from Health University & Institutional Ethics Committee) at Department of Psychiatry OPD in a tertiary care general hospital (NRS medical college & hospital, Kolkata, West Bengal).

Result: We observed that In Bipolar Affective Disorder, 1 (2.8%) patient had Mild hypo metabolism and 35 (97.2%) patients had Normal Posterior Frontal Lobe Right. In Schizophrenia, all patients [36(100.0%)] had Normal Posterior Frontal Lobe Right and it was not statistically significant (p=0.3139).

Conclusion: In Occipital Lobe Left, Diffuse hyper metabolism and Mild hyper metabolism were found in Bipolar disorder but Mild hypo metabolism and Mild to moderate hyper metabolism were found in Schizophrenia.

Keywords: Cancer screening, FDG, PET/CT, nuclear medicine and bipolar disorder.

ISSN 2515-8260 Volume 10, Issue 2, 2023

INTRODUCTION

Schizophrenia and bipolar affective disorder are two major psychiatric illnesses, each affecting approximately 1% of the population. Schizophrenia is a primary psychotic disorder, affecting 20 million people worldwide. Bipolar disorder is a primary mood disorder, affects about 45 million people worldwide[1].

Functional neuroimaging studies with F-18 fluorodeoxyglucose based Positron emission tomography(FDG-PET) have demonstrated a possible cortico-limbic metabolic dysregulation in bipolar disorder with features of hypermetabolism involving the limbic regions (anterior temporal cortex, parahippocampal gyrus, cingulate region and amygdala) accompanied by hypometabolism in the prefrontal cortex (i.e., dorsolateral prefrontal cortex (DLPFC) and anterior cingulate) [2]. The glucose metabolism has been correlated with cognitive, attention and memory deficits in such patients with manic -depressive phases; even during euthymic phases. A recent meta analyses on functional neuro imaging studies with a large volume of patients with bipolar disorder and normal controls, also confirmed a possible underlying anterior paralimbic dysregulation [3]. However, multiple studies on functional neuro imaging in schizophrenic patients have also demonstrated prefrontal and anterior cingulate hypo-metabolism . In addition, posterior limbic, amygdalar, basal ganglial, and temporal hyper metabolism has been observed in schizophrenia. Similar findings of temporal lobe hyper perfusion and cortical hypoperfusion have been described in functional and contrast enhanced MRI in bipolar and schizophrenic patients.it becomes difficult to differentiate between the two conditions based on FDG PET as a similar prefronto-limbic dysregulation might characterize the two disorders. A progressive decrease in pre-frontal activity in schizophrenia and bipolar disorder could result in a loss of inhibition or modulatory control over the deeper limbic structures, which would as a corollary show increased activation [4]. As there is an overlap of clinical features between the two conditions, it would be illuminative to identify contributory imaging features to differentiate between schizophrenia and bipolar illness.

AIM & OBJECTIVES

- **General objective**:
- To find out the comparison between schizophrenia and bipolar disorder on the basis of PET CT findings.
- **Specific objective**:
- To assess socio-demographic, clinical profile and higher cognitive function of schizophrenia and bipolar disorder patients.
- To assess and compare abnormal metabolic pattern in brain by FDG PET SCAN among schizophrenia and bipolar disorder.

ISSN 2515-8260 Volume 10, Issue 2, 2023

- To study association (if any) between PET scan findings in schizophrenia and bipolar disorder patients on the basis of clinical and cognitive functions.

MATERIALS AND METHODS

Study site: Department of General Psychiatry OPD in a tertiary care general hospital (NRS medical college & hospital, Kolkata, West Bengal).

Study population: All patients attending Psychiatry OPD in a tertiary care general hospital (NRS medical college & hospital, Kolkata, West Bengal)

Study design: A cross sectional, hospital based, single centered observational study.

Period of study: One Year (After approval from Health University & Institutional Ethics Committee).

