Research Article

Value of Neutrophil (Lymphocyte Ratio), Red Blood Cell Distribution Width, Mean Platelet Volume and C - Reactive Protein in the Assessment of Major Depressive Disorder

Kanti Paul T[1], Paul D[2], Shamsun Nahar J[3], Ahmed S[4], Saiful Islam M[2], Ferdoushi S[2], Saiful Islam M[2,5], Sultana T[6], Quddusur Rahman M[7], Uddin Ahmed M[8]* and Nashimuddin Ahmed AN[9]

[1]OSD, DGHS, Mohakhali, Bangladesh
[2]Associate Professor, Department of Laboratory Medicine, BSMMU, Bangladesh
[3]Professor and Chairman, Department of Psychiatry, BSMMU, Bangladesh
[4]Lecturer in Microbiology, Anower Khan Modern Medical College, Bangladesh
[5]Medical officer, Department of Laboratory Medicine, BSMMU, Bangladesh
[6]Associate Professor, Department of Psychiatry, BSMMU, Bangladesh
[7]Professor and Chairman, Department of Laboratory Medicine, BSMMU, Bangladesh
[8]Master of Microbiology, Bangladesh University of Health Sciences, Bangladesh
[9]Professor, Department of Laboratory Medicine, BSMMU, Bangladesh

*Corresponding author: Uddin Ahmed M, Master of Microbiology, Bangladesh University of Health Sciences, Bangladesh

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Abstract

Major Depressive Disorder (MDD) is a common psychological problem in the world. In Bangladesh prevalence of MDD is about 4.6%. MDD is associated with reduced quality of life as well as high level of social and occupational impairment. This case control study was conducted at the Department of Laboratory Medicine (Clinical Pathology) in collaboration with the Department of Psychiatry, BSMMU, Dhaka, from March' 2016 to February' 2017. Total 130 patients were enrolled in this study and divided into Group I (cases) and Group II (controls). Each group was consisted of 65 subjects. The patients who fulfilled the criteria of MDD were determined as cases in this study. This study measured Complete Blood Count (CBC) with Peripheral Blood Film (PBF) including differential count of WBC, Neutrophil/Lymphocyte Ratio (NLR), Red Blood Cell Distribution Width (RDW), Mean Platelet Volume (MPV) and C-Reactive Protein (CRP) in MDD diagnosed patients and healthy controls. CBC was measured by automated hematology analyzer (SYSMEX-XT 4000i) and CRP was measured by biochemistry auto analyzer (Dimension RxL Max). The mean age was 33.06 ± 12.23 years for patients with MDD and 33.05 ± 11.43 years for the control group. There was no significant difference between the age for groups (P>0.05). Female [43(66.2%)] were predominant in both groups. NLR, RDW-CV, MPV and CRP levels were found to be 2.36 ± 0.38, 14.20 ± 1.08 %, 10.93 ± 0.54 fl and 5.25 ± 1.84 mg/L in patients with MDD respectively and 1.77 ± 0.24, 13.03 ± 0.61 %, 9.39 ± 0.91 fl and 2.56 ± 1.16 mg/L in controls respectively. NLR, RDW, MPV and CRP levels were significantly higher in patients with MDD compared to the control group (P<0.05). In ROC analysis, cut off value of NLR was (>1.98) with sensitivity 84.6% and specificity 73.8%. Cut off value of RDW-CV level was (>13.45%) with sensitivity 73.8% and specificity 72.7%. Cut off value of MPV was (>10.25 fl) with sensitivity 89.2% and specificity 81.5%. Cut off value of CRP was (>3.58 mg/L) with sensitivity 83.1% and specificity 72.3%.This findings of the study revealed that NLR, RDW-CV, MPV and CRP trend to be higher in MDD. So these markers may be useful tool for assessing MDD.

