Troponin Patterns and Glycated Hemoglobin (HBA1C) Levels in Diabetic Patients at the Federal Teaching Hospital in Owerri

Kanu Stella Ngozika

Department of Medical Laboratory Science Imo State University Owerri

ABSTRACT: The aim of the research was to evaluate the troponin and glycated hemoglobin (HbA1c) levels in individuals with diabetes. The study's 100 diabetic patients were divided into a control group of 100 healthy individuals between the ages of 55 and 75. Blood samples were tested using ELISA. The findings demonstrated that hemoglobin HbA1c l and troponins were significantly higher in diabetics than in the control group ($p < 0.05$). These findings most likely demonstrate a favorable correlation between troponins and hemoglobin HbA1c in diabetics.

Diabetes mellitus Is a common metabolic disorder of multiple etiology, characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. These high blood sugar levels are what cause the symptoms of polyuria, polydipsia, and polyphagia [1]

The International classification of diabetes mellitus is; gestational diabetes mellitus, type 1 diabetes, type-2 diabetes and other types of the disease There are two main classes of diabetes mellitus, with similar symptoms: type1 and Type 2 [2]

Type 2 accounts for all 90% to 95% of the cases in rich countries, though this may be lower in some Western countries. That is according to a report commissioned by the International Diabetes Federation (IDF) [3].

Laboratory studies have shown that, of all blood glucose indices and vascular complications micro and macrovascular end-points, glycated haemogloblin (hemoglobin HbA1c) appears to be a most suitable surrogate to represent the risk. HbA1c is also monitored to assess the efficacy of antihyperglycemic drugs and now, HbA1c serves as a new screening and diagnostic measure for diabetes mellitus. HbA1c reflects overall glycemic control during the 2 or 3 months prior, but situations that change the lifetime of erythrocytes need to be underscored [4].

Certain muscle types in the body include a complicated chemical compound called troponin, which is a protein. It normally only freely circulates in trace amounts in bloodstream and is found inside muscle cells. However, more troponin may leak into your blood if specific kinds of muscle cells sustain damage. Troponin comes in two varieties that are easier to identify following damage to the heart muscle; they are identified by the letters I and T.Troponin I (cTnI). There

is only one type of troponin found in heart muscle.Troponin T (cTnT). Although it is present in extremely small numbers, various forms of muscle do include troponin T.Additionally, the Troponin T found in your heart muscle is unique to your body and has a slightly different structure [5].

International recognition has been accorded to cardiac-specific troponins (cTn) as the gold standard biomarkers for myocardial damage detection. Recently, new techniques that can identify extremely low blood troponin levels have been developed to increase diagnostic sensitivity . These techniques have also increased diagnostic accuracy, but they have also resulted in a loss of specificity. Subjects without an acute myocardial damage can now detect cTn . In addition to being detected in individuals without acute cardiac illness, detectable cTn is linked to numerous medical disorders, cardiovascular comorbidities, and increased mortality in the general population [6, 7]

A large body of research has been done on the causes, treatments, and management of diabetes, especially in Nigeria; however, there is a paucity of published studies on the assessment of these Troponins in conjunction with glycated hemoglobin (hemoglobin HbA1c) as a combined tool for the diagnosis and treatment of diabetes. Therefore, this research effort will contribute to closing this gap, especially in Nigeria's Eastern area [8,9, 10]. The possibility of using these actions in a routine examination for the care and supervision of individuals with diabetes.

MATERIALS AND METHODS
Study Area
The study was carried out in the Diabetic unit of Federal Teaching Hospital, Owerri. It is a tertiary health institution involved in providing medical care to individuals with

diabetics and is located along Orlu road in Owerri Municipal, Imo state.

Owerri is the capital of Imo State in South Eastern Nigeria and the indigenous ethnic group is Igbo. Its geographical coordinates are 5.48o North latitude, 7.08o East longitude and 150 meters above sea level. Owerri is rich in Agricultural land and has quite a number of restaurants, fast food centres, hotels, schools, markets, churches and a few industries. Owerri has many professionals, artisans, skilled and unskilled man power and there are differences in their nutritional and social lifestyles.