Selection Criteria ˆ

❖ **Inclusion Criteria –**

i) Patients aged 15-45yrs old
ii) Both male & female
iii) Patients having current diagnosis of schizophrenia and bipolar disorder according to the ICD-10 DCR diagnostic criteria
iv) Duration of untreated illness not longer than 5 years.
v) Patients with schizophrenia, were scored with the Positive and Negative Syndrome Scale for Schizophrenia (PANSS) and had a score of less than 50 at the time of scan. Similarly, for those with bipolar disorder, the Hamilton Depression Rating Scale (HDRS) scores and the Young Mania Rating Scale (YMRS) scores had to be <8 and <10, respectively. All patients were on treatment, i.e., those with schizophrenia were on antipsychotics and benzodiazepines and those with bipolar disorder were on antipsychotics, mood stabilizers, benzodiazepines, and/or antidepressants
vi) Has given informed consent
vii) was euglycemic at the time of study

❖ **Exclusion Criteria –**

i) Presence of any lifetime history of significant medical or neurological illnesses.
ii) Presence of co morbid mental retardation.
iii) History of Substance abuse.
iv) Duration of illness less than 1 year.
v) Has not given consent.

ISSN 2515-8260 Volume 10, Issue 2, 2023

RESULT AND DISCUSSION

This cross sectional, hospital based, single centered observational study was conducted in Psychiatry OPD in a tertiary care general hospital (NRS medical college & hospital, Kolkata, West Bengal).

Present study showed that in Bipolar Affective Disorder, 1 (2.8%) patient had Mild hypo metabolism and 35 (97.2%) patients had Normal Posterior Frontal Lobe Left. In Schizophrenia, all patients [36(100.0%)] had Normal Posterior Frontal Lobe Left, which was not statistically significant (p=0.3139).

Jauhar S et al [5] (2017) found that the dopamine hypothesis suggests that dopamine abnormalities underlie psychosis irrespective of diagnosis, suggesting dopamine dysregulation in bipolar affective disorder as well as schizophrenia.

We observed that In Bipolar Affective Disorder, 1 (2.8%) patient had Mild hypo metabolism and 35 (97.2%) patients had Normal Posterior Frontal Lobe Right. In Schizophrenia, all patients [36(100.0%)] had Normal Posterior Frontal Lobe Right and it was not statistically significant (p=0.3139).

Lehrer DS et al [6] (2005) found that because neuroleptic treatment may cause long-lasting changes in brain structure and function. Diminished regional glucose metabolism was found in the medial dorsal nucleus, posterior thalamus, and prefrontal cortex of patients with schizophrenia relative to normal volunteers.

Gonul AS et al [7] (2009) found that the basic concepts of positron emission tomography (PET) and single photon emission computed tomography (SPECT) scanning are introduced. In mania, metabolism increases in the dorsal cingulate cortex, striatal regions, and the nucleus accumbens, as well as in limbic structures of the temporal lobes.

Fu C et al [8] (2018) found that the present study investigated changes in the regional cerebral metabolic rates of glucose uptake. No statistically significant differences were identified between decreased metabolism and ReHo brain regions of MDD patients ($\chi 2=9.16$; P=0.90) and between increased metabolism and ReHo brain regions.

Our study showed that in Bipolar Affective Disorder, 1 (2.8%) patient had Mild hyper metabolism, 20 (55.6%) patients had Mild hypo metabolism, 12 (33.3%) patients had Mild to moderate hypo metabolism, 1 (2.8%) patient had Moderate to severe hypo metabolism and 2 (5.6%) patients had Normal Medial Temporal Lobe Left. In Schizophrenia, 1 (2.8%) patient had diffuse hypo metabolism, 1 (2.8%) patient had Mild hyper metabolism, 17 (47.2%) patients had Mild hypo metabolism. 9 (25.0%) patients had Mild to moderate hypo metabolism, 2 (5.6%) patients had Moderate hypo metabolism, 1 (2.8%) patients had Moderate to severe hypo

metabolism and 5 (13.9%) patients had Normal Medial Temporal Lobe Left. This was not statistically significant (p=0.5493).