Introduction

Major Depressive Disorder (MDD) is one of the common psychological problems in the world [1]. In 2000, depressive disorders were the 4th leading cause of burden as well as of disability in world [2]. According to World Health Organization depressive disorders will be the second leading cause of morbidity worldwide by the year of 2020 [3] (Figure 1). The prevalence of major depressive disorder is about 5% worldwide [4]. In Bangladesh prevalence of MDD is about 4.6% [5]. It is associated with reduced quality of life as well as high level of social and occupational impairment. Diagnosis of MDD is done by clinical criteria. There is no serum marker available for detection of MDD [6]. Tumor necrosis factor-α (TNF-α), interleukine-6 (IL-6), interleukine1β (IL-1β), CD4/CD8 ratio, haptoglobin, Prostaglandin-E2 (PGE2), Corticotrophin-Releasing Hormone (CRH) are useful biomarkers [7,8]. These tests are expensive and time consuming not easily available [9] (Tables 1-3). Neutrophil/lymphocyte Ratio (NLR), Red blood cell Distribution Width (RDW), Mean Platelet Volume (MPV) and C - Reactive Protein (CRP) have been suspected as the predictors of various diseases [6,10]. NLR, RDW and MPV are derived from Complete Blood Count (CBC). CBC and CRP are less expensive and mostly available test all over the world as well as in Bangladesh. The impact of Neutrophil/Lymphocyte Ratio, Red Blood Cell Distribution Width, Mean Platelet Volume and C - reactive protein in major depressive disorder is to prevent unnecessary delay and to start treatment as early as possible and thereby to reduce morbidity and depression related complications. Therefore, the purpose of the study was to evaluate the value of NLR, RDW, MPV and CRP in the assessment of major depressive disorder.

Methodology

Study design: Case-control study

Place of study: This study was conducted at the Department of Laboratory Medicine (Clinical Pathology) in collaboration with the
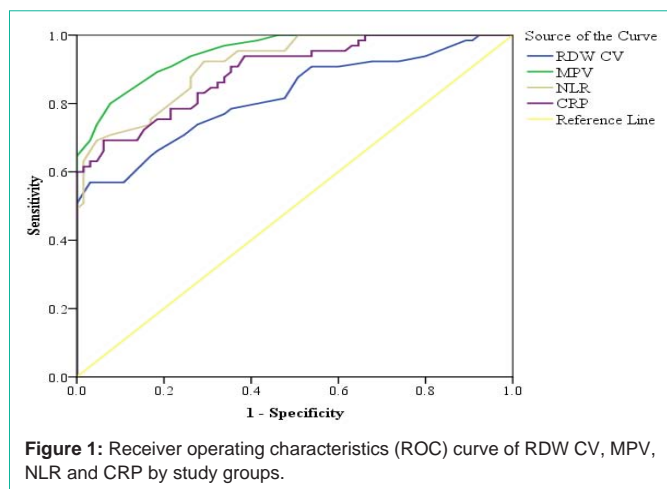
Figure 1: Receiver operating characteristics (ROC) curve of RDW CV, MPV, NLR and CRP by study groups.

Table 1: Age distribution of the study population (n=130).

Age (years)	Study group				p value*
	Case (n=65)		Control (n=65)		
	No.	%	No.	%	
18-25	21	32.3	19	29.2	
25-35	22	33.8	25	38.5	
35-45	11	16.9	14	21.5	
45-55	8	12.3	4	6.2	
55-70	3	4.6	3	4.6	
Mean ± SD	33.06 ± 12.23		33.05 ± 11.43		0.994[ns]

Table 2: Sex distribution of the study population (n=130).

Sex	Study group				p value*
	Case (n=65)		Control (n=65)		
	No.	%	No.	%	
Male	22	33.8	22	33.8	0.999[ns]
Female	43	66.2	43	66.2	

Department of Psychiatry, BSMMU, Dhaka.

Study period: One year (From March 2016 to February 2017).

