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Carotid intimomedial thickness in type 2 diabetes and its correlation to coronary risk factors

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Abstract

Aim: To know the relationship of CIMT with risk factors for atherosclerosis in type 2 diabetes mellitus patients.

Material and Method: Carotid Doppler were performed in all patients to measure the Carotid intimo-medial thickness using Ultrasonographic scanning of the carotid arteries on the machine equipped with colour flow imaging and pulse Doppler, with an electrical linear transducer. The scanning session will be for an average of 30 minutes. The IMT, as defined by Pignoli *et al* will be measured as the distance from the leading edge of the first echogenic line to the leading edge of the second echogenic line.

Result: In type-2 DM patients without CHD, the mean age was 52.46 ± 10.01 yrs, mean weight was 59.31 ± 11.78 kg, mean height was 159.14 ± 10.32 cm, mean BMI was 23.42 ± 4.45 and the mean WHR is 0.95 ± 0.03 . In these patients, mean duration of DM was 4.53 ± 5.19 years. In type-2 DM patients with CHD, the mean BSLF was 185.99 ± 34.05 , mean BSLPP was 244.75 ± 49.11 , mean HbA1c was 9.22 ± 1.37 , mean BUL was 40.09 ± 17.06 , mean creatinine was 1.34 ± 0.67 , mean of total cholesterol was 171.55 ± 43.54 , mean LDL was 93.40 ± 35.01 , mean VDRL was 26.58 ± 16.07 , mean triglyceride was 118.10 ± 56.36 , mean HDL was 41.16 ± 10.88 and the mean M-ALB was 158.42 ± 182.22 .

Conclusion: CIMT lends itself conveniently for measurement, it can be utilized as a surrogate marker of CAD. It cannot replace coronary angiography in the assessment of risk/prognosis of CAD but it can help the clinician decide which diabetic is at higher risk for CAD and hence may benefit from coronary angiography.

Keywords: Carotid Intimomedial Thickness, Type 2 Diabetes

Introduction

The term Human resource Management and Human Resource have largely replaced instead of personnel Management in the processes of Managing people in the organizations. The Human Resource Management means a strategic and coherent approach for the organization's most value assets behind on the workers While Personnel department means to manage the paper work around hiring and paying people. Human Resource Management play an important role in assuring employee satisfaction, improving performance and productivity. This can further organization's competitive advantage and directly contribute to the organization stress. Human Resource manager are well positional to play on instrument role in helping their organization achieve its goals of becoming a socially and environmentally responsible firm are which reduces its negative and enhances it positive impact on society and the Environment. Human Resource Management is the process to engage people, train them, compensate them. It develops the policies to retain them. Human Resource Management has undergone many changes over the last few years, giving it an even more important role in today's competitive business world. The aim of Human Resource Management is to hire, train and develop staff. It keeps control over staff and their functioning. Through effective training and development employee at enterprise achieve promotion within the company and reach their full potential. By HRM processes and Diabetes mellitus is one of the main threats to human health in the 21st century.

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The past two decades have seen an explosive increase in the number of people diagnosed with diabetes worldwide. India leads the world with largest number of diabetic subjects earning the dubious distinction of being termed the “diabetes capital of the world”^[1]. According to the Diabetes Atlas 2006 published by the International Diabetes Federation, the number of people with diabetes in India currently around 40.9 million and is expected to rise to 69.9 million by 2025 unless urgent preventive steps are taken^[2].

Type 2 diabetes, characterized by insulin resistance, impaired insulin secretion, and hyperglycaemia, affect at least 171 million people worldwide and 31.7 million people in India^[1]. A pathophysiologic hallmark of type 2 diabetes is insulin resistance, which has both genetic and acquired components^[3]. Glucose intolerance and hyperglycaemia supervene only when the pancreatic beta cells are unable to maintain compensatory hyperinsulinaemia to overcome tissue resistance to insulin action^[4] However, in addition to having hyperglycaemia and insulin resistance/secretory defects, nearly 80 per cent of diabetics are obese and have other metabolic abnormalities, including dyslipidaemia (increased LDL, decreased HDL, and raised triglyceride levels), hypertension, and 2 abnormalities of coagulation and the fibrinolytic system.

