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ORIGINAL ARTICLE

Correlation of age and gender with red cell indices in anemic patients (A hospital based study).

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ABSTRACT… Objectives: To determine the correlation of red cell indices with age and gender in a hospital based study. **Study Design:** Cross Sectional study. **Setting:** Department of Pathology, Qazi Hussain Ahmed Medical Complex Nowshera. **Period:** 1st June 2019 to 10th December 2019. **Material & Methods:** A Total of 298 smears were studied. Descriptive statistics for numerical variables and Pearson & Spearman correlation tests were used. **Results:** The Mean with Standard Deviation of age was (27years+ 16.8), Hb% (11+ 2.6 g/dl), HCT (36.06%+ 10.3), MCV (84 fl + 12.4), MCH (27.7 pg + 3.7), MCHC (32 g/dl + 2.06) and RDW (42.89 fl + 5.6). The distribution of all red cell indices was the same across the categories of gender groups (p>0.05). Age as a variable has an inverse statistically significant relation with HCT, MCH, MCV and RDW (p=0.001) but it does not have any significant affect on Hb% & MCHC. Hemoglobin had a mild to moderate positive correlation with other indices like MCV, MCH, MCHC, HCT (p=0.001, r=0.2 to 0.4), while it has no statistically significant relation with RDW, Age. HCT has positive correlation with Hb%, MCH and MCHC (p=0.001) and a negative correlation with MCV, RDW and Age (p=0.001). **Conclusion:** Gender has no significant association with red cell indices, However an increase in age has an inverse correlation with HCT, MCH, MCV and RDW.

Key words: Age and Gender Effects, Correlation Statistics, Red Cell Indices.

INTRODUCTION

World Health organization defines anemia when the concentration of hemoglobin is less that 11g/dl.[1] In Pakistan literature review supports the prevalence of anemia as per definition of WHO that 90.5% of the study population was anemic with Hb% lower than 11g/dl. On further segregation 75.0% had mild anemia (hemoglobin from 9.0 to 10.9 g/dL) and 14.8% had moderate to severe anemia (hemoglobin ranging from from 6.0 to 8.9 g/dL).[2] Amongst all types of anemia the iron deficiency anemia is most prevalent of all types of anemia accounts for 83%of in Pakistan.[3]

The clinical importance of all red cell indices cannot be ruled out specially in reporting a peripheral smear. A study reported that a high sensitivity of more than 70% in cases of IDA was obtained for the cut-off values of Hb less than 11g/dl, MCV<83FL, MCH<27pg and MCHC <33.2g/dl.[4]

Globally the report published in Lancet global health, suggests 38% of the prevalence of Iron deficiency anemia in pregnancy.[5]

Measurement of these red cell indices that are components of the Red Blood count is determined nowadays with use of automated hematology analyzer that is less cumbersome and inexpensive. The use of Red cell indices is common in reporting smear and in differentiating the Iron deficiency anemia and thalassemia Trait.[6,7] We suggested in concluding that trial from journal of Public health, published in Pakistan patients with RBC count >4600000/cmm3 and RDW-SD less than 45% may be screened for thalassemia trait.[6]

The Erythrocytes indices are important in

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many diseases management. Similarly the red call indices are affected with Hemoglobin concentration, ferrtin levels, gender, and age factors.[4,6,7] Tempelhoff GFO et al[8] observed that MCV and Hemoglobin concentration had a strong impact on deformability in apparently healthy women. An increased MCHC and MCV were associated with increased fragility and a high MCHC and low MCV is associated with increased rigidity in the cell.

Present study was conducted as to determine the correlation of Erythrocyte indices with Hb%, age and gender as well as the inter-relation of indices with each other.

MATERIAL & METHODS

This was a cross sectional study was conducted in the Pathology department of QaziHussain Ahmed Medical Complex Nowshera, from 1st June 2019- 10th Dec 2019 after approval from ethical committee (33ERC/NMC/QHAMC).

This study was conducted through convenient (Non-Probability) sampling. A total of 298 patients smears were included irrespective of age and gender for analysis.

Inclusion criteria were all clients irrespective of symptomatology, gender, age or cause for attending the OPD or in-patients were included.

Exclusion criteria were all cases that were advised complete blood count without peripheral smear.

The sample size of 298 was calculated using the anticipated proportion of iron deficiency anemia at 70%from the study of Rabindrakumar MSK[4], at 95%confidence and 5% of absolute precision.

Blood samples were collected from all patients. The technique for the blood samplingwas to collect3 ml of venous blood by veine-puncture using disposable syringes under aseptic techniques. The blood was added in an EDTA vacutainer at concentration of 1.5mg/ml and mixed gently. Complete blood count was calculated on Sysmex automated haematology Analyzer (XE-3000). Smear was prepared and stained with Giemsa stain for cell morphology and was reported by the consultant hematologist. Data was entered in SPSS version 25th. Descriptive statistics were used for scale/numerical variables like Hb%, MCH, MCV, RDW, MCHC and age. Independent t-test was used for red cell indices mean with standard deviation in gender groups. Pearson Correlation test was used to find the correlation Red cell indices with each other and age and gender. Spearman correlation was used to determine the correlation of categories of indices with Hb%, gender and age categories.

