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A study on the assessment of severity of major depression in relation to neutrophil-lymphocyte ratio and platelet-lymphocyte ratio

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ABSTRACT

To assess the severity of major depression in relation to neutrophil-lymphocyte ratio and platelet-lymphocyte ratio. A total of 186 patients gave their consent to participate in this study. The symptoms and the severity of depression were assessed by using the "Hamilton rating scale for depression" (HAM-D). Blood samples were collected for biochemical analysis and were subjected to measure the values of neutrophils, lymphocytes, platelets, neutrophil-lymphocyte ratio and platelet-lymphocyte ratio. The mean values of neutrophil-lymphocyte ratio in mild, moderate, severe and very severely depressed individuals were found to be 1.40 (± 0.24), 2.52 (± 0.27), 3.53 (± 0.3) & 4.39 (± 0.3) respectively and it was observed that the values of neutrophil-lymphocyte ratio was increased as the severity of the depression increases ($r=0.9995$, $p=0.0005$). The mean values of platelet-lymphocyte ratio in mild, moderate, severe and very severely depressed individuals were observed to be 147.21 (± 34.25), 217.83 (± 12.09), 267.31 (± 15.86) & 316.29 (± 18.44) respectively and it was found that the values of platelet-lymphocyte ratio was increased as the severity of the depression increases ($r=0.9993$, $p=0.0007$). Increase in severity of depression positively correlated with increase in the values of both neutrophil-lymphocyte ratio (NLR) and platelet-lymphocyte ratio (PLR). Increased values of PLR showed a significant impact when compared to the values of NLR, as more than two third of the patients (71.5%) reported an increased values of PLR beyond their normal range when compared to the increased values of NLR which was just confined to only 4.8% of the study population.

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INTRODUCTION

Depression is a mental disorder that presents with depressed mood, loss of interest or pleasure, decreased energy, feelings of guilt or low self-worth, disturbed sleep or appetite, and poor concentration (Mossie *et al.*, 2016). Depression is majorly caused by abuse either physically or emotionally, certain medications like corticosteroids, death or loss of loved one, genetical factors, serious illness and substance abuse (Brown and Gershon, 1993; Marcus *et al.*, 2012). According to WHO, about 300 million people are suffering from depression worldwide (Bashar *et al.*, 2019). In severe cases, depres-

sion may lead to suicide and almost 800000 deaths occur every year (Wang *et al.*, 2007). Proper and early diagnosis is very important for the effective treatment of depression which improves the quality of life of the patient (Unutzer and Park, 2012). When the diagnosis for the depression is not accurate, the search for physical explanation of the symptoms causes unnecessary increase in the medication utilization rate (Smith *et al.*, 2013). Hence, the evaluation of symptoms is necessary prior to the initiation of drug therapy. No proper laboratory tests were available for the diagnosis of depression at present (Lee *et al.*, 2018). In various clinical settings, interview based instruments and non-interview methods exist for the screening of depression (Milica *et al.*, 2019). There is a need for the development of accurate methods for the diagnosis of depression which may increase the reliability in diagnosis that would help the health care providers in dealing the depression with a positive outcome.

The neutrophil-lymphocyte ratio (NLR) is a simple, inexpensive and reliable method to evaluate the extent of stress and systemic inflammation (Luo *et al.*, 2018). This ratio has been extensively studied in the clinical fields like oncology (Ittiamornlert and Ruengkachorn, 2019) and cardiology (Chen *et al.*, 2018), but there are only few studies related to the neuropsychiatry (Atli *et al.*, 2015; Ozyurt *et al.*, 2018). Studies suggest that neutrophil-lymphocyte ratio and platelet-lymphocyte ratio (PLR) can be used as the prognostic inflammatory mediators in the psychiatry disorders (Kayhan *et al.*, 2017). Very few studies were available which projects the relationship of neutrophil-lymphocyte and platelet-lymphocyte ratios with the severity of depression. Hence in this study, we made an attempt to investigate the relationship of neutrophil-lymphocyte ratio and platelet-lymphocyte ratio with the severity of depression in the Indian scenario.

MATERIALS AND METHODS

This was a prospective study conducted for a period of 6 months at a Psychiatry hospital after obtaining the ethical clearance from the institutional ethics committee. Patients of both the genders of all age groups who were diagnosed with major depression were included in the study. Patients with concurrent disease conditions such as mixed anxiety depressive disorder, bipolar disorder, substance abuse, hypertension, diabetes mellitus, heart diseases, hepatic impairment, renal impairment, smoking, pregnancy, acute/chronic inflammatory disease state, auto immune disorders, obesity, hypothyroidism, mental retardation and other psychological disor-

ders were excluded from the study. A total of 186 patients gave their consent to participate in this study and demographic details of these patients were collected by using a previously designed data collection proforma.