It was found that in Bipolar Affective Disorder, 1 (2.8%) patient had Mild hyper metabolism, 20 (55.6%) patients had Mild hypo metabolism, 11(30.6%) patients had Mild to moderate hypo metabolism, 1 (2.8%) patient had Moderate to severe hypo metabolism and 3 (8.3%) patients had Normal Medial Temporal Lobe Right. In Schizophrenia, 1 (2.8%) patient had Diffuse hypo metabolism, 1 (2.8%) patient had Mild hyper metabolism, 17 (47.2%) patients had Mild hypo metabolism. 9 (25.0%) patients had Mild to moderate hypo metabolism, 2 (5.6%) patients had Moderate hypo metabolism, 1 (2.8%) patients had Moderate to severe hypo metabolism and 5 (13.9%) patients had Normal Medial Temporal Lobe Right. This was not statistically significant (p=0.6844).

We examined that in Bipolar Affective Disorder, all patients [36 (100.0%)] had Normal Lateral Temporal Lobe Left. In Schizophrenia, 1 (2.8%) patient had Mild to moderate hyper metabolism and 35(97.2%) patients had Normal Lateral Temporal Lobe Left. This was not statistically significant (p=0.3139).

Altamura AC et al [9] (2017) found that bipolar disorder (BD) may be characterized by the presence of psychotic symptoms and comorbid substance abuse. Gray matter (GM) volume and cerebral metabolism reductions in temporal cortices were observed in all patients compared to healthy controls.

We also found that in Bipolar Affective Disorder, all patients [36 (100.0%)] had Normal Lateral Temporal Lobe Right. In Schizophrenia, 1 (2.8%) patient had Mild to moderate hyper metabolism and 35(97.2%) patients had Normal Lateral Temporal Lobe Right. And it was not statistically significant (p=0.3139).

Our study showed that, in Bipolar Affective Disorder, 1 (2.8%) patient had diffused hyper metabolism, 3 (8.3%) patients had Mild hypo metabolism, 3 (8.3%) patients had Mild to moderate hypo metabolism and 29 (80.6%) patients had Normal Parietal Lobe Left. In Schizophrenia, 1 (2.8%) patient had diffuse hypo metabolism, 3 (8.3%) patients had Mild hypo metabolism, 4 (11.1%) patients had Mild to moderate hypo metabolism and 28 (77.8%) patients had Normal Parietal Lobe Left. This was not statistically significant (p=0.7063).

We found that in Bipolar Affective Disorder, 1 (2.8%) patient had diffused hyper metabolism, 3 (8.3%) patients had Mild hypo metabolism, 2 (5.6%) patients had Mild to moderate hypo metabolism and 30 (83.3%) patients had Normal Parietal Lobe Right. In Schizophrenia, 1 (2.8%) patient had diffuse hypo metabolism, 3 (8.3%) patients had Mild hypo metabolism, 4 (11.1%) patients had Mild to moderate hypo metabolism and 28 (77.8%) patients had Normal Parietal Lobe Right. This was not statistically significant (p=0.6030).

In our study, in Bipolar Affective Disorder, 2 (5.6%) patient had diffused hyper metabolism, 2 (5.6%) patients had Mild to moderate hypo metabolism and 32 (88.9%) patients had Normal Cingulated Cortex Left. In Schizophrenia, 1 (2.8%) patient had diffused hyper metabolism, 1 (2.8%) patient had Mild hyper metabolism, 2 (5.6%) patients had Mild to moderate hypo metabolism and 32 (88.9%) patients had Normal Cingulated Cortex Left. This was not statistically significant (p=0.7212).