RESULTS

The Mean with Standard Deviation of age was 27+ 16.8 years. In present study we observed that the Mean with Standard Deviation of Hb% was (11+ 2.6 g/dl), HCT (36.06%+ 10.3), MCV (84 fl + 12.4), MCH (27.7 pg + 3.7), MCHC (32 g/dl + 2.06) and RDW (42.89 fl + 5.6). (Table-I).

There was no statistically significant difference in Mean with Standard Deviation of hematological parameters like Hb%, HCT, MCH, MCHC, MCV, RDW in genders and age groups (Table-II and III).

We observed that Erythrocyte indices were having no significant correlation (Pearson correlation) with age. However the inter-relation of the red cell indices are significant and worth mentioning. Hemoglobin had a moderate positive correlation with indices like MCV, MCH, MCHC, HCT ($p=0.001$, $r=0.2$ to 0.4), while is independent of RDW, Age & Gender.

MCH, MCHC and MCV had statistically significant inter-relation with p-value of 0.001). MCV had a significant inverse (negative) relation with Hematocrit at 95% (CI).

HCT has positive correlation with Hb, MCH and MCHC ($p= 0.001$) and a negative statically significant relation with MCV, RDW and Age.

MCH has a significant correlation with Hb%, MCV, MCHC, HCT and a weak inverse relation with Age.

On other hand MCHC (Mean corpuscular Hb Conc) has a weak inverse relation with RDW.

MCV has a positive correlation MCH, MCHC, RDW (p=0.001) and an inverse relation with HCT (r=-0.215) and age.

Age as a variable has an inverse statistically

	AGE	Hb%	HCT	MCV	MCH	MCHC	RDW
Number of cases	298	298	298	298	298	298	298
Mean	27	11	36.06	84.15	27.72	32.08	42.89
Std. Error of Mean	0.97	0.119	0.59	0.71	0.21	0.11	0.32
Median	28	11	35	87	28.7	32	43
Std. Deviation	16.82	2.06	10.32	12.4	3.71	2.06	5.58
Range	69.4	14	74	77	23	21	51
Minimum	0.6	4	17	28	16	22	17
Maximum	70	18	91	105	39	43	68

Table-I. Descriptive statistics

Continuous Variable	Gender	N	Mean	Std. Deviation	P-Value
Hb%	Male	160	10.96	2.10	0.67
	Female	138	11.06	2.04	
HCT	Male	160	35.64	10.39	0.45
	Female	138	36.54	10.27	
MCV	Male	160	83.65	12.55	0.44
	Female	138	84.76	12.24	
MCH	Male	160	27.55	3.88	0.35
	Female	138	27.94	3.51	
MCHC	Male	160	32.06	2.08	0.82
	Female	138	32.11	2.06	
RDW	Male	160	42.94	5.62	0.89
	Female	138	42.85	5.55	

Table-II. Independent Samples Test- difference in red cell indices in Gender groups

Continuous Variable	Age Groups	Number of Cases	Mean	Std. Deviation	P-Value
Hb%	Age>45	89	10.88	2.10	0.70
	Age<45	209	10.99	2.15	
HCT	Age>45	89	35.18	8.14	0.29
	Age<45	209	36.69	11.26	
MCV	Age>45	89	84.83	12.32	0.71
	Age<45	209	84.20	12.36	
MCH	Age>45	89	27.77	4.00	0.98
	Age<45	209	27.75	3.64	
MCHC	Age>45	89	32.20	1.45	0.35
	Age<45	209	31.93	2.35	
RDW	Age>45	89	43.22	6.26	0.67
	Age<45	209	42.91	4.92	

Table-III. Independent Samples Test- difference in red cell indices in Age groups

		Hb%	HCT	MCV	MCH	MCHC	RDW
HCT	Pearson Correlation	.348**					
	Sig. (2-tailed)	0.001					
	Number of cases	298					
MCV	Pearson Correlation	.206**	-.215**				
	Sig. (2-tailed)	0.001	0.001				
	Number of cases	298	298				
MCH	Pearson Correlation	.378**	.453**	.544**			
	Sig. (2-tailed)	0.001	0.001	0.001			
	Number of cases	298	298	298			
MCHC	Pearson Correlation	.213**	.189**	0.111	.481**		
	Sig. (2-tailed)	0.001	0.001	0.056	0.001		
	Number of cases	298	298	298	298		
RDW	Pearson Correlation	0.052	-0.023	.131*	0.041	-.118*	
	Sig. (2-tailed)	0.373	0.695	0.024	0.481	0.042	
	Number of cases	298	298	298	298	298	
Age of patients	Pearson Correlation	0.060	-0.007	-0.076	-0.038	0.021	-0.043
	Sig. (2-tailed)	0.301	0.902	0.194	0.508	0.720	0.457
	Number of cases	298	298	298	298	298	298
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

