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Original Research Article

Reference Value of Neutrophil-Lymphocyte Ratio in Healthy Sudanese in Khartoum

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Abstract: Neutrophil-lymphocyte ratio (NLR) has been recently identified as clinically useful predictive and prognostic biomarker in patients with the different medical illness. To assure easy application and interpretation, the reference value of such parameter should be established. To establish the Sudanese reference value for NLR; a total of 300 Sudanese healthy subjects (150 males, 150 females) with the different age groups between 5 and 85 (mean: 39 year)- were enrolled. A venous blood sample was collected from each subject and analyzed using a Sysmex-KX-21 automated blood analyzer. The NLR was calculated from the absolute number of neutrophils and lymphocytes. Reference value was calculated as mean-2SD to mean+2SD. Simple T-test was used to compare the reference value of WBCs count, neutrophils, lymphocytes, and NLR between both genders and different age groups. The following reference values were obtained for NLR – males 0.5-1.7, females 0.2-2.2; the overall reference value was 0.3-2.9. The mean of NLR in different age groups were as follow: 0.8, 1.3, 1.4, 0.9, 1.2, 1.2 in the age group of <20, 20-29, 30-39, 40-49, 50-59, >60 years old; respectively. There were no significant differences between males/females and individuals below/over 40 years old age, p-values were 0.1, 0.46 respectively. This study illustrated the importance of determining local reference value, because ethnic groups and instruments may vary from published reference values. The reference values for NLR do not vary with age or gender. This reference values pave the way for the clinicians to apply such parameter in the investigations of disease states.
Keywords: Reference, value, Neutrophil, lymphocyte, ratio, Sudan

INTRODUCTION

Complete blood count is a simple, inexpensive and routine practical laboratory test that gives useful information about the patient's peripheral blood picture and counts. Routine peripheral blood picture and contents may be useful in diagnosis and prognosis of many diseases [1-11].

Neutrophil-lymphocyte ratio (NLR) is a simple, easy parameter- calculated by dividing the number of absolute neutrophil by the number of absolute lymphocyte count- to evaluate easily the inflammatory status of a subject. It has demonstrated its usefulness in the stratification of mortality in major cardiac events [12, 13], as a strong prognostic factor in several types of cancers [14–21], or as a predictor and a marker of inflammatory or infectious pathologies and postoperative complications [22, 23]. Even when white blood cells (WBCs) count is in a normal range, NLR has been confirmed to play a predictive role in the prognosis of chronic and acute inflammatory processes [1-11]. A recent meta-analysis study concludes that a high NLR is an independent factor associated with poorer overall survival in many solid tumors (colorectal, hepatocellular, gastroesophageal, ovarian, and pancreatic carcinoma). This marker may be associated with renal or hepatic dysfunction, diabetes mellitus, abnormal thyroid function, hypertension, metabolic syndrome, hematological malignancies, known malignancy, preceding history of local or systemic infection, inflammatory diseases, and any use of medication connected to the inflammatory status of patients [8-11].

However, it's important to know the cut-off value for the NLR; in order to discriminate normal from abnormal results. Moreover, the reference ranges indicated by some manufactures may be unsuitable for

every laboratory and therefore local laboratory reference values should be established [24-26].The importance of determining local references values stems from the observation that laboratory machines may be using different measuring principles and population dynamics vary [25]. Thus, the present study aimed to establish the local reference range of NLR in healthy Sudanese.

MATERIAL AND METHODS

Ethical approval was obtained from the Research Ethics Committee at FMLS-Khartoum University. Cross sectional study was carried out in Khartoum state among healthy Sudanese during a period of January to April 2017. A written informed consent was obtained; demographic data were recorded in a questionnaire. Individual with any acute illness and/or chronic debilitating disease or any condition that can elevate the WBCs count was excluded. A total of 300 subjects were included from different schools/universities, private/governmental institutions and houses. There were 150 males and 150 females with different age groups, their ages ranged between 5 and 85 years old. The Multistage sampling method was followed; study population was categorized into 5 age groups, each group represents equal numbers of both genders.

Procedure: From each enrolled subject EDTA- K3 venous blood sample (3 ml) was collected, mixed gently, and was delivered immediately after collection for laboratory analysis. WBCs count including absolute count of neutrophils and lymphocytes was performed as part of full blood count by automated procedure using Sysmex KX-21 blood cell analyzer. The whole blood mode was selected to analyze blood sample without pre-dilution.

Data analysis:

The results data was collected analyzed using SPSS program and presented in tables. Reference value was calculated as mean-2SD to mean+2SD, simple T-test was used to compare the reference values between both genders and different age groups.

RESULTS

The full blood counts of 300 Sudanese individuals (150 male and 150 female) between the ages of 5 and 86 year (mean was 39 years) were analyzed on the automated blood cell analyzer Sysmex KX-21 to obtain the Neutrophil–lymphocyte ratio (NLR). Means, standard deviations (SD) and reference values of the TWBCs count, absolute count of neutrophil/ lymphocyte and NLR of the entire study population is presented in TABLE 1. The reference value of NLR obtained in this study was 0.3-2.9.