Justification of the place of study: Bangabandhu Sheikh Mujib Medical University is the only medical university of Bangladesh. Department of Psychiatry, of Bangabandhu Sheikh Mujib Medical University is also a well-established and have inpatient and outpatient unit (Table 4). Through outpatient department, around 8-10 Patients of Major Depressive Disorder per day get services by qualified psychiatrist or by trainee doctor under supervision of qualified psychiatrist. Samples are more representative as patients come from different places and social class. This is a national level tertiary hospital and is concerned with national policy making along with hospital services. This hospital has high quality consultations service, follows standard diagnostic protocol and is within reach of general people. That's why this is highly resourceful place for data collection. Considering all, it is assumed that sufficient number of patients of Major Depressive Disorder would be available in these facilities within specified time.

Study population: Newly diagnosed all stages of MDD patients

Table 3: Laboratory test results of mean difference between cases and controls (n=130).

Parameters	Study group		p value*
	Case (n=65)	Control (n=65)	
	Mean ± SD (Min-max)	Mean ± SD (Min-max)	
Hb (g/dl)	12.70 ± 0.89 (11.50-15.30)	13.09 ± 1.04 (11.50-16.30)	0.023[s]
ESR (mm in 1st hour)	21.35 ± 7.56 (5.00-32.00)	14.52 ± 5.54 (2.00-25.00)	0.001[s]
RBC count (x 10^{12}/L)	4.36 ± 0.54 (3.1-5.40)	4.52 ± 0.43 (3.60-5.50)	0.064[ns]
WBC count (x 10^9/L)	8.87 ± 1.25 (6.50-11.00)	8.34 ± 1.07 (6.00-10.00)	0.011[s]
PLT count (x 10^9/L)	302.94 ± 41.14 (200.00-390.00)	316.57 ± 47.25 (204.00-397.00)	0.082[ns]
MCV (fl)	85.61 ± 4.64 (76.00-95.80)	85.37 ± 4.27 (76.10-94.40)	0.752[ns]
MCH (pg)	28.62 ± 1.36 (25.10-31.90)	29.04 ± 1.19 (27.00-31.50)	0.064[ns]
MCHC (g/dl)	33.42 ± 1.21 (30.40-36.00)	33.79 ± 1.26 (30.00-36.50)	0.088[ns]
N%	65.63 ± 3.63 (57.00-72.00)	59.15 ± 3.08 (51.00-64.00)	0.001[s]
ANC (x 10^9/L)	5.83 ± 0.93 (3.99-7.92)	4.94 ± 0.70 (3.36-6.40)	0.001[s]
L%	28.26 ± 3.05 (22.00-34.00)	33.78 ± 3.07 (28.00-41.00)	0.001[s]
ALC (x 10^9/L)	2.50 ± 0.39 (1.61-3.30)	2.82 ± 0.44 (2.04-3.90)	0.001[s]

Table 4: Laboratory test results of mean difference between cases and controls (n=130).

Parameters	Study group		p value*
	Case (n=65)	Control (n=65)	
	Mean ± SD (Min-max)	Mean ± SD (Min-max)	
RDW CV (%)	14.20 ± 1.08 (12.00-16.70)	13.03 ± 0.61 (11.70-14.00)	0.001[s]
MPV (fl)	10.93 ± 0.54 (9.80-11.80)	9.39 ± 0.91 (7.30-10.60)	0.001[s]
NLR	2.36 ± 0.38 (1.76-3.27)	1.77 ± 0.24 (1.24-2.25)	0.001[s]
CRP (mg/L)	5.25 ± 1.84 (1.98-10.20)	2.56 ± 1.16 (0.34-4.40)	0.001[s]

Table 5: Area under the curve of RDW-CV, MPV, NLR and CRP by MDD Group (n=130).

Test Result Variables	AUC	p value[a]	95% CI of AUC	
			Lower Bound	Upper Bound
RDW CV (%)	0.819	0.001[s]	0.746	0.892
MPV (fl)	0.949	0.001[s]	0.917	0.982
NLR	0.914	0.001[s]	0.870	0.959
CRP (mg/L)	0.892	0.001[s]	0.839	0.944

without taking antidepressant drugs, attending in the Department of Psychiatry, BSMMU, Dhaka and age, sex matched healthy subjects were enrolled in this study. Control group comprised healthy volunteers who were attendances of patients (Table 5), attending in the Department of Psychiatry and Laboratory Medicine, BSMMU, Dhaka.

