

High HbA1C Level Is Associated With Low Hemoglobin Level

Mafooz Rashid^{*1}, B. K. Gupta², Vinay Bharat³, Abhishek Gupta⁴, Zubair Rashid⁵

¹Junior Resident, Department of Biochemistry, Subharti Medical College

^{2,3}Professor, Department of Biochemistry, Subharti Medical College

⁴Assoc. Professor, Department of Biochemistry, Subharti Medical College

⁵Asst. Professor, Department of Surgery, Subharti Medical College



Abstract

Background: The aim of the study was to compare the hemoglobin levels among normal controls (patients) and patients of Type II diabetes with HbA1c levels below 7 % & above 7 % and secondly to identify the undetected cases of anemia in Type II diabetes.

Materials & Methods - 50 patients of type 2 diabetes mellitus with their glycosylated hemoglobin levels less than 7 %, 50 patients of type 2 diabetes mellitus with their glycosylated hemoglobin levels more than 7 % attending the Medicine outpatient department of Subharti Medical College and Hospital will be the subjects for the study. 50 age and sex matched controls will be selected randomly from Subharti Medical College and Hospital. Informed written consent will be taken from all the subjects. The study will be conducted from January 2016 to January. **Result** - We studied 50 cases with HbA1C > 7 (poor control), 50 cases with HbA1C 5.6 to 7 (good control) and 50 controls with HbA1C ≤ 5.6, we observed in cases with HbA1C > 7 (poorly control), the mean HbA1C is 9.9 ± 2 and mean Hb is 9.8 ± 1.3 as compared to cases with HbA1C 5.6 to 7 (good control) where mean HbA1C is 6 ± 0.4 and Hb is 13 ± 0.5, this clearly indicates that in cases HbA1C is more Hb levels are low and when HbA1C is less Hb levels are higher. **Conclusion** - In the present study we found negative correlation between HbA1c & Hb levels. As the value of HbA1c increases, as in cases of HbA1c > 7 (poor diabetic control), we found low Hb levels as compared to the cases with HbA1c < 7 (5.6-7) (good control).

Keywords - Anemia, Hemoglobin, HbA1c, Diabetes Type II.

Introduction

Anemia may be defined as relative or absolute deficiency of hemoglobin in blood. It can be detected by simple blood test known as complete blood count. Hemoglobin is a complex molecule in red blood cells that carries the oxygen to the tissues in the body. The hemocrit is a percentage of red blood cells to the total volume of blood contained in a sample. This condition can be temporary (rapid blood loss) or a long-term illness depending on the cause. Mild anemia may have mild or no symptoms, while more severe anemia symptoms are more pronounced with tiredness. About one-fourth of all people with diabetes will have problems with anemia. There are currently approximately 40.9 million patients with diabetes mellitus in India and this number is expected to rise to about 69.9 million by the year 2025. This high burden of diabetes is likely to be associated with an increase in associated complications. The majority of anemic symptoms are due to a sheer lack of oxygen to the tissues in the body. Some common problems are: Tiredness, Weakness, Headaches, Peripheral neuropathy in fingers and toes, Difficulty in concentration, Pale skin color, Sore tongue, Poor sense of balance, Shortness of breath, Tachycardia.

Type 2 Diabetes Mellitus is a non-autoimmune, complex, heterogeneous and polygenic metabolic disease condition in which the body fails to produce enough insulin, characterized by abnormal glucose homeostasis. Its pathogenesis appears to involve complex interactions between genetic and environmental factors. Type 2 Diabetes Mellitus occurs when impaired insulin effectiveness (insulin resistance) is accompanied by the failure to produce sufficient cell insulin.

In type 2 diabetes mellitus, patients glycosylated haemoglobin (HbA1c) is an effective tool in monitoring long term blood glucose control. HbA1c gives an accurate estimate of the average of the plasma glucose levels from the past 8 to 12 weeks. Hence glycosylated haemoglobin becomes an important marker of glycaemic control in diabetes mellitus. HbA1c testing is a measure of diabetic glycaemic control. Diabetes control is categorized as poor control (HbA1c levels > 9%), moderate control (HbA1c levels between 7% and 9%) and good or desired control (HbA1c levels < 7%). Anemia is one of the world's most common preventable condition yet it is often overlooked especially in people with Diabetes Mellitus. Anemia is a common finding in patients with diabetes. Diabetes related

chronic hyperglycaemia can lead to a hypoxic environment in the renal interstitium which results in impaired production of erythropoietin by the peritubular fibroblasts and subsequently anemia occurs. Anemia in patients with diabetes mellitus might contribute to pathogenesis and progression of cardiovascular disease and aggravate diabetic nephropathy and retinopathy. However, an emphasis on regular screening for anemia, alongside that for other diabetes – related complications, might help to delay the progression of vascular complication in this patient.

Methods

Protocol for the present study was designed and submitted on 30.09.15. Application was moved to ethical committee of Subharti Medical College, Meerut for ethical clearance of this work. In the meantime patients consent forms and data sheets were designed. Ethical clearance was granted by Institutional ethical committee and thereafter this study was undertaken.