The symptoms and severity of depression were assessed by using the "Hamilton rating scale for depression" (HAM-D). According to this scale, the severity of the depression can be classified into normal (0-7), mild depression (8-13), moderate depression (14-18), severe depression (19-22) and very severe depression (≥ 23). Blood samples were collected for biochemical analysis and were subjected to measure the values of neutrophils (normal range: 50-70%), lymphocytes (normal range: 20-40%), platelets (normal range: 1.5-4.0 Lakhs/cmm), neutrophil-lymphocyte ratio (normal range: 1.2-4.4) and platelet-lymphocyte ratio (normal range: 75-199). Neutrophil-lymphocyte ratio can be calculated by dividing the neutrophil count with the lymphocyte count while the platelet-lymphocyte ratio can be calculated by dividing the absolute platelet count with the absolute lymphocyte count (Lee *et al.*, 2018; Milica *et al.*, 2019).

Statistical analysis

The data was analysed by using the statistical software SPSS 21.0. Mean and Standard deviations were calculated and chi-square test was performed for obtaining the chi-square values. Correlation analysis was also performed in order to obtain the correlation coefficient (r) values and the p-values ($p < 0.05$).

RESULTS

During this study, a sample of 186 patients with depression was taken into consideration for the collection of blood samples in order to estimate the neutrophil-lymphocyte ratio and platelet-lymphocyte ratio. Out of these, 114 (61.2%) were males and 72 (38.8%) were females. Table 1 represents the categorization of the study population based on age and severity of depression. Majority of the patients were found in the age group of 41-50 years (42.3%) followed by the age group 51-60 years (25.7%). The assessment of the severity of depression was done by using Hamilton rating scale for depression in this study. Majority of the depressed individuals were observed with moderate depression (34.9%) followed by mild (28.0%) and severe depression (24.2%). The mean score of the mild, moderate, severe and very severely depressed individuals were found to be 11.52 (± 1.14), 15.63 (± 1.39), 20.67 (± 1.12) and 33.63 (± 6.74) respectively in this study.

Table 1: Categorization of the study population based on age and severity of depression

Parameters		Male (%)	Female (%)	Total (%)	χ^2 value	p-value
Age (in years)	31-40	21 (18.5)	22 (30.6)	43 (23.0)	7.13	0.067
	41-50	53 (46.5)	26 (36.1)	79 (42.3)		
	51-60	33 (28.9)	15 (20.8)	48 (25.7)		
	61-80	7 (6.1)	9(12.5)	16 (9.0)		
	Total	114 (100)	72 (100)	186 (100)		
Severity of depression	Mild	32 (28.1)	20 (27.8)	52 (28.0)	2.57	0.46
	Moderate	39 (34.2)	26 (36.1)	65 (34.9)		
	Severe	25 (21.9)	20 (27.8)	45 (24.2)		
	Very Severe	18 (15.8)	6 (8.3)	24 (12.9)		
	Total	114 (100)	72 (100)	186 (100)		

Table 2: Mean and Standard deviations of various parameters included in the study based on severity of depression

Parameter	Severity	Male Mean (\pm SD)	Female Mean (\pm SD)	Overall Mean (\pm SD)
Moderate Severe Very severe	Mild	63.33 (\pm 11.81)	64.12 (\pm 12.24)	63.65 (\pm 11.89)
	Moderate	78.24 (\pm 11.70)	77.70(\pm 8.78)	78.00 (\pm 10.30)
	Severe	86.22 (\pm 3.13)	81.60 (\pm 5.53)	85.08 (\pm 4.24)
	Very severe			
Lymphocytes	Mild	33.66 (\pm 7.90)	32.50 (\pm 9.34)	33.21 (\pm 8.41)
	Moderate	24.54 (\pm 3.60)	25.12 (\pm 2.93)	24.77 (\pm 3.33)
	Severe	22.16 (\pm 2.60)	22.10 (\pm 1.74)	22.13 (\pm 2.24)
	Very severe	19.72 (\pm 1.17)	18.50 (\pm 0.83)	19.42 (\pm 1.21)
Platelets	Mild	4.97 (\pm 1.30)	4.60 (\pm 1.32)	4.82 (\pm 1.31)
	Moderate	5.33 (\pm 0.82)	5.48 (\pm 0.66)	5.39 (\pm 0.76)
	Severe	6.01 (\pm 0.54)	5.83 (\pm 0.47)	5.93 (\pm 0.52)
	Very severe	6.17 (\pm 0.66)	5.91 (\pm 0.62)	6.11 (\pm 0.65)
NLR	Mild	1.41 (\pm 0.26)	1.38 (\pm 0.22)	1.40 (\pm 0.24)
	Moderate	2.54 (\pm 0.26)	2.50 (\pm 0.30)	2.52 (\pm 0.27)
	Severe	3.51 (\pm 0.31)	3.57 (\pm 0.28)	3.53 (\pm 0.30)
	Very Severe	4.38 (\pm 0.03)	4.41 (\pm 0.33)	4.39 (\pm 0.30)
PLR	Mild	147.40 (\pm 31.81)	146.90 (\pm 38.70)	147.21 (\pm 34.25)
	Moderate	217.92 (\pm 11.75)	217.69 (\pm 12.82)	217.83 (\pm 12.09)
	Severe	269.56 (\pm 15.47)	264.45 (\pm 16.30)	267.31 (\pm 15.86)
	Very severe	315.55 (\pm 16.77)	318.5 (\pm 24.48)	316.29 (\pm 18.44)