Inclusion criteria:

- The patients were included as MDD according to the criteria's of the Diagnostic and Statistical Manual of Mental Disorders (5th edition) and patients were diagnosed by

Table 6: Distribution of the study population according to groups with RDW-CV (n=130).

RDW CV (%)	Case (n=65)		Control (n=65)		p value*
	n	%	n	%	
Raised (>13.45)	48	73.8	18	27.7	0.001ˢ
Normal	17	26.2	47	72.3	
Total	**65**	**100**	**65**	**100**	

Table 7: Distribution of the study population according to groups with MPV (n=130).

MPV (fl)	Case (n=65)		Control (n=65)		p value*
	n	%	n	%	
Raised (>10.25)	58	89.2	12	18.5	0.001ˢ
Normal	7	10.8	53	81.5	
Total	**65**	**100**	**65**	**100**	

Table 8: Distribution of the study population according to groups with NLR (n=130).

NLR	Case (n=65)		Control (n=65)		p value*
	n	%	n	%	
Raised (>1.98)	55	84.6	17	26.2	0.001ˢ
Normal	10	15.4	48	73.8	
Total	**65**	**100**	**65**	**100**	

Table 9: Distribution of the study population according to groups with CRP (n=130).

CRP (mg/L)	Case (n=65)		Control (n=65)		p value*
	n	%	n	%	
Raised (>3.58)	54	83.1	18	27.7	0.001ˢ
Normal	11	16.9	47	72.3	
Total	**65**	**100**	**65**	**100**	

Table 10: Validity of diagnostic tests.

Diagnostic tests	Sensitivity	Specificity	PPV	NPV	Accuracy
RDW CV (%)	73.8%	72.3%	72.7%	73.4%	73.1%
MPV (fl)	89.2%	81.5%	82.9%	88.3%	85.4%
NLR	84.6%	73.8%	76.4%	82.8%	79.2%
CRP (mg/L)	83.1%	72.3%	75.0%	81.0%	77.7%

expert psychiatric clinician

- The healthy controls with no previous psychiatric diseases
- Age was ≥18 years old
- Both sexes

Exclusion criteria:

- The patients were excluded with-
- Anemia
- Active infections, a leukocyte value suggesting infection
- Other inflammatory or autoimmune diseases
- Severe systemic diseases such as - epilepsy, diabetes mellitus, hypertension, cardiac diseases, hepatic or renal failure

- Alcohol or other substances addiction
- Severe head trauma or mental retardation
- Pregnancy
- Vitamin or fish oil intake
- Heavy smoking (>30cigarettes/day)
- Obesity (BMI > 30 kg/m²) and concomitant drug use for any reason

Total sample size: 130

Group I (MDD group): 75 patients with MDD were evaluated and 65 newly diagnosed MDD patients were enrolled in this study as cases.

Group II (control group): 65 age sex matched healthy subjects were enrolled in this study as controls.

Sampling technique: Consecutive sampling technique was applied for enrollment of the patients in this study. As per inclusion criteria the patients were enrolled in this study. The procedures were explained to the participants and informed written consent was taken (Tables 6,7). Prior to the study pre-testing was carried out among patients equivalent to 10% of total study population to test the applicability of the methodology including the research instruments. Some modification in the questions was made out and was finalized.

Specimen collection: About 4.0 ml venous blood was collected from each patient through an aseptic venipuncture from antecubital vein. 2.0 ml blood was collected in EDTA tube for Complete Blood Count (CBC) which was measured by haematology auto analyzer (SYSMEX-XT 4000i) and a smear was made for Peripheral Blood Film (PBF) examination. The EDTA containing blood sample was tested within 2 hours of collection. Rest 2.0 ml blood was collected in plain test tube for CRP measurement. CRP was measured by Biochemistry auto analyzer (Dimension RxL Max) within 2 hours of collection.

