Review article

Early Detection of Atherosclerotic Changes in Diabeic Patients

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Diabetes mellitus is associated with accelerated atherosclerosis1and increased prevalence of cardiovascular disease. Both micro and macro vascular diseases are more prevalent in diabetic than non-diabetic populations causing morbidity associated with the disease2.

Cardiovascular disease is one of the most common complications in diabetes mellitus. In USA 77% of hospitalizations due to diabetes related complications are mostly attributable to cardio vascular diseases. The age adjusted cardio vascular mortality is about two fold higher in diabetic subjects than in non-diabetic subjects. These observations have highlighted the high prevalence of undiagnosed CVD in diabetic patients. The problem of undiagnosed disease is partly the result of unawareness of strong association between diabetes and CVD by the patients. CVD mortality has been reduced during a decade of follow up suggesting certain interventions that have been useful in reducing CVD mortality in general population1.

Bangladesh is ranked number ten position in the world in the number of diabetic patients3 .In 2030 Bangladesh will occupy the 7th position with 11.1 million diabetic patients3 .Several epidemiological studies in migrant populations observed that diabetes and coronary risk factors are more prevalent in Bangladeshis compared with other South Asian Migrants (Indians and Pakistanis) settled in UK and with native populations4. Moreover Bangladeshis have highest mortality and attack rate from diabetes and coronary heart diseases among other south Asian Immigrants5. These findings favour the hypothesis that Bangladeshi populations are genetically more prone to develop Diabetes and its complications than other south East Asian region populations. It is known that Cardio-vascular disease is the most common cause of mortality and peripheral vascular disease is the leading cause of lower limb amputation in the world.

Atherosclerosis, one of the most important complications of DM is the leading cause of coronary artery disease and stroke. Based on available literature, the first pathophysiology of atherosclerosis would be endothelial dysfunction function followed by structural changes like fatty degeneration and foam cell formation leading to intima- medial thickening, plaque formation and finally clogging of the artery. These changes interfere with blood flow and later on rupture of the atheromatous plaque occurs with consequent intraluminal thrombosis, which results in a clinical event7.

The presence of atherosclerosis is generally deduced from the occurrence of clinical manifestations like angina pectoris, myocardial infarction, intermittent claudicating, gangrene, TIA, stroke. However these ischemic syndromes only occur when lesions are relatively advanced. These lesions themselves may have been present but remain silent for decades until clinically manifested. At the pre-clinical phase only advanced atherosclerotic lesions can be detected by clinical examination, angiography, surgical inspection and pathological exemptions allow them to be directly demonstrated. However such procedures cannot be extensively used in asymptomatic population, because they are invasive techniques8.Computer assisted angiography may improve reproducibility of estimates of lumen obstruction, but more serious concerns surround the use of angiography to provide a valid estimates of disease extent9.In the last decade, ultrasound methods have been developed to allow non-invasive evaluation of atherosclerotic lesions and their haemodynamic effects8

Ultrasonic tissue characterization of atheromatous plaques was performed using a high resolution real time scanner. Atheromatous plaques obtained at autopsies and surgical carotid endarterectomy specimens were scanned in a water bath with an 8MHz high resolution real time scanner. The findings were correlated with histology at the corresponding sites in each specimen. Fatty streaks were not detectable by ultrasound. Small fibro-fatty plaques appear as localized thickening of the arterial wall with little change in echogenicity or echotexture. In larger fibro fatty lesions, sizable aggregates of amorphous lipid residue appeared less echogenic than adjacent tissues and regions of dense fibrosis more echogenic. Densely calcified foci in plaques were highly

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echogenic and associated with acoustic shadowing. Surface irregularities of plaques at ultrasound may simulate ulceration. Ulcers, evident at gross inspection, appeared as marked surface irregularities or excavations at ultrasound. The basis of findings and their relevance to clinical vascular ultrasound imaging are discussed10.

Ultra-sound methods have other advantages in addition to their non invasive nature. A direct evaluation of the arterial wall is possible with B-mode imaging. With angiography arterial wall cannot be visualized and only the residual lumen can be directly imaged. In order to assess the severity of the disease accurately and to evaluate its progression, both lumen diameter and wall thickness should be measured. Angiography does not allow such a combined evaluation. The direct visualization of the plaque has stimulated the development of research on ultrasound characterization of plaque structure and composition. The local and distal homodynamic effects of a lesion can be determined. The pressure gradient generated by a stenosis can be measured as can the reduction of blood flow and alterations in the velocity pulse both proximal and distal to lesion. The velocity field within a few diameters from the lesion can be explored and the velocity profile displayed. Arterial compliance can be measured locally or as the mean for a defined arterial segment8.

The amount of severity of atherosclerosis in coronary bed shows a positive correlation with the degree of atherosclerosis in the aorta and other major arterial branches11.Carotid Intima-Medial thickness measurements are applied widely to measure atherosclerosis because increased IMT is a strong predictor of coronary heart disease and stroke11.High-resolution B mode ultrasonography is a non-invasive method to quantify sub clinical arterial wall thickening and atherosclerotic progression. This technique permits to measure IMT, an early marker atherosclerosis . Moreover ,measurement of IMT at the common carotid artery (CCA) alone is a reasonable alternative to more detailed and difficult investigations at other sites12.Changes in CCA IMT have also been adopted as a surrogate end point for determining the success of interventions that lower the levels of low-density lipoprotein cholesterol13.

Multiple factors including obesity, hypertension dyslipidaemia, modification of lipoproteins, glycation and oxidation of other key proteins, increased procoagulation and possibly the state of insulin resistance contribute to the accelerated atherosclerosis in diabetes1.Despite this association, carotid-artery intima medial thickness is a strong predictor of new cardio vascular events even after statistical adjustment of other risk factors13.

The specific lesion in DM is microangiopathy, causing thickening of the basement membrane. So early diagnosis and management of the disease with its contributing risk factors may prevent cardiovascular complications and may help one to lead a near normal life and positive good health. It may be difficult for clinicians to identify diabetic patients with subclinical cardiovascular disease on the basis of classic risk factors. Increased Intimal-Medial thickness, an indicator of subclinical disease, can reflect the consequence of past exposure to risk factors. Therefore addition of IMT measurement may help to identify cardiovascular complications of asymptomatic persons who would benefit from aggressive preventive measures

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