Present study showed that in Bipolar Affective Disorder, 1 (2.8%) patient had diffused hyper metabolism, 1 (2.8%) patient had Mild hypo metabolism, 2 (5.6%) patients had Mild to moderate hypo metabolism and 32 (88.9%) patients had Normal Cingulated Cortex Right. In Schizophrenia, 1 (2.8%) patient had diffused hyper metabolism, 1 (2.8%) patient had Mild hyper metabolism, 2 (5.6%) patients had Mild to moderate hypo metabolism and 32 (88.9%) patients had Normal Cingulated Cortex Right. This was not statistically significant (p=0.7358).

SUMMARY AND CONCLUSION

- We found that in Bipolar, Only 1 patient had Mild hypo metabolism in Posterior Frontal Lobe both Left and right though it were not statistically significant.
- Mild to moderate hypo metabolism and Mild hypo metabolism was more in Bipolar disorder Medial Temporal Lobe both Left and right though it were not statistically significant.
- Lateral Temporal Lobe Left and Lateral Temporal Lobe Right were not significant difference in Bipolar disorder and Schizophrenia.
- Parietal Lobe Left and Parietal Lobe Right were not significant difference in Bipolar disorder and Schizophrenia.
- Cingulated Cortex Left and Cingulated Cortex Right were not significant difference in Bipolar disorder and Schizophrenia.
- In Occipital Lobe Left , Diffuse hyper metabolism and Mild hyper metabolism were found in Bipolar disorder but Mild hypo metabolism and Mild to moderate hyper metabolism were found in Schizophrenia.
- In Occipital Lobe Right , Diffuse hyper metabolism and Mild hyper metabolism were found in Bipolar disorder but Mild hypo metabolism and Mild to moderate hyper metabolism were found in Schizophrenia.
- Both Cerebellum Left and Right were not significant difference in Bipolar disorder and Schizophrenia.
- Both Basal Ganglia Left and Right were not significant difference in Bipolar disorder and Schizophrenia.
- In this study explain both the overlap and the distinctions between schizophrenia and bipolar disorder needs to invoke both common and unique risk factors: certain susceptibility genes, shared between schizophrenia and bipolar illness.

REFERENCES

1. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Diseases Study 2017.
2. Brooks III JO, Hoblyn JC, Woodard SA, Rosen AC, Ketter TA, 2009a. Corticolimbic metabolic dysregulation in euthymic older adults with bipolar disorder. Journal of Psychiatric Research 43, 497-502. http://dx.doi.org/10.1016/j.jpsychires.2008.08.001
3. Kupferschmidt DA, Zakzanis KK, 2011. Toward a functional neuroanatomical signature of bipolar disorder: quantitative evidence from the neuroimaging literature. Psychiatry Research 193, 71-79.
4. Gonul AS, Coburn K, Kula M, 2009. Cerebral blood flow, metabolic, receptor, and transporter changes in bipolar disorder: the role of PET and SPECT studies. International Review of Psychiatry 21, 323-335.
5. Jauhar S, Nour MM, Veronese M, Rogdaki M, Bonoldi I, Azis M, Turkheimer F, McGuire P, Young AH, Howes OD. A test of the transdiagnostic dopamine hypothesis of psychosis using positron emission tomographic imaging in bipolar affective disorder and schizophrenia. JAMA psychiatry. 2017 Dec 1;74(12):1206-1
6. Lehrer DS, Christian BT, Mantil J, Murray AC, Buchsbaum BR, Oakes TR, Byne W, Kemether EM, Buchsbaum MS. Thalamic and prefrontal FDG uptake in never medicated patients with schizophrenia. American Journal of Psychiatry. 2005 May 1;162(5):931-8.
7. Gonul AS, Coburn K, Kula M. Cerebral blood flow, metabolic, receptor, and transporter changes in bipolar disorder: the role of PET and SPECT studies. International Review of Psychiatry. 2009 Jan 1;21(4):323-35.
8. Fu C, Zhang H, Xuan A, Gao Y, Xu J, Shi D. A combined study of 18F‐FDG PET‐CT and fMRI for assessing resting cerebral function in patients with major depressive disorder. Experimental and therapeutic medicine. 2018 Sep 1;16(3):1873-81.
9. Altamura AC, Delvecchio G, Marotta G, Oldani L, Pigoni A, Ciappolino V, Caletti E, Rovera C, Dobrea C, Arici C, Benatti B. Structural and metabolic differentiation between bipolar disorder with psychosis and substance-induced psychosis: An integrated MRI/PET study. European Psychiatry. 2017 Mar;41(1):85-94.