Test procedure: Complete blood count (CBC): CBC was estimated by hematology auto- analyzer (SYSMEX-XT 4000i) which again rechecked manually by peripheral blood film. NLR was measured by dividing neutrophil count to lymphocyte count from CBC report and RDW and MPV was simultaneously reported as a part of CBC.

NLR= Total Neutrophil Count/Total Lymphocyte Count

RDW-CV= 1 SD/MCV×100%

MPV (fl) = Plateleterit (%)/PLT (×10⁹/L)

Peripheral Blood Film (PBF): For examination of peripheral blood film, uniform blood smear was made on a glass slide with the help of spreader. Leishman's staining was done by standard technique. It was examined by binocular light microscope at first 10x objective then 40x objectives.

C - reactive protein: CRP was measured by Biochemistry auto analyzer (Dimension RxL Max) using the C-Reactive Protein Extended Range (RCRP) method. The RCRP method is based on a particle enhanced turbidimetric immunoassay (PETIA) technique.

Safety precaution: Universal precaution was obtained. Gloves,

laboratory coat, and safety glasses was worn when handling all human blood products. Disposable plastic, glass, paper and gloves that contact blood were placed in a biohazard bag. Non-disposable material at the end of working day was disinfected. Washing hands thoroughly was done after removal of personal protective devices used in handling specimens and kit reagents.

Data collection: Data were collected by a pre designed proforma. Blood samples were obtained from the patient. Patient's information was obtained through using patient's information sheet which involves, questionnaire, clinical finding & laboratory reports. Statistical Package for Social Science (SPSS) version 23 was used for all statistical analysis. The significance of mean difference between case and control groups were assessed by Student's t test and Chi-square test was used to compare categorical variables. Data were presented as mean ± SD. Receiver Operating Characteristics (ROC) curve graphics were used in the comparison of sensitivity and specificity. P-values less than 0.05 were regarded as significant.

Results

Among the 12 parameters the mean difference between cases and controls, five parameters shows non-significant result (p>0.05) but rest seven parameters show statistically significant (p<0.05). In this study, Hb, ESR, RBC count, WBC count, PLT count, MCV, MCH, MCHC, Neutrophil%, ANC, Lymphocyte% and ALC were linked to main outcome variables but not direct outcome variables. So these parameters were placed in separated.

Discussion

Among the psychological conditions, depression is a common, complex disease. Depression is associated with prominent disability, social burden and reduced quality of life [11]. Immune response and inflammation play a significant role in the etiology of MDD [12]. This case-control study was conducted in the Department of Laboratory Medicine (Clinical Pathology) in collaboration with the Department of Psychiatry, BSMMU, Dhaka. In this study, Level of NLR, RDW, MPV and CRP were measured in newly diagnosed Major Depressive Disorder patients and compared with healthy controls. This study included total 130 patients of which Group I, 65 patients with MDD who were clinically diagnosed and Group II, 65 controls who did not have any symptom or sign of MDD and were apparently healthy. In this study, it was found that mean age of patients with Group I (MDD) and Group II (control) was 33.06 ± 12.23 and 33.05 ± 11.43 years respectively. The difference of mean age was not statistically significant among two study groups (p>0.05). This observation is consistent with the findings of others [6,12,13]. Demir and co-investigators found that the median age of MDD group and control group was 28.4±9.2 and 30.0±9.2 years respectively. The difference in age between the groups were not also statistically significant (p>0.05).The present study showed that male were 22 (33.8%) and female were 43 (66.2%). Predominance female patient was also found in other studies [6,13,14]. Their study found that male and female ratio was approximately 1:2. These findings were nearly consistent with our study. In this study, it was found that mean Hb were 12.70±0.89 g/dl in cases and 13.09±1.04 g/dl in controls (p<0.05). Mean ESR were 21.35±7.56 mm in 1st hour in cases and 14.52±5.54 mm in 1st hour in controls (p<0.05). Mean RBC count were 4.36±0.54 x 1012/L in cases and 4.52±0.43 x 1012/L in controls (p>0.05). Mean WBC count were