Table-IV. Pearson correlations of age with red cell indices

significant relation with HCT, MCH (Average corpuscular Hb), MCV and RDW. (Table-IV)

DISCUSSION

Retrogressive changes in hemorheological indices are closely related to changes in red cell indices which in term determine the functional ability of the red cell to afford stress and are indicative of specific hematological disorder.[9] Patient age has been shown to have a significant correlation with Erythrocyte indices. Classically, very young (<20 years old) and old (= or >35 years) and female gender especially in pregnancy have been identified to have strongly observed changes in erythrocyte indices.[10] In present study we observed that the Mean with Standard Deviation of Hb% was (11+ 2.6 g/dl), HCT (36.06%+ 10.3), MCV (84 fl + 12.4), MCH (27.7 pg + 3.7), MCHC (32 g/dl + 2.06) and RDW (42.89 fl + 5.6). In one of our previous intervention in 2012 on pregnant women, we determined that out of the total sampling 51% were anemic on the basis of Hb<11g/dl (As defined by WHO[1]), while 22% of the same had less than 32% HCT, Similarly 17% had <26pg of MCH as compared to 29% with MCHC<31g/dl. From that intervention we were able to say that Hb% is best indicator of anemia than HCT and MCHC is best indicator of hypochromia than MCH.[11] We observed that there was no statistically significant difference in Mean with Standard Deviation of Age, Hb%, HCT, MCH, MCHC, MCV, RDW in genders using independent T test. However Gligoroska JP et al[12] reported that Erythrocyte indices irrespective of age factor, differ greatly in gender groups specially in favor of male examinees, as their finding were suggestive of increased in all indices in male group as compared to female group.[12] This was further supported by Kameneva MV et al[13] who observed that male blood as compared to female blood have higher viscosity (higher Hb%, MCH, MCHC, HCT) and lower RBC fragility (stable MCV and RDW values). The findings of Wish JB[14] correlates with our findings where in they reported no major difference in the Hemoglobin and other red cell indices across the gender groups.

We observed that MCH, MCHC and MCV had statistically significant inter-relation with p-value of 0.001), as the entire indicators showing the hypo/hyperchromic and macro/microcytosis status of the RBCs.

We observed that MCV had a significant inverse (negative) relation with Hematocrit at 95% (CI),

means that when hematocrit increase MCV decreases and vice versa.

HCT has positive (Direct) statistically significant correlation with Hb, MCH and MCHC (P-value 0.001) and a negative statically significant relation with MCV, RDW and Age.

When there is and advancement of age the HCT falls and the same has been observed with volume and size variation of RBC when mass of call increase.

On other hand MCHC (Mean corpuscular HbConc) has a weak inverse relation with RDW that makes it more specific as indicator of hypochromia.

There is clinical relevance to these indicators; a study reported that RDW had sensitivity 82.3% and specificity 97.4%. Whereas MCV, MCH and MCHC had 29.2%, 68.1% and 15% sensitivity but specificity was 98.7%, 83.1% and 96.1% in the detection of iron deficiency.[15,16]

Hb% has a significant relation with MCH MCV, MCHC, HCT but has no relation with RDW and a weak inverse relation with Age. Rabindrakumar et al[4] findings shows a higher sensitivity for MCH than MCHC in detection of anemia (Hemoglobin concentration) that correlates our finding.

Age as a variable has an inverse statistically significant relation with HCT, MCH (Average corpuscular Hb), MCV and RDW but it does not has any significant effect on Hb and MCHC.

Age categories in ranked pattern has inverse relation with categories of MCH, MCHC and RDW. And has a positive significant relation (p=0.05) with Hb% Categories.

Gligoroska JP et al[12] reported no significant differences in red cell indices and many other hematological variables including the concentration of hemoglobin within the age groups.However another study they claim that hemoglobin and other erythrocyte indices do vary in different age groups from fetal life to adolescent hence they stress to have reference levels for Hb% and other indices for each population and each age group categories[17,18], that coincide and supports our findings.

CONCLUSION

We concluded that gender has no significant correlation with red cell indices. An increase in age has an inverse correlation with HCT, MCH, MCV and RDW. Hemoglobin had a mild to moderate positive correlation with other indices like MCV, MCH, MCHC, HCT (p=0.001, r=0.2 to 0.4), while it has no statistically significant relation with RDW, Age & Gender.

There is need for further studies to prove the relevance and clinical use of these indicators in blood of different age groups and both genders in different disorders depending upon the strength of different indicators /indices in different age and gender groups.

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2	Fareedullah Shah	Writing manuscript, Critical review.	
3	Hameeda Qureshi	Design of study, Critical review.	
4	Sobia Bashir	Data collection, Data analysis.	
5	Khalid Khan	Design of study, Critical review.	