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RESEARCH ARTICLE

TyG-BMI AS A SURROGATE MARKER IN HYPERTENSIVE PATIENTS - AN OBSERVATIONAL STUDY IN TERTIARY CARE HOSPITAL

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Abstract

Background: Previous epidemiological studies have shown that the triglyceride-glucose index (Ty-G) was well- known predictor for the development of diabetes mellitus. A study proposed that traditional lipid ratios, particularly the TG\HDL- C ratio based on the proportion between pro atherogenic and anti-atherogenic fractions are more effective than single lipids measure in identifying IR. Ty-G index predicted the subsequent occurrence of HTN in a positive and dose-dependent manner. Therefore, early detection of the Ty-G index may be beneficial for early interventions to prevent HTN among the Chinese population

Methodology: The present study was an observational study and the results of total 128 hypertensive patients and healthy volunteers aged between 35 to 60 years was collected from a Tertiary care hospital. Body mass index (BMI), Waist Circumference (WC), blood pressure, fasting blood glucose and Triglyceride levels were measured. Receiver Operating Characteristic (ROC) Curve was used to check association between the study groups.

Results: ROC curve based on sensitivity and specificity with reference to TyG-BMI as dependent variable among the groups. Area under curve for Waist/Hip ratio(W/H) was 0.543, HbA1c was 0.766, albumin/creatinine was 0.512, aspartate aminotransferase/alanine aminotransferase was 0.528, triacylglycerol/high density lipoprotein was 0.681 with cut-off value of W/H is 0.81, HbA1c is 5.05, albumin/creatinine is 2.56, AST/ALT is 0.41, TAG/HDL is 0.71 respectively. TyG-WC as dependent variable in normotensive and hypertensive subjects, area under curve for W/H was 0.626, HbA1c was 0.671, albumin/creatinine was 0.527, AST/ALT was 0.528, TAG/HDL was 0.681 with cut-off value of W/H ratio is 0.80, HbA1c is 5.05, albumin/creatinine is 2.56, AST/ALT is 0.55, TAG/HDL is 1.64 respectively.

Conclusion: Our observational study suggests that higher Ty-G index was associated with higher probabilities of hypertension in general adult population. Large-scale prospective cohort studies are looked-for

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to elucidate the latent pathophysiological mechanisms underlying the association among Ty-G index and hypertensive subjects.

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Introduction:-

The third most significant risk factor linked to the prevalence of illnesses in south Asia is high blood pressure (BP) [1]. The cardiovascular health status and healthcare systems in India are significantly impacted by hypertension (HTN) [2]. HTN is one of the leading global causes of premature death, according to the WHO [3]. In 2005, according to a study of global data on the prevalence of HTN, 20.6% of Indian males and 20.9% of Indian women had the disease. By 2025, it is anticipated that the percentage rates for HTN will increase to 22.9 and 23.6 for Indian men and women, respectively [4]. As a result, in 2003 [5], the JNC-7 announced that hypertension (120-139/80-89 mmHg) will be a new BP classification criteria.

Specific systolic and diastolic blood pressure values or the documented usage of antihypertensive drugs can be used to diagnose hypertension. Only 14% of persons with high blood pressure in the globe have it under control, according to estimates [6]. The Ty-G index, which is created from the fasting triglyceride and glucose levels, showed promise as a stand-in marker for the evaluation of insulin resistance [7].

It has been a tool to recognize metabolically obese, normal-weight individuals [8]. So, measuring serum TG level as part of the Ty-G index or alone can be a useful and cost-effective marker and represent the glycemic and cardiovascular status of an individual simultaneously [9].

Although elevated BP is often accompanied by obesity, which is often assessed by body mass index (BMI), many individuals with normal BMI are also characterized by elevated BP, especially in East Asian populations [10]. In addition, Ty-G combined with BMI, waist circumference (WC), and waist-to-height (WtHR) has been reported to be more efficient than Ty-G alone [11]. The lipid accumulation product (LAP), another mathematical model calculated from the WC and fasting TG levels, has been demonstrated as an alternative index for lipid accumulation and as a surrogate marker for insulin resistance (IR) [12]. BMI and WC are simple, inexpensive, and noninvasive anthropometric parameters that are commonly adopted as useful indicators of obesity and other metabolic risks [13]. Recent studies from India have shown the prevalence of hypertension to be 25% in urban and 10% in rural people [14]. According to the WHO, the prevalence of raised BP in Indians was 32.5% (33.2% in men and 31.7% in women) [15].

