Original Article

Assessment of insulin secretory status in adult male with essential hypertension

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Abstract

The patients with essential hypertension are increasing in our country and all over the world. Insulin secretion by the pancreatic beta cells may be increased in several metabolic disorders including glucose intolerance, dyslipidemia and essential hypertension. Many studies suggested an association between essential hypertension and defective insulin secretion. So, insulin secretory capacity may act as important clinical and biochemical determinant which will provide further information to minimize hypertension related other complications. This study was aimed to assess insulin secretory capacity in adult male with essential hypertension. This cross sectional study was conducted in the Department of Physiology, Dhaka Medical College, Dhaka from July 2012 to June 2013. A total number of one hundred fifty male subjects were selected with age ranging from 25 to 45 years. Among them, seventy five male essential hypertensive subjects were included in the study group. The study subjects were selected from Out- patient Department of Medicine, Dhaka Medical College Hospital. Age matched 75 apparently healthy males were studied as control group (A) for comparison. or the calculation of insulin secretory capacity, fasting serum insulin level was measured by ELISA method and fasting serum glucose by glucose oxidase method in the laboratory of Department of Physiology and Molecular Biology, BIRDEM Academy, Dhaka.In this study, insulin secretory capacity (HOMA%B) was significantly higher in essential hypertensive male patients than those of the control subjects. It was seen that essential hypertension has positive and significant relationship with insulin secretory capacity.

Key-words: Essential hypertension, insulin secretory capacity, pancreatic beta cell

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Introduction

Hypertension is a recognized modifiable risk factor of cardiovascular disease (CVD), stroke and end stage renal disease. The prevalence of hypertension has increased in young man than in woman. It is considered as the leading cause of morbidity and mortality in the modern world.[1] Seventh Joint National Committee has defined hypertension as Systolic blood pressure >140 mmHg or Diastolic blood pressure >90 mmHg or self-reported use of drug treatment for hypertension irrespective of measured blood pressure.[2] The exact prevalence of hypertension in Bangladesh is not known. Only a limited number of small-scale epidemiological studies are available. A recently published survey observed that the prevalence of hypertension is about 20.1%.[3]

In more than 95% of cases, a specific underlying cause of hypertension cannot be found. Such patients are said to have essential hypertension.[4] The pathogenesis of essential hypertension is not clearly understood. Many factors may contribute to its development, including renal dysfunction, peripheral resistance, vessel tone, endothelial dysfunction, autonomic tone, insulin resistance and neurohumoral factors.[5]

Beta- cell secretory capacity is expressed as HOMA%B, the higher the value the more the beta-cells have to secrete insulin to handle existing blood glucose level. Insulin secretory status (or capacity) was calculated using the homeostasis model assessment (HOMA) software.[6,7] The homeostasis model assessment (HOMA), based on plasma levels of fasting glucose and insulin, has been widely validated and applied for quantifying insulin resistance and beta-cell function.[8]

Essential hypertension greatly contributes to the development of atherosclerosis. The contribution of essential hypertension to the development of coronary

artery disease is thought to be due to the direct effect of elevated blood pressure on the arterial wall as well as the indirect effects of multiple metabolic abnormalities frequently present in hypertensive subjects.[9] Epidemiological studies have identified an association between hyperinsulinemia (elevated fasting and postprandial insulin levels) and hypertension.[10]

In essential hypertension there is increase in pancreatic beta cell secretion as a response to decreased peripheral (i.e. muscular) insulin-mediated glucose utilization.[11] Population-based studies suggest that this increased insulin secretory status of beta-cells is an independent risk factor for the development of coronary artery disease.[12] Several investigators reported that insulin secretory capacity was increased in the subjects with essential hypertension.[13, 14]

In contrast some investigators observed no significant difference between the healthy group and essential hypertensive patients in regard to insulin secretory status.[15, 16]

So, the precise nature of the relationship between insulin secretory status and essential hypertension remains indescribable. Several studies have been done regarding this issue in abroad. But no published data is available in our country on this aspect. Again, we need to know the magnitude of this issue in adult male subjects with essential hypertension of Bangladesh for our own standard baseline as well as for reference value. Therefore, this study has been designed to assess the insulin secretory status in adult male with essential hypertension.

Methods

This cross sectional study was conducted in the Department of Physiology, Dhaka Medical College, Dhaka from July 2012 to June 2013. A total number of one hundred fifty male subjects were selected with age ranging from 25 to 45 years. Among them, seventy five male essential hypertensive subjects were included in the study group (B). The study subjects were selected from Out- patient Department of Medicine, Dhaka Medical College Hospital. Age matched seventy five apparently healthy males were studied as control group (A) for comparison. Data were collected in pre-designed structured questionnaire by the researcher herself. All the subjects were free from any endocrine disorder, renal disease, psychic disorder and any hereditary disease. Subjects with obesity and habit of smoking were excluded.