This cluster of metabolic abnormalities, which has been termed the metabolic syndrome^[5] or the cardiovascular dysmetabolic syndrome is associated with a higher incidence of premature cardiovascular morbidity and mortality^[6]. Type 2 diabetes patients suffer from numerous microvascular and macrovascular complications, which cause a lot of morbidity and mortality. The microvascular complications include diabetic retinopathy, nephropathy and neuropathy, which lead to significant morbidity in the form of blindness, end-stage renal disease and limb amputations^[7]. The macrovascular complications of type 2 diabetes include coronary artery disease (CAD), cerebrovascular disease (CVD) and peripheral vascular disease (PVD).

Keeping the implications of the above in mind, the present study was undertaken to know the relationship of CIMT with risk factors for atherosclerosis in type 2 diabetes mellitus patients. This is the first ever cross sectional analysis carried out in type II diabetic patients in the XX and surrounding region.

Material and Method

This chapter presents an overview of the design and conduct of a study entitled “Carotid intimomedial thickness in Type 2 DM and its correlation with coronary risk factors”. Ethics Committee permission The study was initiated only after obtaining permission from the Institutional Ethics Committee, Krishna Hospital, Karad.

The study was conducted on 102 patients with type II diabetes mellitus reported in Krishna hospital. The study was designed to identify Carotid intimomedial thickness in Type 2 DM and assess its correlation with coronary risk factors. All patients with type II diabetes mellitus attending the Medicine ward were invited to participate in the study and written informed consent was taken. All patients underwent a standard clinical and laboratory evaluation. Demographic information such as age, sex, weight and height were requested. Information on duration of diabetes was taken. Following this, BMI, waist-hip ratio and other parameters such as arterial blood pressure was measured.

Carotid Doppler were performed in all patients to measure the Carotid intimo-medial thickness using Ultrasonographic

scanning of the carotid arteries on the machine equipped with colour flow imaging and pulse Doppler, with an electrical linear transducer. The scanning session will be for an average of 30 minutes. The IMT, as defined by Pignoli *et al.* will be measured as the distance from the leading edge of the first echogenic line to the leading edge of the second echogenic line. The first line represents the lumen intimal interface and the second line is produced by the collagen containing upper layer of the tunica adventitia. The image will be focussed on the posterior far wall and four images of the left and right common carotid arteries each will be recorded at least 15 mm proximal to the bifurcation. The CIMT will be calculated as the mean of eight measurements. IMT values below 0.8 mm are considered as normal.

All the data were entered into the excel database from paper proforma. During the data entry, data were checked for any error or missing data. After resolution of all issues, the database was analyzed. Following analyses were performed. Demographic data (sex) were presented in number and percentage. Continuous data (age, age, sex, weight, height, duration of diabetes, BMI, waist-hip ratio, arterial blood pressure) were presented as mean and standard deviation. Findings of the investigations (Fasting blood sugar, Post prandial blood sugar, Urea, Creatinine, HbA1c, Total cholesterol, LDL, HDL, LDL, Triglycerides, Micro-albuminuria and CIMT) were presented as mean and standard deviation.

Result

Study enrolled 67 diabetes mellitus patients with coronary heart disease (CHD) and 35 diabetes mellitus patients without coronary heart disease. Of 67 CHD, 47 (70.15%) were male and the remaining 18 cases (26.87%) were female. In case of 35 non-CHD patients, 20 (57.14%) were male and the remaining 17 (48.57%) were female. Gender distribution in type-2DM patients with and without coronary heart disease showed the insignificant results. The demographic profiles of type-2DM patients with CHD. In DM patients with CHD, the mean age of the patients was 65.61±9.63 years, mean weight was 67.91±12.72 kg, mean height was 161.70±7.94 cm, mean BMI were 25.81 ±4.07 and the mean WHR was 0.95 ± 0.04. In these patients, mean duration of DM was 7.61 ±5.97 years.

In type-2 DM patients without CHD, the mean age was 52.46 ± 10.01 yrs, mean weight was 59.31 ±11.78 kg, mean height was 159.14 ± 10.32 cm, mean BMI was 23.42± 4.45 and the mean WHR is 0.95± 0.03. In these patients, mean duration of DM was 4.53 ±5.19 years. In type-2 DM patients with CHD, the mean BSLF was 185.99 ± 34.05, mean BSLPP was 244.75 ± 49.11, mean HbA1c was 9.22 ± 1.37, mean BUL was 40.09 ± 17.06, mean creatinine was 1.34 ± 0.67, mean of total cholesterol was 171.55 ± 43.54, mean LDL was 93.40 ± 35.01, mean VDRL was 26.58 ± 16.07, mean triglyceride was 118.10 ± 56.36, mean HDL was 41.16 ± 10.88 and the mean M-ALB was 158.42 ± 182.22.