However, only about 25.6% of treated patients had their BP under control in a multicenter study from India on awareness, treatment, and adequacy of control of hypertension [16].According to the World Health Organization (WHO), in 2005, approximately billion adults over the age of 15 were overweight [17]. The Ty-G index, a product of the fasting levels of triglycerides and glucose, presented promising results as a surrogate marker for the assessment of insulin resistance (IR) [18], with a good correlation with the gold standard hyperglycemic clamp, according to a study in Brazil and Mexico [19].

In recent years, some scholars have proposed the triglyceride-glucose index (Ty-G) as an important indicator of insulin resistance, which is the fasting blood glucose and triglyceride synthesis index. In recent years, some scholars have proposed the triglyceride-glucose index (TyG) as an important indicator of insulin resistance, which is fasting blood glucose and the triglyceride synthesis index [20].More recently, the triglyceride glucose (TyG) index, the product of fasting plasma glucose (FPG), and triglycerides (TG) have been proposed as simple and efficient surrogate markers for early identification of IR [21]. Khamseh et al. suggested that the TyG index with the addition of indices of obesity such as BMI and WC may be more accurate than the TyG index alone [22].The triglyceride-glucose index (TyG index), calculated according to fasting blood glucose (FBG) and triglyceride (TG) measurements, can also be used as an indicator of insulin resistance [23].The TyG index is calculated as ln [fasting TG (mg/dL) x FBG (mg/dL)/2]. It has been shown that the TyG index is a better marker for determining diabetes risk than FPG and TG measurements in patients with blood glucose below 100 [24]. Previous studies have proved that TG and FPG are also significantly associated with incident hypertension risk [25].So we compared the ability to predict hypertension risk between TyG, FPG, and TG in this study [26]. Previous articles mainly explored the relationship between insulin resistance and obesity, while few studies studied the interaction between insulin resistance and obesity on disease risk. Traditionally, the frequently used anthropometric indices to define obesity include BMI, WC, WHR, and WHtR. Numerous studies have compared the ability of different obesity indices to identify hypertension risk [27]. Though such studies have documented the role of TyG-BMI and TyG-WC in hypertensive subjects, very few studies are available from India. Hence, we undertook this study.

Materials and Methodology:-

The study was conducted for a period of 1 year in a Tertiary care Hospital, Puducherry. The study was approved by Institution Research Council (IRC) and Institution Human Ethical Committee (IHEC).

Inclusion Criteria:
Adult hypertensive patients diagnosed (JNC 8 criteria) for the first time or on antihypertensive drugs with age group (35-60), irrespective of gender (Systolic blood pressure ≥140 mmHg, Diastolic blood pressure ≥90 mmHg).

Exclusion Criteria:
Chronic illness (renal, hepatic, cardiac), Endocrinology disorders, Pregnant women, Patients under antihypertensive drugs.

All the quantitative determinations were enabled by established methods/procedures approved by the International Federation of Clinical Chemistry (IFCC). Stringent Quality Control was promulgated. The Internal quality Control was enabled through samples provided by M/S Biorad USA. External Quality Assessment, under the aegis of ACBI was facilitated through the Clinical Biochemistry laboratory of Christian Medical College (CMC), Vellore which has been accredited by NABL under ISO/IEC 15189).

Fasting plasma glucose (FG) level was determined by the glucose oxidase method. HbA1c was determined by a high-performance liquid chromatography. Serum total cholesterol (TC) was estimated by the cholesterol oxidase method, the high-density lipoprotein cholesterol (HDL-C) levels by a direct homogeneous enzymatic method, while serum triglyceride (TG) levelswere estimated by glycerol oxidase method. The low-density lipoprotein cholesterol (LDL-C) was calculated using the Friedewald's equation. The total protein was estimated by biuret method. Adult hypertensive patients diagnosed (JNC 8 criteria) for the first time or on antihypertensive drugs with age group (35-60), irrespective of gender (Systolic blood pressure ≥140 mmHg, Diastolic blood pressure ≥90 mmHg) are included in study. Chronic illness (renal, hepatic, cardiac) Endocrinology disorders,Pregnant women, Patients under antihypertensive drug are excluded form study

Statistical Analysis
MS - Excel (2007) were used to record the data set. SPSS - 16 was used for statistical analysis namely, percentage that were computed for categorical variables. Receiver Operating Characteristic (ROC) curves were enabled to determine Area Under Curve (AUC) for assessing the utility of a biochemical predictor and also a means of comparing two or more predictive models. P values <0.005 were considered statistically significant.

Results:-

The predictor nature with reference to TyG-BMI, TyG-WC were utilized as dependent variables in both hypertensive and normal healthy volunteers were enabled and found to be statistically significant.

