

Diabetes and Cardiovascular Diseases

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Abstract: Cardiovascular disease is one of the major complications of diabetes and is the leading cause of early death among people with diabetes. People with diabetes also have higher incidence of hypertension, dyslipidaemia, and obesity, which contribute to increased incidence of cardiovascular disease. The present article focuses on the predisposing factors, management and preventive strategies for cardiovascular disease in diabetes.

INTRODUCTION

Diabetes mellitus (DM), frequently referred as diabetes, is a constellation of metabolic diseases in which there are high blood sugar levels over an extended period. Several distinct types of DM are caused by a complex interplay of genetics and environmental factors including diet, lifestyle and addiction behaviour. Depending on the type of the DM, factors causing hyperglycemia include reduced insulin secretion, insulin resistance, decreased glucose utilization, and increased glucose production. The metabolic disharmony associated with DM causes several secondary pathological changes in multiple organ systems that impose a huge burden on the individual with diabetes and on the entire health care system.

Cardiovascular disease (CVD) is a major complication of diabetes and the leading cause of early death among people with diabetes—about 65 percent of people with diabetes die from heart disease and stroke. Adults with diabetes are two to four times more likely to have heart disease or suffer a stroke than people without diabetes. Compared to individuals without diabetes, those with diabetes have a higher prevalence of silent myocardial ischemia. High blood glucose in adults with diabetes increases the risk for heart attack, stroke, angina, and coronary artery disease¹. People with type 2 diabetes also have higher incidence of increased blood pressure, lipid problems, and obesity, which contribute to increased incidence of CVD.

Diabetes without prior myocardial infarction and prior myocardial infarction without diabetes indicate similar risk for coronary heart disease (CHD) death in men and women. That is the reason diabetes is considered as CHD equivalent. However, diabetes without any prior evidence of CHD (myocardial infarction or angina pectoris or ischemic ECG changes) indicates a higher risk than prior evidence of CHD in nondiabetic subjects, especially in women. **Sushruta, famous ancient Indian clinician par excellence is credited for not only recognizing diabetes and related complications but also emphasizing the role of exercise in preventing type2 diabetes mellitus². (Figure 1)**



Figure1: Shushruta, the ancient surgeon who gave vivid description of diabetes about 5 thousand years ago. He also prescribed exercise to prevent and treat diabetes.

EPIDEMIC OF CARDIOVASCULAR DISEASE IN INDIA

CVDs are the largest cause of mortality, accounting for around half of the death resulting from non-communicable diseases (NCDs). Overall, CVDs accounted for around one fourth of all deaths in India in 2008. CVDs are expected to be the fastest growing chronic illness in foreseeable future

growing at 9.2% annually from 2000 onwards. A more worrying fact is that the incidence has gone up significantly to 24.8% for people between ages 25-69 years³. The down ward escalation of CVDs is of primary concern as it is affecting the productive population of India. The present evidence suggests an average mortality of 4% in the age group of 20-49 years and 6% in those above 50 years due to CVD. This may remain the same if the current situation continues for the next 10-15 years⁴. According to a world health organization (WHO) report, the current age standardised CVD mortality rates among males and females in India (per 100,000) are 363-443 and 181-281 respectively⁵. **India leads the world with largest number of diabetic subjects earning the dubious distinction of being termed the “diabetes capital of the world”. The most disturbing trend is the shift in age of onset of diabetes to a younger age in the recent years. This could have long lasting adverse effects on nation’s health and economy⁶.**

PREDISPOSING FACTORS OF CVD IN DIABETES

Diabetes is treatable, but even when glucose levels are under control it greatly increases the risk of heart disease and stroke. That’s because people with diabetes, particularly type 2 diabetes, often have the following conditions that contribute to their risk for developing cardiovascular disease.

1. Cigarette Smoking / Smokeless tobacco /Betel Nuts

Cigarette smoking is a leading risk factor for CVD. Patients with diabetes who are smokers are doubly at risk. Framingham data further reveal that smoking is not only a powerful risk factor for myocardial infarction; it is even stronger than angina pectoris⁷. Of great importance is the fact that smoking cessation rapidly and markedly reduces risk for myocardial infarction⁸.

Smokeless tobacco users have a higher incidence of diabetes and smokeless tobacco has been associated with insulin resistance in people with diabetes and hence complications. Betel-nut chewing caused hyperglycaemia and diabetes mellitus in animal models. It was significantly associated with high fasting capillary blood glucose and was an independent risk factor for type 2 diabetes mellitus⁹.

2. Hypertension

When hypertension coexists with overt diabetes, which it commonly does, the risk for CVD, including nephropathy, is doubly increased. Studies report a positive association between hypertension and insulin resistance.

3. LDL Cholesterol and Atherogenesis in Diabetic Patients

An elevated concentration of serum low density lipoprotein (LDL) cholesterol is a major risk factor for CHD¹⁰. In fact; some elevation of LDL cholesterol appears to be necessary for the initiation and progression of atherosclerosis. In populations having very low LDL cholesterol levels, clinical CHD is relatively rare, even when other risk factors-hypertension, cigarette smoking, and diabetes - are common¹¹. In contrast, severe elevations in LDL cholesterol can produce full-blown atherosclerosis and premature CHD in the complete absence of other risk factors.