Table 2 represents the mean values and the standard deviations of various parameters included in the study based on severity of depression. The mean values of the neutrophils in mild, moderate, severe and very severely depressed individuals were found to be 46.13 (\pm 11.24), 63.65 (\pm 11.89), 78.00 (\pm 10.30) and 85.08 (\pm 4.24) respectively. The mean values of the lymphocytes in the mild, moderate, severe and very severely depressed individuals was found to be 33.21 (\pm 8.41), 24.77 (\pm 3.33), 22.13 (\pm 2.24) and 19.42 (\pm 1.21) respectively. The

mean values of the platelets in the mild, moderate, severe and very severely depressed individuals was observed to be 4.82 (\pm 1.31), 5.39 (\pm 0.76), 5.93 (\pm 0.52) and 6.11 (\pm 0.65) respectively.

The mean values of neutrophil-lymphocyte ratio and platelet-lymphocyte ratio of the overall study population were found to be 2.70 (\pm 1.04) and 222.76 (\pm 60.88) respectively. The mean values of neutrophil-lymphocyte ratio in mild, moderate, severe and very severely depressed individuals were found to be 1.40 (\pm 0.24), 2.52 (\pm 0.27),

3.53 (± 0.30) & 4.39 (± 0.30) respectively. The mean values of platelet-lymphocyte ratio in mild, moderate, severe and very severely depressed individuals were observed to be 147.21 (± 34.25), 217.83 (± 12.09), 267.31 (± 15.86) & 316.29 (± 18.44) respectively.

DISCUSSION

A total of 186 patients who were diagnosed with major depression were included in this study and the neutrophil-lymphocyte ratio and platelet-lymphocyte ratio were estimated for assessing the severity of major depression in relation to neutrophil-lymphocyte ratio and platelet-lymphocyte. Most of the patients with major depression were observed in the age group of 41-50 years (42.3%) as the major depression is more common in the middle aged persons due to various personal and professional reasons in their life. Hamilton rating scale for depression was used for the assessment of the severity of depression and it was observed that moderately depressed patients (34.9%) were observed to be more in this study.

In this study, the mean values of the neutrophils, lymphocytes and platelets of the overall study population were found to be 64.99 (± 17.49), 25.80 (± 7.00) and 5.45 (± 1.00) respectively. It was observed that as the neutrophil count increases, the severity of the depression was increased ($r=0.9958$, $p=0.0042$) where as the lymphocytes values were found to be decreased as the severity of the depression increases ($r = -0.9733$, $p=0.0267$). This result was similar to the study done by Demir S *et al.* (Demir S *et al.*, 2015). It was also observed that the platelet count was found to be increased in the patients as the severity of the depression increases ($r=0.9917$, $p=0.0083$).

In this study, the values of the neutrophil-lymphocyte ratio was increased as the severity of the depression increases ($r=0.9995$, $p=0.0005$) and it was also found that the values of the platelet-lymphocyte ratio was also increased as the severity of the depression increases ($r=0.9993$, $p=0.0007$). This result was similar to the study done by Fatih K *et al.* (Fatih K *et al.*, 2017). Among the 186 study participants, a total of 9 (4.8%) patients were found to have the values of neutrophil-lymphocyte ratio beyond the reference range and were observed to be with very severe depression. No patient with mild, moderate and severe depression was observed with neutrophil-lymphocyte ratio values above the reference range. About 133 (71.5%) depressed patients were observed to have the values of platelet-lymphocyte ratio beyond the

reference range. Among these 133 individuals, about 64(48.1%) individuals were observed with moderate depression, 45 (33.8%) were of severe depression and about 24 (18.1%) were of very severe depression. No patient with mild depression was observed with platelet-lymphocyte ratio value beyond the reference range.

CONCLUSIONS

As the severity of depression increases, the neutrophil count as well as the platelet count was observed to be increased, while the lymphocyte count was found to be decreased. Increase in severity of depression positively correlated with the increase in the values of both neutrophil-lymphocyte ratio (NLR) and platelet-lymphocyte ratio (PLR). Increased values of PLR showed a significant impact when compared to the values of NLR, as more than two third of the patients (71.5%) reported an increased values of PLR beyond their normal range when compared to the increased values of NLR which was just confined to only 4.8% of the study population.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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