50 patients of type 2 diabetes mellitus with their glycosylated hemoglobin levels more than 7 %, 50 patients with their glycosylated hemoglobin levels less than 7 %, attending the Medicine outpatient department of Subharti Medical College and Hospital were included in the study. 50 age and sex matched controls were selected randomly from Subharti Medical College and Hospital. Informed consent and a detailed history was taken from each individual patient. These selected patients were subjected to complete physical and systemic examination and findings were noted. Height, weight and blood pressure was recorded, Weight was taken in Kilogram by an electronic weighing machine which is well calibrated and compared with standard weighing machine in the hospital. Height was measured in centimeters. The measurement of blood pressure was taken in sitting posture after resting for minimum of 10-15 minutes. Three consecutive reading were taken at an interval of a day or in subsequent OPDs using sphygmomanometer before final conclusion of high blood pressure. Basic routine investigations like Hb, Total and Differential leucocyte count, ESR, Complete blood picture, Lipid profile, Fasting /Random blood sugar, Blood Urea, Serum Creatinine, Total and Direct Bilirubin, SGPT, SGOT, Routine urinary/microscopy, ECG and Plain X Ray chest was done in all cases. A questionnaire was provided to the controls and subjects to know about their lifestyle, past history, family history and list of medications.

Results

Out of 50 subjects in group with HbA1C>7 (poor diabetic control), there were 32 females (64%) and 18(36%) males. Out of 50 subjects in group with HbA1C <7(5.7 to 7), there were 18(36%) females and 32(64%) males. Out of 50

controls, HbA1C ≤5.6, there were 29(58%) females and 21(42%) males.

In this study we observed that, the mean hemoglobin of the cases with HbA1C>7 is 9.8 ± 1.3 . Group with HbA1C 5.7 to 7, the mean hemoglobin observed is 13 ± 0.5 .

In cases with HbA1C>7 (poor diabetic control) we observed low hemoglobin levels and with cases HbA1C 5.7 to 7 (good diabetic control) we observed high hemoglobin levels, hence Hb and HbA1C are negatively correlated. The values are statistically significant too (p-value<0.05)

In this study we observed that, the mean hemoglobin of the cases with HbA1C>7 is 9.8 ± 1.3 ,

And mean hemoglobin of controls is 14 ± 0.7 , which clearly indicates that in poor diabetics the anemia is more severe. The values are statistically significant too (p-value<0.05).

In this study we observed that, the mean hemoglobin of the group with HbA1C<7(5.7 TO 7) is 13.0 ± 0.5 , and mean hemoglobin of controls with HbA1C ≤5.6 is 14 ± 0.7 . The values are statistically significant too (p-value<0.05)

The mean age of cases with HbA1C>7 (bad diabetic control) is 45.7 ± 6.2 , mean age of cases with HbA1C<7(5.7 TO 7, good diabetic control) is 44.6 ± 7.5 and mean age of controls with HbA1C≤5.6 is 41.7 ± 6 , hence it indicates that with advance age the incidence of diabetes mellitus also increase

In this study we observed that hemoglobin and HbA1C have negative correlation and is significant with r value -0.979 .

The values are statistically significant too (p-value<0.05)

Discussion

We studied 50 cases with HbA1C>7 (poor control), 50 cases with HbA1C 5.7 to 7 (good control) and 50 controls with HbA1C ≤5.6, we observed in cases with HbA1C>7 (poorly control), the mean HbA1C is 9.9 ± 2 and mean Hb is 9.8 ± 1.3 as compared to cases with HbA1C 5.7 to 7 (good control) where mean HbA1C is 6 ± 0.4 and Hb is 13 ± 0.5 , this clearly indicates that in cases HbA1C is more Hb levels are low and when HbA1C is less Hb levels are higher, hence both are negatively correlated, which is similar to study done by Escorcio et al.90 he said poorly control diabetic patients are affected by kidney diseases. The decreased renal function and proinflammatory cytokines are the most important determining factors for reduction of hemoglobin levels in those patients. Therefore, diabetic patients with kidney disease have the highest risk for developing anemia90.

Conclusion

In the present study we found negative correlation between HbA1c & Hb levels. As the value of HbA1c increases, as in,

cases of HbA1c >7 (poor diabetic control), we found low Hb levels as compared to the cases with HbA1c <7 (5.6-7) (good control).

References

- [1] <https://www.unitedhealthfoundation.org/uhfassets/docs/2011/GWU-report-04-2011.pdf>.
- [2] Dhruv K. Singh, Peter Winocour and Ken Farrington. Erythropoietic Stress and Anemia in Diabetes Mellitus. *Nature Reviews Endocrinology*. 2009; 5: 204-10
- [3] Merlin C Thomas, Richard J. MacIsaac, Con Tsalamandris, David Power, George Jerums. Unrecognized Anemia in patients with Diabetes.
- [4] Merlin C Thomas. Anemia in Diabetes: marker or mediator of micro vascular disease. *Nature Reviews Nephrology*. January 2007; 3: 20-30.
- [5] Katherine J. Craig, John D. Williams, Stephen G. Riley, Hilary Smith, David R. Owens, Debbie Worthing et al. Anemia and Diabetes in the Absence of Nephropathy. *Diabetes Care*. May 2005; 28(5): 1118-23
- [6] Babatunde Ishola Adejumo, Uchechukwu Dimkpa, Chinwe Obianuju Ewenighi, Abdulfatah Adekunle Onifade, Azukaego Thomas Mokogwu, Tosan Amos Erhabor et al. Incidence and Risk of Anemia in type 2 diabetic patients in the absence of renal impairment. *Health*. 2012; 4(6): 304-8.
- [7] Janet B Mc Grill, David S.H. Bell. Anemia and the role of erythropoietin in diabetes. *Journal of Diabetes and its Complications*. July - August 2006; 20 (4): 262- 72.
- [8] Bonakdaran S, Gharebaghi M, Vahedian M, Saudi J *Kidney Dis Transpl*. 2011 Mar; 22(2):286-90
- [9] *J Pak Med Assoc*. 2014 Dec;64(12):1389-91, Elevated levels of ferritin and hs-CRP in type 2 diabetes. Alam F, Fatima F, Orakzai S, Iqbal N, Fatima SS