4. Obesity

Obesity is a major risk factor for cardiovascular disease and has been strongly associated with insulin resistance. Weight loss can improve cardiovascular risk, decrease insulin concentration and increase insulin sensitivity. Obesity and insulin

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resistance also have been associated with other risk factors, including high blood pressure. Obesity plays a large role in the development of this disease, inciting medical professionals to coin the term “diabesity”- a cohesive name for the combined effects of the two rising health issues. (Figure 2)



Figure 2: An example of Diabesity. 51years old lady weighing 140kg (BMI 50 kg/m²), waist 166.5 cms, HTN/T2DM/obesity for 12 years duration, presented with breathlessness & anasarca, RBS 413.mg/dl. Eldest child died at 2 yrs age, had GDM and pregnancy induced hypertension.

5. Lack of physical activity

Physical inactivity is another modifiable major risk factor for insulin resistance and cardiovascular disease. Exercising and losing weight can prevent or delay the onset of type 2 diabetes, reduce blood pressure and help reduce the risk for heart attack and stroke. It's likely that any type of moderate and/or vigorous intensity, aerobic physical activity - whether sports, household work, gardening or work-related physical activity - is similarly beneficial.

Several lines of evidence indicate that chronic lack of sleep may contribute to the risk of type 2 diabetes mellitus. This fact is of paramount importance in BPO and other night workers. Adequate sleep and good sleep hygiene should be included among the goals of a healthy lifestyle, especially for patients with diabetes¹².

MANAGEMENT OF CARDIOVASCULAR DISEASES IN DIABETES

As far as treating overt CVD in diabetic patients, it has been divided in non invasive and invasive, which are going to be discussed in brief.

MEDICAL (NONINVASIVE) MANAGEMENT OF DIABETIC PATIENTS WITH CLINICAL CVD

Pharmacological therapy in patients with CVD has the following benefits: it extends overall survival; improves quality of life; decreases the need for intervention procedures, such as angioplasty and coronary artery bypass graft surgery; and reduces the incidence of subsequent myocardial infarction¹³. In many patients with CHD, aggressive risk reduction with medical therapy will delay the need for invasive revascularization procedures¹⁴⁻¹⁸. A few general comments can be made about application of these guidelines to patients with diabetes. These along with good glycemic control can help in delaying and possibly eliminate the further ischemic events.

1. Smoking remains an important modifiable risk factor in patients with diabetes, a major effort must be made to overcome the smoking habit. The American Heart Association (AHA) has recently published practical guidelines for assisting patients in smoking cessation.
2. For lipid management, the primary goal of therapy is to reduce LDL-cholesterol levels to <100 mg/dL. (19) This goal should be achieved by addition of drug therapy (when necessary) to maximal dietary therapy. Statins are first-line therapy to achieve LDL cholesterol of <100 mg/dL. When triglycerides remain >200 mg/dL in patients receiving statin therapy, consideration should be given to adding a fibrate to achieve the secondary goal of lipid management, ie, a triglyceride <200 mg/dL.

Few plant foods have been identified to have lipid lowering properties²⁰:

- a) Amla- *Emblica officinalis*
- b) Flaxseed- *Linum Usitatissimum*
- c) Garlic - *Allium sativum*
- d) Finger Millet- *Eleusine coracana*

Table-1: NCEP:ATPIII 2001 and IDF Criteria for the Metabolic Syndrome

NCEP:ATPIII 2001(24)	IDF Criteria for Central Adiposity(25)		
Three or more of the following:	Waist circumference		
Central obesity: Waist circumference >102 cm (M), >88 cm (F)	Men	Women	Ethnicity
Hypertriglyceridemia: Triglycerides 150 mg/dL or specific medication	94 cm	80 cm	Europid, Sub-Saharan African, Eastern and Middle Eastern
Low HDL cholesterol: <40 mg/dL and <50 mg/dL, respectively for men and women, or specific medication	90 cm	80 cm	South Asian, Chinese, and ethnic South and Central American
Hypertension: Blood pressure 130 mm systolic or 85 mm diastolic or specific medication	85 cm	90 cm	Japanese
Fasting plasma glucose 100 mg/dL or specific medication or previously diagnosed Type 2 diabetes	Two or more of the following:		
	Fasting triglycerides >150 mg/dL or specific medication		
	HDL cholesterol <40 mg/dL and <50 mg/dL for men and women, respectively, or specific medication		
	Blood pressure >130 mm systolic or >85 mm diastolic or previous diagnosis or specific medication		
	Fasting plasma glucose 100 mg/dL or previously diagnosed Type 2 diabetes		