8.87±1.25x109/L of blood in cases and 8.34±1.07 x109/L of blood in controls (p<0.05).Mean PLT count were 302.94±41.14 x109/L of blood in cases and 316.57±47.25 x109/L of blood in control (p>0.05). Mean MCV were 85.61±4.64 fl in cases and 85.37±4.27 fl in control (p>0.05). Mean MCH were 28.62±1.36 pg in cases and 29.04±1.19 pg in control group (p>0.05). Mean MCHC were 33.42±1.21 g/dl in cases and 33.79±1.26 g/dl in control group (p>0.05). Mean neutrophil (%) were 65.63±3.63 in cases and 59.15±3.08 in control group (p<0.05). Mean ANC were 5.83±0.93 x 109/L in cases and 4.94±0.70 x 109/L in control group (p<0.05). Mean lymphocyte (%) were 28.26±3.05 in cases and 33.78±3.07 in control group (p<0.05). Mean ALC were 2.50±0.39 x 109/L in cases and 2.82±0.44 x 109/L in control group (p<0.05). Here, RBC count, PLT count, MCV, MCH and MCHC of mean difference between cases and controls show not statistically significant (p>0.05). These findings are similar to several studies [6,9]. But others like Hb, ESR, WBC count, Neutrophil%, ANC, Lymphocyte%, ALC are statistically significant (p<0.05). These results are consistent with other studies [6,9,13]. These parameters are part of CBC and are linked to the main outcome variables. RDW are derived from the formula of [(one Standard deviation of red cell volume ÷ mean cell volume) x 100] and NLR also derived from dividing absolute neutophil count by absolute lymphocyte count [6]. In our study, it was observed that the baseline NLR were higher in MDD patients than healthy controls. In this study mean NLR in Group I was 2.36±0.38, whereas it was 1.77±0.24 in Group II. The differences between the Group I (case) and Group II (Control) of NLR were statistically significant (p<0.001). These results agreed to the findings of other studies [6,13]. Demircan F et al. [6] found that mean NLR was 2.55±0.70 in patients with MDD, whereas it was 1.41±0.8 in control group (p<0.001). Peng YF et al., [13] also found higher mean NLR in patients with MDD group compared to the control group (1.9±0.73 *vs.* 1.7±0.62) (p<0.05). In this study, mean RDW-CV (%) level was found to be 14.20±1.08 in patients with MDD and mean RDW-CV (%) level was found to be 13.03±0.61 in the control group. RDW levels were significantly higher in patients with MDD compared to the control group (p<0.001). These findings are similar to a study conducted by Demircan F et al., [6]. They also found higher mean RDW in patients with MDD group compared to the control group (14.3±2.6 *vs.* 13.4±1.8) (p<0.001). Peng YF et al., [13] also found higher mean RDW in patients with MDD group compared to the control group (13.4±0.87 *vs.* 12.9±0.58) (p<0.001). These findings are also consistent with present study. In the present study, it was found that means MPV level was 10.93±0.54 fl in patients with MDD group and mean MPV level was 9.39±0.91 fl in the control group. There was high MPV level in patients with MDD when compared with controls. The differences between the patients with MDD group and control group of MPV were statistically significant (p <0.001). These results are consistent with other studies [6,14]. Demircan F et al., [6] found higher mean MPV in patients with MDD group compared to the control group (10.4±1.46 *vs.* 9.33±1.14) (p<0.001). Ataoglu A et al., [14] also found higher mean MPV in patients with MDD group compared to the control group (10.92±0.75 *vs.* 10.01±0.66) (p<0.001). This study demonstrated that mean CRP level was 5.25±1.84 mg/L in patients with MDD group and mean CRP level was 2.56±1.16 mg/L in the control group. CRP levels were significantly higher in depression group relative to controls (p<0.001). The present study is comparable with several studies that have