Ethical approval.
The ethical approval of Federal Teaching Hospital Owerri was gotten and Informed consent was also obtained from prospective participants.

Subject Selection and Selection Criteria
One hundred (100) subjects of both sexes between the ages of 55-75 years and who had blood sugar of 200mg/dl or above and who have been attending the diabetic clinic of Federal University Teaching Hospital, Owerri for not less than three months was recruited for the study. One hundred (100) subjects who were apparently healthy served as the control group.

Laboratory assay
Troponin was determined using Enzyme linked immunosorbent assay technique as modified by Assay Genie (Dublin, Ireland) (catalogue number HUES01810) while glycated haemogloblin was determined using standard method

Statistical Analysis
Data was analyzed using software statistical package for social sciences (SPSS) version 21, windows 9. Difference in mean values between two groups were assessed using student t-Test at $P = 0.05$ (95% confidence interval). Tests with a probability value of $P < 0.05$ were considered statistically significant. Values were expressed as mean ± standard deviation (mean ± S.D).

RESULTS

Table 1. The level of Troponins and glycated haemogloblin Parameters in diabetics

parameters (Units)	Diabetics (n=104)	Control (n=100)	P –value
Troponin I (ng/ml)	0.081± 0.030*	0.040 ± 0.03	0.05
Troponin T (ng/ml)	5.37 ± 0.38*	0.05 ± 0.20	0.05
glycated haemogloblin (%)	8.2±1.6	3.0±1.0	0.05

*Significantly increased when compared to control at $p < 0.05$

DISCUSSION

A particular kind of protein called troponin is present in the heart's muscle. Blood naturally contains no troponin. Troponin is released into the circulation in response to injury to the heart muscles. More troponin is released into the bloodstream when cardiac damage gets worse [11].

Elevated blood troponin levels could indicate that you are experiencing or have just experienced a heart attack. When the heart's blood supply is cut off, a heart attack occurs. This obstruction may be fatal. In this study, people with diabetes had considerably higher levels of troponin 1 and T than did the control group. Furthermore, the research revealed no appreciable distinction in troponin 1 and T levels between those with diabetes and those without it [12].

Because microvascular problems in diabetics cause troponins 1 and T to leak into the bloodstream, the study population's significantly higher levels of these biomarkers may indicate sub-clinical diabetic necrosis, which may predict the risk of developing a variety of microvascular disorders in diabetics. This is in line with the study by [13], which found that these participants had a notable increase in those biomarkers [14]. The precise reasons for the elevated levels of cardiac troponins in diabetics are unknown, but they could be associated with either an increase in the activity of the adrenergic system or the activation of pathways that lead to cardiomyocyte apoptosis when the myocardium is stretched and under increased load [15].

It makes perfect sense that these routes would have contributed to the increase in cardiac troponin levels in the serum, given their importance in the genesis of diabetes. The increase in cardiac troponins that was seen in the diabetic subjects may have been caused by myocardial hypertrophy that was conditioned by exposure to elevated blood pressure [16].

Additionally, in this study, persons with diabetes had considerably higher levels of glycated hemoglobin than did the control group. An analysis of hemoglobin A1C (HbA1C) tells you how much glucose (blood sugar) you've typically had over the previous two to three months [17].

Glucose is one type of blood sugar that is taken in by food. Cells use glucose as their energy source. Your cells can absorb glucose more easily with the help of the hormone insulin. Insufficient insulin synthesis or reduced cell absorption of insulin are the hallmarks of diabetes. Because glucose is difficult to enter cells, blood sugar levels rise as a result. It aligns with previous works [18]. Blood glucose binds to the

Corresponding Author: Kanu Stella Ngozika

protein called hemoglobin found in red blood cells. As blood glucose levels increase, more of hemoglobin will be coated with glucose.

CONCLUSION

The study discovered that diabetics had notably higher levels of glycated hemoglobin and troponin. These findings suggest that the biomarkers glycated hemoglobin and troponin may be important indicators of the degree and progression of diabetes. If these physiological signs are kept an eye on, patients with diabetes might benefit from an earlier diagnosis and improved treatment outcomes.