Table 1: MEAN, S.D and Reference Values of NLR

Variable	N/300	Mean ± SD	Min	Max	Reference value
Age		39.0 ± 19.2	5	85	
TWBCs		5.1 ± 0.7	3.8	6.6	3.7-6.5
Absolute Neutrophil		2.3 ± 0.7	0.6	3.9	0.9-3.7
Absolute Lymphocyte		2.3 ± 0.8	0.9	4.7	0.7-3.9
NLR		1.2 ± 0.45	0.2	3.0	0.3-2.1

Table 2: Reference Values for NLR in Males/Female

Variable	N/300	Mean ± SD	Reference value	P- value
White Blood Cells				
M	150	5.1 ± 0.8	3.5-6.7	0.24
F	150	5.2 ± 0.6	4.0-6.4	
Absolute Neutrophils				
M		2.2 ± 0.5	1.2-3.2	0.30
F		2.4 ± 0.6	1.2-3.6	
Absolute Lymphocytes				0.75
M		2.3 ± 0.6	1.1-3.5	
F		2.3 ± 0.6	1.1-3.5	
Neutrophil-Lymphocyte Ratio				0.10
M		1.1 ± 0.3	0.5-1.7	
F		1.2 ± 0.5	0.2-2.2	

In TABLE 2, the reference values were listed separately for males and females and the p-value is noted to indicate whether the difference is significant ($p \leq 0.05$) between both genders. The reference values of NLR in males and females were; 0.5-1.7 and 0.2-2.2, respectively. The NLR values did not show a significant difference between males and females with p-value of 0.1. In TABLE 3, the reference values are listed separately for subject below 40 years of age and over 40 years of age and the p-value is noted to indicate whether the difference is significant ($p \leq 0.05$) between subjects below/over 40 years old age. The NLR value between subjects below/over 40 years old age was not varied significantly with p-value of 0.46.

Table 3: Reference Values for NLR in Age<40/

Variable	N/300	Mean ± SD	Reference value	P- value
White Blood Cells				
<40	150	5.1±0.5	4.1-6.1	0.36
>40	150	5.1±0.5	4.1-6.1	
Absolute Neutrophils				
<40		2.3±0.5	1.3-3.3	0.10
>40		2.2±0.6	1.0-3.4	
Absolute Lymphocytes				
<40		2.4±0.6	1.2-3.6	0.54
>40		2.3±0.6	1.1-3.5	
Neutrophil-Lymphocyte Ratio				
<40		1.2±0.5	0.2-2.2	0.46
>40		1.1±0.4	0.3-1.9	

Table 4: Mean Of NLR among Different Studied Age Groups

Group	Age/year	TWBCs	Neutrophils	Lymphocytes	NLR
<20	10	5.5	2.1	2.9	0.8
20-29	24	4.8	2.4	2.4	1.3
30-39	34	5.2	2.6	2.2	1.4
40-49	44	5.2	2.1	2.6	0.9
50-59	54	5.8	2.2	2.2	1.2
>60	67	5.0	2.3	2.1	1.2

DISCUSSION

Recently, NLR has been discovered as useful biomarker in the prediction and prognosis of many medical conditions; consequently numerous studies have been conducted to evaluate such parameter. Moreover; NLR is considered as a potent marker of inflammation which underlies the basic pathologies of various disorders. It's easy application and availability without additional costs to the patients may gradually substitute the other markers of inflammation. The present study constitutes 300 healthy subjects; their ages ranged from 5 to 85 year old, and comprised equal number of males and females. We categorized the study population into different groups according to their ages, blood sample analyzed to calculate NLR. The results data was compared in both genders and different age groups to find any statistically significant differences, TABLE 2, 3.

The study findings showed that the mean value for NLR in our locality was 1.2. This is lower than the values reported in Whites American (1.76) and Non-Hispanic Black (2.24) [27]. Studies done by Shiny et al in China[28] and Forget et al in Belgium [29], they reported a NLR of 1.5 ± 0.41 and 1.65[±1.96 SD: 0.78–3.53] (95% CI [0.75–0.81] and [3.40–3.66]), respectively. Another study carried out on healthy adults in Nigeria, the mean NLR was 2.8 ± 1.7 [30]. Such differences in the NLR values may be an indication that ethnicity and geographical area have effect on the NLR; since Sudanese are a mixture of Afro-Arab race. In addition, laboratory machines may be using different measuring principles. Therefore the use of arbitrary cut-off points for risk stratification will be virtually false. This support the require of establishing our local reference values for this parameter. The study finding also revealed that there were no significant variations in NLR values with respect to gender and age similar to other studies [27, 28, 30].

CONCLUSION

The reference values obtained in this study compared well with the results in the literature though there are slight differences. Gender and age have no significant effects on NLR value. These established local reference value will assist the clinicians to provide better care to patients in our locality.

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