reported a positive association between CRP and depression [10,15,17]. Sawyer J., [14] showed mean CRP levels were significantly higher in the depressed population than in the healthy control group (4.4±8.4 mg/L *vs.* 1.6±2.0 mg/L) (p<0.05). Jangpangi D et al., [10] also found that the serum levels of CRP (ng/ml) were significantly higher in depression group as compared to the control group (2132±50.24 *vs.* 1969±69) (p<0.05). Sensitivity and specificity of NLR, RDW, MPV and CRP were determined by Receiver-Operator Characteristic (ROC) curves (Tables 8-10). The curves also determines about prediction of MDD. In ROC analysis, a cut point of 1.98 was identified for NLR in Group I (case). Area under curve was 0.914, 95% CI of AUC was 0.870 - 0.959 for NLR. An NLR value of more than 1.98 demonstrates a sensitivity of 84.6% and a specificity of 73.8%. This study findings correlate with a similar study conducted by Sunbul E A et al., [7]. In ROC curve, they found a cut of point of 1.57 in MDD patients and concluded that an NLR value ≥ 1.57 revealed a sensitivity of 61.4% and a specificity of 61.2%. In another study conducted by Demircan F et al., [6] also found similar result. The cut off value for NLR was 2.05 for diagnosis of MDD in that study population. ROC analysis showed that an optimal RDW cut off value was 13.45% in patients with MDD. Area under curve was 0.819, 95% CI of AUC was 0.746- 0.892 for RDW. A RDW value ≥ 13.45% shows a sensitivity of 73.8% and a specificity of 72.3% for assessing MDD patients. These results are consistent with other studies [6,11]. Peng Y F et al., [11] showed that an optimal RDW cut off value was 13.05% (area under the curve 0.780, 95 CI%: 0.729-0.831) (p<0.001) in patients with MDD, the sensitivity and specificity of an elevated RDW values were 75.69% and 70.66%, in assessing MDD patients. In ROC analysis, a cut off value of 10.25 fl was found for MPV in Group I (case). Area under curve was 0.949, 95% CI of AUC was 0.917- 0.982 for MPV. A MPV value ≥ 10.25 fl demonstrates a sensitivity of 87.7% and a specificity of 73.8% in assessing MDD patients. Similar result is also found by other studies [6,13]. ROC analysis showed that an optimal CRP cut off value was 3.58 mg/L in patients with MDD. Area under curve was 0.892, 95% CI of AUC was 0.839- 0.944 for CRP. A CRP value ≥ 3.58 mg/L shows a sensitivity of 83.1% and a specificity of 72.3% in assessing MDD patients. These findings are consistent with other studies [9,15-19]. Diagnosis of Major Depressive Disorder (MDD) is done by clinical criteria. Tumor necrosis factor-α (TNF-α), interleukine-6 (IL-6), interleukine1β (IL-1β), CD4/CD8 ratio, haptoglobin, PGE2, corticotrophin releasing hormone are useful biomarkers. These tests are expensive and time consuming not easily available. Neutrophil/Lymphocyte Ratio (NLR), Red blood cell Distribution Width (RDW) Mean Platelet Volume (MPV) and C - Reactive Protein (CRP) have been suspected as the predictors of various diseases as well as MDD. NLR, RDW and MPV are derived from Complete Blood Count (CBC). CBC and CRP is less expensive and mostly available test all over the world as well as in Bangladesh. So, observations of this study were within international norms. Our data indicate that, RDW, NLR, MPV and CRP may play role in the assessment of MDD.

Conclusion

It is concluded that RDW, NLR, MPV and CRP were found higher in patients with MDD than healthy controls. These are less expensive and mostly available test. NLR, RDW-CV and MPV can detect during CBC count by auto-analyzer. Sensitivity and specificity are also more. So these parameters can be used as a valuable and effective tool for the management of MDD and treatment follow up.

References

1. Baxter AJ, Scott KM, Ferrari AJ, Norman RE, Vos T, Whiteford HA. Challenging the myth of an 'epidemic' of common mental disorders; trends in the global prevalence of anxiety and depression between 1990 and 2010'. Depress Anxiety. 2014; 31; 506-516.

2. Ustun TB, Ayuso-Mateos JL, Chatterji S, Mathers C, Murray CJ. 'Global burden of depressive disorders in the year 2000'. British Journal of Psychiatry. 2004; 184: 386–392.