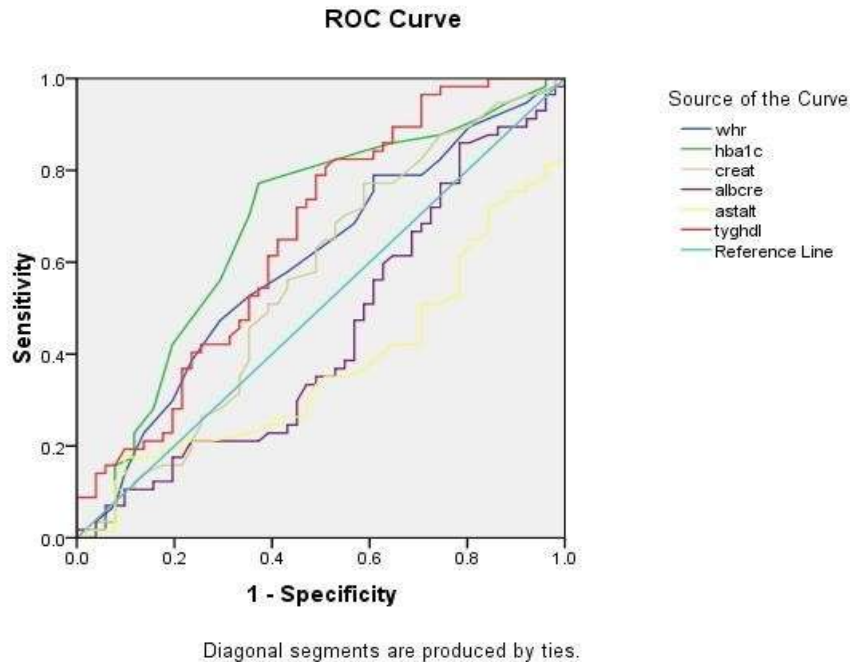

Fig. 1:- ROC Curve for Normotensive and Hypertensive subjects with biochemical parameters as TYG-BMI as dependent variable.

ROC curve based on sensitivity and specificity with reference to TyG-BMI in normotensive and hypertensive subjects with biochemical profile as TYG-BMI as dependent variable. Area under curve for Waist/Hip ratio was 0.543, HbA1c was 0.766, creatinine was 0.582, albumin/creatinine was 0.512, aspartate aminotransferase/ alanine aminotransferase was 0.528, triacylglycerol/high density lipoprotein was 0.681 with cut-off value of Waist/Hip ratio is 0.81, HbA1c is 5.05, creatinine is 0.84, albumin/creatinine is 2.56, aspartate aminotransferase/ alanine aminotransferase is 0.41, triacylglycerol/high density lipoprotein is 0.71 respectively.

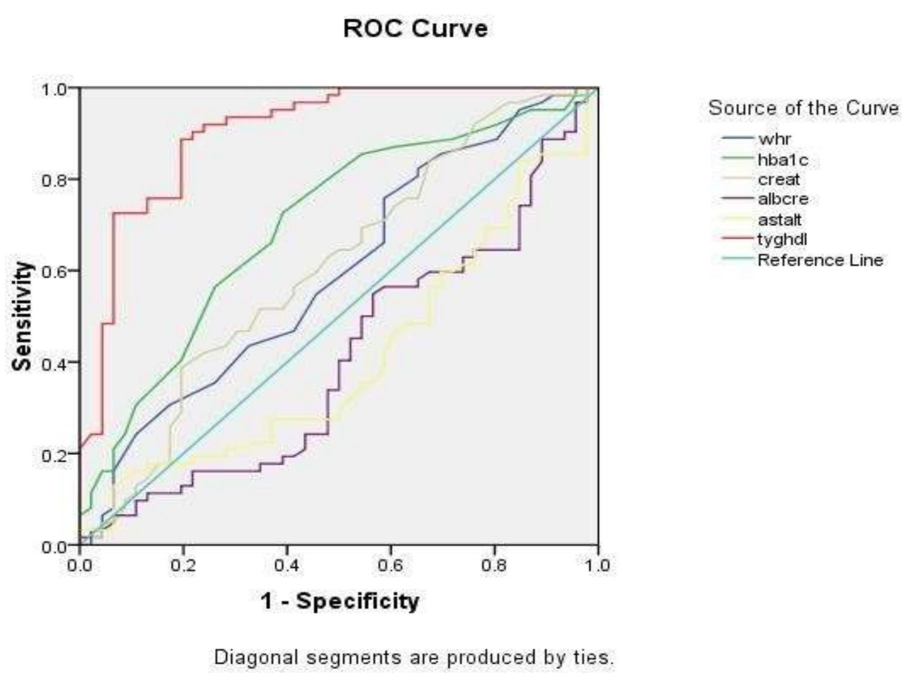

Fig. 2:- ROC Curve for Normotensive and Hypertensive subjects with biochemical profile as TYG-WC as dependent variable