Table: Association between Posterior Frontal Lobe Left : Diagnosis

	DIAGNOSIS		
Posterior Frontal Lobe Left	**BIPOLAR**	**SCHIZOPHRENIA**	**TOTAL**
Mild hypometabolism	1	0	1
Row %	100.0	0.0	100.0
Col %	2.8	0.0	1.4

Normal	35	36	71
Row %	49.3	50.7	100.0
Col %	97.2	100.0	98.6
TOTAL	36	36	72
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

Chi-square value: 1.0141; **p-value:** 0.3139

Table: Association between Lateral Temporal Lobe Left : Diagnosis

DIAGNOSIS			
Lateral Temporal Lobe Left	**BIPOLAR**	**SCHIZOPHRENIA**	**TOTAL**
Mild to moderate hypermetabolism	0	1	1
Row %	0.0	100.0	100.0
Col %	0.0	2.8	1.4
Normal	36	35	71
Row %	50.7	49.3	100.0
Col %	100.0	97.2	98.6
TOTAL	36	36	72
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

Chi-square value: 1.0141; **p-value:**0.3139

Table: Association between Occipital Lobe Left : Diagnosis

DIAGNOSIS			
Occipital Lobe Left	**BIPOLAR**	**SCHIZOPHRENIA**	**TOTAL**
Diffuse hypermetabolism	1	0	1
Row %	100.0	0.0	100.0
Col %	2.8	0.0	1.4
Mild hypermetabolism	1	1	2
Row %	50.0	50.0	100.0
Col %	2.8	2.8	2.8
Mild hypometabolism	0	1	1
Row %	0.0	100.0	100.0
Col %	0.0	2.8	1.4

Mild to moderate hypermetabolism	0	1	1
Row %	0.0	100.0	100.0
Col %	0.0	2.8	1.4
Normal	34	33	67
Row %	50.7	49.3	100.0
Col %	94.4	91.7	93.1
TOTAL	36	36	72
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

Chi-square value: 3.0149; **p-value:**0.5553

Table: Association between Basal Ganglia Right: Diagnosis

DIAGNOSIS			
Basal Ganglia Right	**BIPOLAR**	**SCHIZOPHRENIA**	**TOTAL**
Diffuse hypermetabolism	1	4	5
Row %	20.0	80.0	100.0
Col %	2.8	11.1	6.9
Mild hypermetabolism	1	4	5
Row %	20.0	80.0	100.0
Col %	2.8	11.1	6.9
Mild hypometabolism	2	1	3
Row %	66.7	33.3	100.0
Col %	5.6	2.8	4.2
Mild to moderate hypometabolism	0	1	1
Row %	0.0	100.0	100.0
Col %	0.0	2.8	1.4
Normal	32	26	58
Row %	55.2	44.8	100.0
Col %	88.9	72.2	80.6
TOTAL	36	36	72
Row %	50.0	50.0	100.0
Col %	100.0	100.0	100.0

Chi-square value: 5.5540; **p-value:** 0.2350

ISSN 2515-8260 Volume 10, Issue 2, 2023

Table: Distribution of mean DURATION OF ILLNESS: Diagnosis

		Number	Mean	SD	Minimum	Maximum	Median	p-value
Duration of Illness	BipoLar	36	6.8056	3.7631	2.0000	21.0000	7.0000	0.9805
	Schi Zop HreNia	36	6.8333	5.6594	1.0000	25.0000	5.0000	