Discussion

Patients with diabetes mellitus suffer unduly from premature and severe atherosclerosis. The Framingham study pointed out that diabetic individuals have higher serum concentrations of lipids and more hypertension, obesity, and thus are more prone to advanced atherosclerosis and it's sequelae, namely coronary artery disease (CAD), cerebrovascular disease, aortic atherosclerosis, and peripheral vascular disease^[8].

Ultrasonographic assessment of easily accessible arteries has been advocated as a surrogate marker for less accessible vessels, such as coronary and cerebral arterial systems. Ultrasound imaging, which can provide information on intimal-medial thickness (IMT), plaque presence and type, calcification, and wall diameter, offers the ability to examine pre-symptomatic lesions, assess atherosclerotic burden and hence the risk of cardiovascular events. Intimal-medial thickness of the common carotid artery is considered to be an excellent non-invasive measure of generalized atherosclerosis and also a surrogate marker of coronary artery disease^[6, 7].

The current study was undertaken primarily to determine the carotid intimal-medial thickness in Type II Diabetes Mellitus patients with coronary heart disease (CHD) as compared to Type II Diabetes Mellitus patients without coronary heart disease (CHD). The correlation of carotid intimal-medial thickness with coronary risk factors in patients with Type II Diabetes Mellitus was the secondary objective.

The mean CIMT in our study group of a total of 102 cases with type 2 diabetes was 0.98 ± 0.21 mm. The value was higher than the nondiabetic patients. The age, weight, BMI were significantly higher in patients with CHD group as compared to patients without CHD ($p=0.001$). Height and WHR were comparable in both the groups ($p>0.05$). Similarly, duration of diabetes was significantly higher in patients with CHD group as compared to patients without CHD ($p=0.01$). The finding was in the line with the published literature^[9].

In a study by Aggarwal *et al*, the mean CIMT in study group of a total of 111 cases with type 2 diabetes was 0.840 ± 0.18 mm. This was lower than the value reported by Mohan *et al*. in the CUPS study (0.95 ± 0.31 mm), yet higher than normal. Multivariate regression analysis showed that age and diabetes were the major risk factors for IMT. Kawamori *et al*. [D-3] (1992) in their study on the prevalence of carotid atherosclerosis in diabetic subjects concluded that IMT is linearly related with age in diabetic subjects ($IMT = [0.0155 \times \text{age}] + 0.32450$). Multivariate regression analysis of 275 type 2 diabetic cases indicated that smoking, hyperlipidaemia, duration of diabetes, hypertension and age were factors determining thickness of the carotid arterial wall.

Chen *et al*.^[10] investigated the association of fasting and postprandial triglyceride levels with CIMT among type 2 diabetic patients in Southeast China. The CIMT in patients with postprandial HTG was significantly greater than that in patients with postprandial normotriglyceridaemia ($p<0.05$). The cardiovascular health study collaborative research group has recently observed, in 4476 subjects without clinical cardiovascular disease followed over 6 years, that the relative risk for myocardial infarction (MI) or stroke for the quantile with the highest IMT as compared with the lowest quantile was 3.87. IMT is a strong independent predictor for new cardiovascular events, even after statistical adjustment for other traditional risk factors.

In a case control study of 772 persons selected from the ARIC population to evaluate adults free of clinical cardiovascular disease, case subjects, identified on the basis of carotid arterial wall thickness, had consistently higher values for atherogenic risk factors (age, body mass index, systolic and diastolic blood^[11] pressure, pack years of smoking, total triglycerides, low-density lipoprotein (LDL cholesterol), and low high density lipoprotein (HDL

cholesterol) than control subjects. Carotid IMT (CIMT) has been shown to be independently associated with CAD in Indian subjects. This fact was reinforced by our study wherein CIMT was found to be very strongly and significantly correlated with the prevalence of CAD ($p<0.0001$). In our study, among the CAD patients, triglyceride and micro-albuminuria was significantly correlated to mean CIMT ($p<0.001$).

Conclusion

Intimal-medial thickness of the common carotid artery is considered to be an excellent non-invasive measure of generalized atherosclerosis. In asymptomatic type 2 diabetic patients, measurement of CIMT is a simple and safer alternative to stress testing for detection of silent CAD. Also, as CIMT lends itself conveniently for measurement, it can be utilized as a surrogate marker of CAD. It cannot replace coronary angiography in the assessment of risk/prognosis of CAD but it can help the clinician decide which diabetic is at higher risk for CAD and hence may benefit from coronary angiography.

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