3. Ebmeier KP, Donaghey C, Steele JD. 'Recent developments and current controversies in depression'. Lancet. 2006; 367: 153-167.

4. Ferari AJ, Somerville AJ, Baxter AJ. 'Global variation in the prevalence and incidence of major depressive disorder: a systematic review of the epidemiological literature'. Psychol Med. 2013; 43; 471-481.

5. Firoz AHM, Karim ME, Alam MF. 'Community based multi-centric service oriented research on mental illness with focus on awareness, prevalence, care, acceptance and follow-up in Bangladesh'. Manual on Mental Health for primary health care physicians; 2nd edn. NIMH & WHO. 2017.

6. Demircan F, Gozel N, Kilinc F, Ulu R, Atmaca M. 'The Impact of Red Blood Cell Distribution Width and Neutrophil/Lymphocyte Ratio on the Diagnosisof Major Depressive Disorder'. Neurol Ther. 2015.

7. Raison CL, Capuron L, Miller AH. 'Cytokines sing the blues: inflammation and the pathogenesis of depression'. Trends Immunol, 2006; 27: 24-31.

8. Zorrilla EP, Luborsky L, McKay JR, Rosenthal R, Houldin A, Tax A, et al. 'The relationship of depression and stressors to immunological assays: a meta-analytic review'. Brain Behav Immun. 2001; 15: 199–226.

9. Sunbul EA, Sunbul M, Yanartas O, Cengiz F, Bozbay M, Sari I, et al. 'Increased Neutrophil/Lymphocyte Ratio in Patients with Depression is correlated with the Severity of Depression and Cardiovascular Risk Factors.' Psychiatry Investing. 2016; 13: 121-126.

10. Jangpangi D, Mondal S, Bandhu R, Kataria D, Bhattacharjee J, Gandhi A. 'A study of changes in inflammatory markers in patients of depression'. Journal of Mental Health Human Behavior. 2014; 19; 74-77.

11. Kessler RC, Berglund P, Demler O, Jin R, Koretz D, Merikangas KR. 'The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R)'. JAMA, 2003; 289: 3095-3105.

12. Demir S, Atli A, Bulut M, Ibiloglu AO, Gunes M, Kaya MC, et al. 'Neutrophil–lymphocyte ratio in patients with major depressive disorder undergoing no pharmacological therapy'. Neuropsychiatric Disease and Treatment. 2015; 11; 2253–2258.

13. Peng YF, Zhong SM, Luo B, Qin YH, Wei YS. 'Evalution of red blood cell distribution width and neutrophil to lymphocyte ratio in patients with major depressive disorder'. Int J Clin Exp Med. 2016; 9: 3242-3246.

14. Karim ME, Firoz AHM, Alam MF. 'Assessment of depression in Parkinson's disease, psoriasis, stroke and cancer patients'. Ban J of Psychiatry. 2001; 15: 11-8.

15. Ataoglu A, Canan F. 'Mean Platelet Volume in Patients with Major Depression, Effect of Escitalopram Treatment'. Journal of clinical psychopharmacology. 2009; 29: 368-371.

16. Sawyer J. 'C – Reactive Protein (CRP) Levels in a Young Adult Population with Major Depressive Disorder (MDD)'. Honors Scholar Theses. 2016; 501.

17. Penninx BW, Kritchevsky SB, Yaffe K, Newman AB, Simonsick EM, Rubin S, et al. Inflammatory Markers and Depressed Mood in older Persons: Results from the Health, Aging and Body Composition Study. Biol Psychiatry. 2003; 54: 566–572.

18. Berk M, Wadee AA, Kuschkek RH, O'neill-Kerr A. 'Acute Phase Proteins in Major Depression'. Journal of Psychosomatic Research. 1997; 43: 529-534.

19. Sluzewska A, Rybakows J, Bosmansb E, Sobieska M, Berghmans R, Maesd M, et al. 'Indicators of immune activation in major depression'. Psychiatry Research, 1996; 64: 161-167.