A Study of Effect of Anemia over HbA1C Level in Non-Diabetic Patients in a Tertiary Care Hospital in Puducherry

Uthaya Sankar M.K[1], Sivaram A[2], Louis Ferdin Zeno.J[3], Asmathulla.S[4]

[1]Professor and Unit Chief of Medicine, [2,3]Postgraduate residents, [4]Professor of Biochemistry,
Department of General Medicine, Sri Manakula Vinayagar Medical College and Hospital, Puducherry 605107, India

Corresponding Author: Sivaram A

ABSTRACT

HbA1c assay is as an accurate and precise measure of chronic glycemic levels as it correlates well with the risk of diabetes complications for the same reason it is recommended to rely on HbA1c for diagnosing diabetes. [2] Falsely elevated HbA1c concentrations are encountered when there is increased circulating erythrocyte life span (decreased red cell clearance) or impaired reticulocyte production. [3] Anemia is most common factor in Indian population affecting the level of HbA1C. Therefore it's necessary to know whether anemia due to any etiology will affect the level of HbA1C level in non-diabetic patients.

Keywords: Anemia, HbA1C

INTRODUCTION

Hemoglobin A1C (HbA1c) is the predominant hemoglobin found in HbA1 fractions and it constitutes 5% of the total hemoglobin in normal adults and up to 15% in patients with diabetes mellitus [1]. Hgb A to HbA1c conversion takes place during the entire life span of the red blood cell and the rate of this reaction is faster in diabetics because of the higher prevailing glucose concentration, resulting in a higher concentration of HbA1c. Red blood cells (RBC) are freely permeable to the plasma glucose molecules, and hemoglobin is practically exposed to the same glucose concentrations as plasma. Therefore, HbA1c level is directly proportional to average blood glucose concentration over the previous 4weeks to 3 months or the average lifespan of the erythrocyte.

There are a number of methods available to estimate glycated hemoglobin like immunoturbidimetry, ion exchange high-performance liquid chromatography (HPLC), boronate affinity, and enzymatic method. HbA1c assay is as an accurate and precise measure of chronic glycemic levels as it correlates well with the risk of diabetes complications for the same reason it is recommended to rely on HbA1c for diagnosing diabetes [2]. Despite its benefit, HbA1c is affected by a variety of genetic, physiological, hematological and illness related factors.

Falsely elevated HbA1c concentrations are encountered when there is increased circulating erythrocyte life span (decreased red cell clearance) or impaired reticulocyte production [3]. Out of these factors affecting the level of HbA1C , most common entity in Indian population is anemia out of which most common type iron deficiency anemia has showed impact in HbA1C value in non diabetic individuals [4].

Therefore it's necessary to know whether anemia due to any etiology will affect the level of HbA1C level in non-diabetic patients for whom accurate analysis of glycemic status is necessary. So this study was done to estimate the HbA1C level

in non-diabetic patients with and without anemia and to compare the HbA1C value of both the anemic and non-anemic group.

MATERIALS AND METHODS

This study was done under the department of general medicine at Sri Manakula Vinayagar Medical College and Hospital, a tertiary care hospital situated at Puducherry. The design employed was a hospital based analytical cross sectional study. The sample size for study group and control group was a total of 76 patients. All patients having haemoglobin less than 13gm/dl in male and less than 12gm/dl in female above the age of 18 years with fasting blood sugar less than 126 mg/dl or random less than 200 mg/dl was included in

the study population. All patients having haemoglobin more than 13gm/dl in male and more than 12gm/dl in female above the age of 18 years was included in the control population. Patients with known diabetes mellitus and those having low hemoglobin level due to acute blood loss were excluded from this study.

Blood samples were collected for basic haematological analysis like complete blood count, random blood sugar or fasting blood sugar. The patients with anemia were sorted from the non anemic individual, then HbA1C level was assessed in both the group of patients. The HbA1C level of both the test as well as control group was estimated and the baseline HbA1C level was compared.

RESULTS

Table 1: Demographic and risk factor profile distribution among the anaemic groups in non-diabetic patients (n=76)