ROC curve based on sensitivity and specificity withreference to TyG-WC in normotensive and hypertensive subjects with biochemical profile as TYG WC as dependent variable. Area under curve for Waist/Hip ratio was 0.626, HbA1c was 0.671, creatinine was 0.555,albumin/creatinine was 0.527, aspartate aminotransferase /alanine aminotransferase was 0.528, triacylglycerol/high density lipoprotein was 0.681 with cut-off value of Waist/Hip ratio is 0.80, HbA1c is 5.05, creatinine is 0.84, albumin/creatinine is 2.56, aspartate aminotransferase/ alanine aminotransferase is 0.55, triacylglycerol/high density lipoprotein is 1.64 respectively.

Discussion:-

We looked into the relationship between TyG and its combination of obesity indices (BMI and WC) and hypertension in the South Indian population in this observational study. According to our findings, adiposity status and Ty-G (TyG BMI and TyG WC) together still exhibited a significant and favorable correlation with hypertension in people of normal weight. TyG BMI also fared better than other metrics with a moderate area under the curve. The findings indicated that TyG BMI can be a practical and useful assessment indication in the hierarchical management of hypertensive and healthy people. The major findings of our investigation shown that, in both healthy and hypertensive patients, TyG-BMI and TyG-WC are related to HbA1C, creatinine, albumin/creatinine, AST/ALT, and TAG/HDL parameters. There was significant association between BMI and hypertension, our study add to the evidence suggesting that there are ethnic differences in the strength of the association between BMI and hypertension [28].Previous studies found that Asian populations had a much stronger association between BMI and blood pressure. BMI has been found to be associated with hypertension, diabetes, and other Non Communicable Diseases in South Asian populations, at a much lower threshold level than the level for other populations [29]. The possible reasons for such differences could be genetic and metabolic variations, as well as clustering of environmental, dietary, and social factors associated with hypertension[30]

This indicates that a biological rather than an environmental factor is more likely to be involved in the connection between BMI and hypertension [31]. Any amount of a decrease in BMI at the population level might significantly lessen the burden of hypertension because BMI is log-linearly associated with hypertension [31]. The criteria of overweight and obesity employed in earlier research looking at the connection between adiposity and hypertension in this population were varied [32]. Given the strong and linear relationship between BMI and hypertension, primary prevention through reducing BMI would have a much greater impact on reducing cardiovascular morbidity and mortality [31]. Early diagnosis and treatment of hypertension are essential for reducing the burden of NCDs in South Asian countries [32]. This research giving the robust and linear association between BMI and hypertension, primary prevention through reducing BMI would have much greater effect on reduction of cardiovascular morbidity and mortality [30]. Previous studies indicating the trajectories of hypertension in the general population, often revealing that it is frequently preceded by insulin resistance and obesity. In addition, BMI and insulin levels have been extensively reported in relation to hypertension [33].

In recent years, some scholars have proposed triglyceride-glucose index (TyG) as an important indicator of insulin resistance, which is fasting blood glucose and triglyceride synthesis index. In recent years, some scholars have proposed triglyceride-glucose index (TyG) as an important indicator of insulin resistance, which is fasting blood glucose and triglyceride synthesis index [34]. TyG index predicted the subsequent occurrence of HTN in a positive and dose-dependent manner. Therefore, early detection of the TyG index may be beneficial for early interventions to prevent HTN among the Chinese population (26). In one cross-sectional it is directly compared with 5 parameters (BMI, WC,TyG, TyG - BMI and TyG -WC) as predictors of pre- diabetes and diabetes in FDRs of T2DM patients (27).

For this reason, TyG index was applied instead of insulin resistance in this study to explore the temporal relationship with BMI. TyG combined with BMI, waist circumference (WC), and waist-to-height ratio (WtHR) have been reported they are more efficient than TyG alone [35]. TAG/HDL ratio and thyroid hormone levels could be used as objective markers for insulin resistance with thyroid comorbidity in overweight and obese type 2 diabetics [36].

This study was limited by the use of an observational data. There are possibilities of reverse causation; and we cannot establish a causal association between BMI and hypertension, or whether BMI is an independent risk factor of hypertension. Taking advantage of the large sample size of our study, we may be able to show that the associations of BMI with hypertension and its complications.

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Conflict of Interest

The authors declare no conflict of interest in the study.

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