- e) Soy- *Glycine max*
 - f) Fenugreek- *Trigonella foenum-graecum*
 - g) Cinnamon- *Cinnamomum cassia*
 - h) Psyllium husk - *Plantago psyllium*
 - i) Oats- *Avena sativa*
 - j) Nuts(Almonds)- *Prunus dulcis*
 - k) Terminalia arjuna
3. The goal of blood pressure control is to reduce blood pressure to <135/85 mm Hg in hypertensive patients²¹; this goal often will require antihypertensive drug therapy.
 4. Antiplatelet agents have become almost routine in patients with atherosclerotic CVD, and their use can be extended to patients with diabetes who have established atherosclerotic disease.
 5. β -Blockers may be particularly effective in patients with diabetes, who are at risk for symptomatic ischemic episodes secondary to increased sympathetic activity. Clinicians should be aware of potential danger of their blocking of hypoglycemic symptoms in the presence of a hypoglycemic regimen, although this side effect don't preclude use of β -blockers in CVD patients with diabetes.
 6. Angiotensin-converting enzyme (ACE) inhibitors are widely prescribed in the post-myocardial infarction period to favourably influence myocardial remodelling.

INVASIVE MANAGEMENT OF CORONARY ARTERY DISEASE

Available data²² enforces the fact that that coronary artery bypass grafting (CABG) is the preferred treatment modality in patients with diabetes whenever invasive management is required. Most of the benefit from CABG seems to be result from use of the internal mammary artery. Extensive data are not yet available with use of stents in patients with diabetes, but regardless, CABG seems to be preferred.

PREVENTIVE MEASURES

Type 2 diabetes is culmination of years of metabolic stress accompanying a state of insulin resistance. It seems that in patients with insulin resistance, the process of atherogenesis starts long before the appearance of overt diabetes²³. Thus, early detection of the risk factors associated with the metabolic syndrome (Syndrome X, Insulin resistance syndrome) (Table 1) is needed for initiation of appropriate primary prevention measures in patients at risk. The major features of metabolic syndrome includes abdominal obesity, elevated blood pressure, hypertriglyceridemia, reduced high density lipoprotein (HDL) cholesterol, borderline high-risk LDL cholesterol and in some patients, impaired fasting glucose (IFG) (110 to 126 mg/dL). The detection of IFG seems particularly significant; it usually signifies long-standing insulin resistance and is a strong risk factor for type 2diabetes.

The AHA has recently published a guide to primary prevention of CVD. This guide integrates well with efforts for early detection of the metabolic syndrome, and it recommends interventions to reduce the risk for CVD for patients without

established CVD. The major risk factors studied extensively at Framingham include cigarette smoking, hypertension, high serum cholesterol and various cholesterol fractions, low levels of high-density lipoprotein (HDL) cholesterol, and diabetes mellitus. If these guidelines are followed, they probably would delay the onset of type 2 diabetes as well as reducing risk for CVD.

PRIMARY PREVENTION OF CVD IN DIABETIC PATIENTS

The guide outlined for primary prevention of CVD is expanded to include diabetic patients in below mentioned table. Goals for smoking cessation, physical activity, and weight management are the same as for non-diabetic patients. However, more tight control of blood pressure, cholesterol and other lipids is indicated for diabetic patients, as discussed by the recent joint national committee (JNC) VIII²⁶ and American Diabetes Association reports²⁷.

Yoga is a wonderful amalgamation of optimum sleep, appropriate food, regular exercise and positive attitude. It is like a bed rock of all preventive measures given by modern day professional bodies like ADA, AHA, EHS.

Yoga has shown an efficacy of improving the dyslipidemic state associated with diabetes. Yoga, being a lifestyle incorporating exercise and stress management training, targets the elevated lipid through integrated approaches resulting in improved lipid profiles, lower BMI, and macro-vascular complications in diabetes²⁸.

The ABC treatment goals for most people with diabetes are: AA1C (blood glucose) less than 7 percent B Blood Pressure less than 130/80 mmHg C Cholesterol – LDL less than 100 mg/dl²⁹.

We intend to propose that S should be added to ABC of diabetes to make it ABC's of diabetes control and S standing for Smoking cessation.

TAKE HOME MESSAGE

People with diabetes can work with their health care team to develop and use an action plan to reach their ABC goals. An action plan can help people to:

1. Reach and stay at a healthy weight. Being overweight or obese is a risk factor for heart attack and stroke.
2. Get at least 30 to 60 minutes of physical activity. Brisk walking or a similar activity most days of the week can help with weight loss and lower blood pressure.
3. Eat foods that are low in saturated fats, trans fats, cholesterol, salt (sodium), and added sugars – choose lean meats, poultry, fish, nuts (in small amounts), fat free or low fat milk, and milk products.
4. Eat more fiber – whole grains, fruits, vegetables, and dry peas and beans. Stop smoking – or ask their health care team for help to quit.
5. Take medications as directed – and ask their doctor about taking daily aspirin.

6. The single most important thing that you can do for your health and the health of others is to quit using tobacco in any form.

Ask family and friends to help them manage their diabetes. This support can help people reach their goals.

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