		Group, n(%)	
		Anaemic	Non-anaemic
Age category	21-40 years	6 (27.27)	16 (72.73)
	41-60 years	13 (48.15)	14 (51.85)
	61-80 years	20 (74.07)	7 (25.93)
Gender	Male	24 (47.06)	27 (52.94)
	Female	15 (60.00)	10 (40.00)
Smoking	Yes	5 (38.46)	8 (61.54)
	No	34 (53.97)	29 (46.03)
Alcohol consumption	Yes	18 (60.00)	12 (40.00)
	No	21 (45.65)	25 (54.35)
Hypertension	Present	8 (50.00)	8 (50.00)
	Absent	31 (51.67)	29 (48.33)
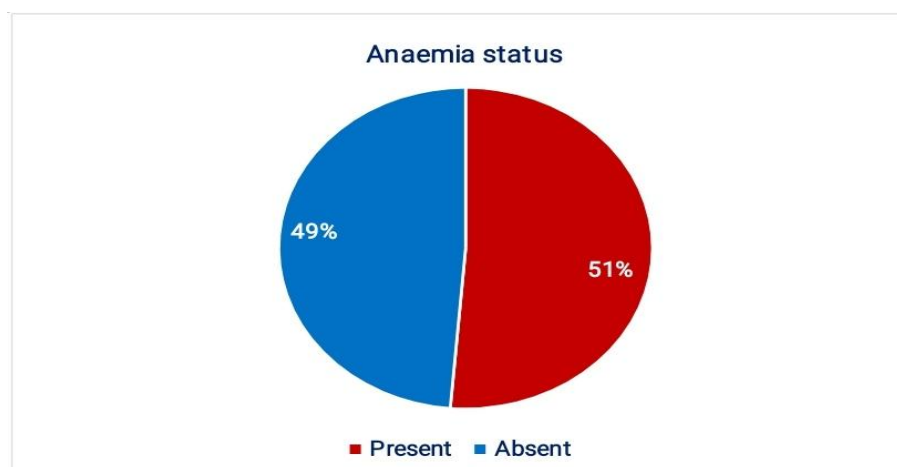
Figure 1: Anaemic status among non-diabetic patients (n=76)

Table 2: Comparison of Hematological parameters and HbA1C levels among the anaemic groups in the non-diabetic patients (n=76)

	Group, mean (±SD)		p value*
	Anaemic	Non-anaemic	
HCT	28.96 (±5.01)	41.79 (±8.12)	<0.001
RBC	3.46 (±0.73)	4.67 (±0.64)	<0.001
MCV	85.38 (±11.92)	92.14 (±8.99)	0.007
MCH	27.44 (±6.19)	31.04 (±4.60)	0.005
MCHC	32.75 (±1.84)	34.08 (±1.21)	<0.001
HbA1C	4.28(±0.53)	5.12 (±0.49)	<0.001

*p value by independent t test

Table 3: Correlation of Hematological parameters with the HbA1C levels among the non-diabetic patients (n=76)

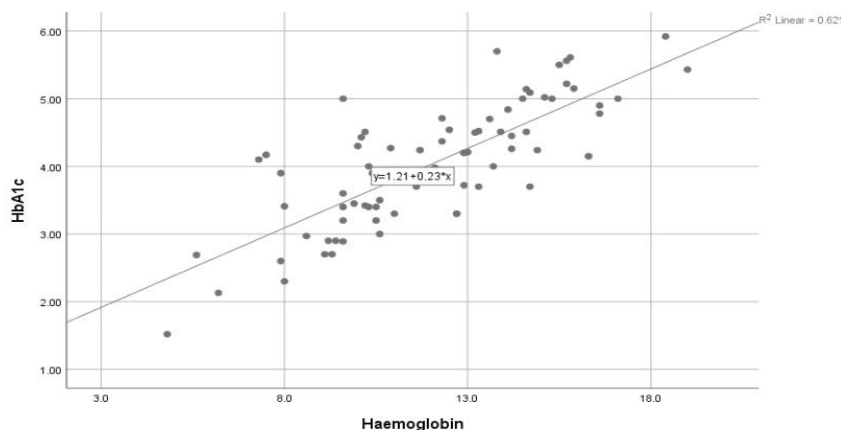|	Mean (±SD)	HbA1C	
		Pearson correlation r value	p value
HB	12.08 (±3.07)	0.788	<0.001
HCT	35.21 (±9.27)	0.577	<0.001
RBC	4.05 (±0.91)	0.861	<0.001
MCV	88.67 (±11.06)	0.700	<0.001
MCH	29.19 (±5.73)	0.596	<0.001
MCHC	33.40 (±1.69)	0.762	<0.001

*p value by Pearson correlation

Figure 2: Scatterplot showing the correlation between Hemoglobin and HbA1C levels (n=76)

DISCUSSION

In this study 51% of the total population were anemic and rest were non anemic. The mean HbA1C in test group was 4.28(+/-0.53) (p <0.001) whereas in control group was 5.12(+/-0.49) (p <0.001). The baseline HbA1C were significantly lower than the control group. A significant difference was observed between the baseline values of test and control group (P<0.01). The result was similar to with the previous study conducted by CH Manoj Kumar, Geethika Nutakki [6] which showed that the base line HbA1c levels were

significantly lower in patients with iron deficiency anemia. And same was the result with the study conducted by Sankar Kalairajan, Vijaya Durairaj K., Malathy A.R [7] which was conducted in Chennai in may 2019.

CONCLUSION

The interpretation of HbA1C is to be done cautiously if the patients are having anemia irrespective of etiology. Moreover, extensive study in this entity with larger population is to be done to understand in depth about the relation between HbA1C and Haemoglobin.

Limitations

The study sample is less and study is done in single hospital setting. Extensive workup for the etiology of anemia couldn't be done. Since the study duration is short (6 months), the follow-up HbA1C level of patient after the treatment of anemia could not be done.

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