After selection of subjects, the objectives, nature, purpose and benefit of the study were explained to the subjects in details. They were encouraged for their voluntary participation. They were also allowed to withdraw themselves as soon as they wish. Informed written consent was taken from the participants. The subjects were advised to attend the laboratory in the Department of Physiology of Dhaka Medical College, Dhaka between 8 AM to 10 AM. On the day of examination, with all aseptic precautions 5 ml blood from each study subject was collected after an overnight fast (at least 12 hours). Blood was transferred into a dry, clean and plain test tube with a gentle push to avoid hemolysis. Then blood was centrifuged at a rate of 3000 rpm for 15 minutes. After that supernatant serum was collected in labeled eppendorf tube and was kept frozen at -200 C until analysis. Whenever the subject appeared in the department, and then the subject was interviewed and detail history regarding personal history, drug history, past medical history were taken. Then thorough physical examinations and anthropometric measurement including height, weight and BMI were taken.

The laboratory investigations were done in the Department of Pathology, Dhaka Medical College, Dhaka and Department of Physiology and Molecular Biology, BIRDEM Academy, Dhaka.

Insulin secretory status (or capacity) was calculated using the homeostasis model assessment (HOMA) software. The homeostasis model assessment (HOMA), based on plasma levels of fasting glucose and insulin, has been widely validated and applied for quantifying insulin resistance and beta-cell function. The HOMA model has been incorporated in a simple MS-DOS based computer program (HOMA-CIGMA software) that allows rapid determination of %B (B cell secretion) from measured values. Although the simple equation gives a qualitatively useful approximation of the model prediction, most authors prefer the computer model. In this study HOMA-CIGMA software was used. For statistical analyses, unpaired Student's 't' and Pearson's correlation coefficient (r) tests were performed by using SPSS (version 13.5) as applicable.

Results

Both the groups were matched for age and BMI.

Mean value of HOMA % B in group A was 126.66±40.90. Mean value of HOMA % B in group B was 161.78±74.13

Mean value of HOMA % B was significantly higher in group B than that of group A (Table-I & Figure - 1)

Table-I: Insulinemic status in both groups (n=150)

Parameter	Group A n= 75	Group B n= 75
HOMA % B	126.66±40.90	161.78±74.13
	Statistical analysis	
Groups	HOMA%B	(p value)
A vs B	0.0001	

Results are expressed as Mean ± SD. Unpaired Student's 't' test was performed to compare between groups. The test of significance was calculated and p values <0.05 was accepted as level of significance. Group A: Control (Healthy) n=Number of subjects, Group B:Study (Essential hypertension) n= Number of subjects

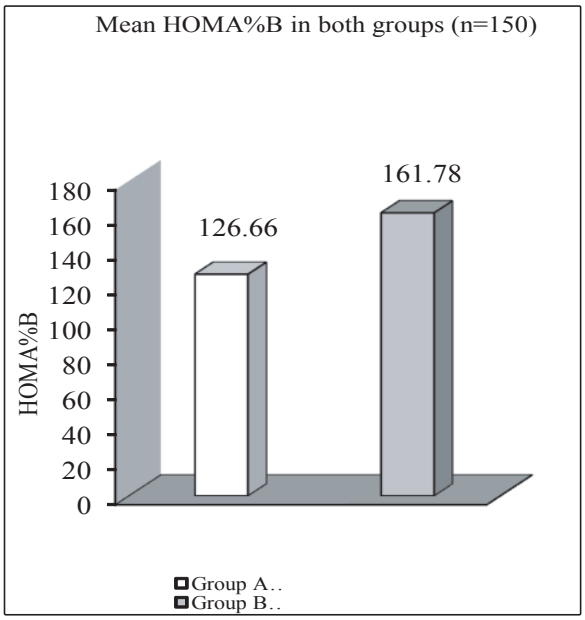

Figure - 1: *Mean HOMA%B in both groups (n=150)*

Discussion

In the present study, insulin secretory capacity in healthy control group were almost within normal range and also similar to those reported by the various investigators from different countries.[10 -14]

In this study, the mean value of insulin secretory capacity was significantly higher in adult male with essential hypertension when compared with that of controls. This finding is consistent with the findings of some other investigators of other countries. [10-14, 17]

There are some postulated mechanisms suggested by different researchers of different countries which may imply the possible mechanism regarding the changes of insulin secretory capacity in essential hypertensive adult male subjects.

It has been suggested that essential hypertensive subjects have significant defect in activating the insulin receptor. There is decreased insulin action on insulin receptor (IR) which reduces the activation of receptor tyrosine kinase. As a result, decrease in receptor Autophosphorylation and tyrosine phosphorylation of IRS-1. Also, there is decrease in activation of phosphatidyl inositol (PI) 3-kinase, a subunit of IRS-1. This IRS-1 causes decrease glucose transport to skeletal muscles.[17] Again, in essential hypertension there is increase in pancreatic beta cell secretion as a response to decreased peripheral (i.e. muscular) insulin-mediated glucose utilization.[11]

In the present study, insulin secretory capacity is increased in adult male subjects with essential hypertension and essential hypertension has positive correlation with HOMA%B. This correlation further supports the findings of the present study. But the exact mechanism is not elucidated as the insulin receptor activity and serum catecholamines level were not assessed in the study.

This study concludes that insulin secretory status (HOMA%B) is increased in adult male subjects with essential hypertension.

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