REFERENCES

1. Nichols GA, Schroeder EB, Karter AJ, (2015)Trends in diabetes incidence among 7 million insured adults, 2006-2011: the SUPREME-DM project. Am J Epidemiol. Jan 1;181(1):32–39

2. Maruthur NM(2013).. The growing prevalence of type 2 diabetes: increased incidence or improved survival? Curr Diab Rep. ;13(6):786–94.

3. Inzucchi SE, Bergenstal RM, Buse JB, (2012). Management of hyperglycemia in type 2 diabetes: A patient-centered approach: Position statement of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). Diabetes Spectrum. ;25(3):154–71

4. Duckworth W, Abraira C, Moritz T, (2009). Glucose control and vascular complications in veterans with type 2 diabetes. The New England journal of medicine. 8;360(2):129–39.

5. Papademetriou V, Lovato L, Doumas M, (2014). Chronic kidney disease and intensive glycemic control increase cardiovascular risk in patients with type 2 diabetes. Kidney Int. 17; 66-68

6. Hinkle J, Cheever K. Brunner & Suddarth's Handbook of Laboratory and Diagnostic Tests. 2nd Ed, Kindle. Philadelphia: Wolters Kluwer Health, Lippincott Williams & Wilkins; c2014. Troponin; p. 492-3.

7. Apple FS, Collinson PO. IFCC Task Force on Clinical Applications of Cardiac Biomarkers. Analytical characteristics of high-sensitivity cardiac troponin assays Clin Chem. 2012;58(1):54–61.

8. Sethi A, Bajaj A, Malhotra G, Arora RR, Khosia S(2014). Diagnostic accuracy of sensitive or high-sensitive troponin on presentation for myocardial infarction: a meta-analysis and systematic review. Vasc Health Risk Manag. 10:435–50.

9. Jia X, Sun W, Hoogeveen RC, Nambi V, Matsushita K, Folsom AR, Heiss G, Couper DJ, Solomon SD, Boerwinkle E, Shah A, Selvin E, de Lemos JA, Ballantyne CM(2019).. High-Sensitivity Troponin I and Incident Coronary Events, Stroke, Heart Failure Hospitalization, and Mortality in the ARIC Study. Circulation 139(23):2642-2653

10. Sherwani SI, Khan HA, Ekhzaimy A, Masood A, Sakharkar MK(2016). Significance of HbA1c test in diagnosis and prognosis of diabetic patients. Biomark Insights. 11:95–104.

11. Bolen S, Feldman L, Vassy J, (2007). Systematic review: comparative effectiveness and safety of oral medications for type 2 diabetes mellitus. Ann Intern Med. 18;147(6):386–99.

12. Maynard SJ, Menown IB, Adgey AA. (2019). Troponin T or troponin I as cardiac markers in ischaemic heart disease. Heart; 83(4):371-373.

13. Reichlin T, Hochholzer W, Bassetti S, Steuer S, Stelzig C, Hartwiger S, (2009) Early diagnosis of myocardial infarction with sensitive cardiac troponin assays. N Engl J Med. 2009;361(9):858–67.

14. Twerenbold R, Jaffe A, Reichlin T, Reiter M, Mueller C(2012). High-sensitive troponin T measurements: what do we gain and what are the challenges? Eur Heart J.;33(5):579–86.

15. Bennett WL, Maruthur NM, Singh S, (2011)Comparative effectiveness and safety of medications for type 2 diabetes: an update including new drugs and 2-drug combinations. Ann Intern Med. 3;154(9):602–13

16. Turner LW, Nartey D, Stafford RS, (2012)Ambulatory treatment of type 2 diabetes in the U.S., 1997-2012. Diabetes Care. 2014 Apr;37(4):985–92.

17. Ang SH, Thevarajah M, Alias Y, Khor SM (2015). Current aspects in hemoglobin A1c detection: a review. Clin Chim Acta. 439:202–211.

18. Radin MS(2014). Pitfalls in hemoglobin A1c measurement: when results may be misleading. J Gen Intern Med. 29(2):388–394