BMH MEDICAL JOURNAL

ISSN 2348–392X

BMH Medical Journal 2014;1(2):22-26 **Review Article**

Cardiac Problems in Diabetic Cardiology

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Key Words: diabetic cardiology, coronary artery disease

Diabetic Cardiology is a branch of Cardiology that is assuming increasing interest among physicians, Cardiologists and Diabetologists. The increasing awareness of the cardiac problems that the diabetic patient faces has prompted a lot of studies and increase in the literature regarding this branch. In this treatise, we shall see in brief the cardiac problems that are common to a patient with diabetes mellitus. In this context it is appropriate to say that "diabetes is a cardiovascular disease". [1]

The most common problems faced in diabetes mellitus are:

1. Coronary Artery Disease (CAD)
2. Dyslipidemia
3. Heart Failure - "Diabetic Cardiomyopathy"
4. Diabetic Autonomic Neuropathy – Cardiac
5. Peripheral Vascular disease

Heart Failure

Heart failure is two to five times more in diabetic males and eight times more in diabetic females.[2] The approximate prevalence of heart failure in diabetics of over 10 year duration is 30%. In the DIGAMI study, 66% of deaths in the first year were due to heart failure. In this context, a "Cardiotoxic Triad" of Hypertension, Myocardial ischemia and Diabetic Cardiomyopathy has been identified.[3] In Diabetic Cardiomyopathy, the epicardial coronary arteries have been found to be normal and the blood pressure is also normal.

Left ventricular dysfunction is seen in 50 - 60 % of diabetics. Initially the patient develops diastolic dysfunction and later goes into systolic dysfunction. Patients with heart failure with a normal ejection fraction are termed to have 'heart failure with preserved ejection fraction'. Most patients have both systolic and diastolic dysfunction. A diabetic with heart failure has to be evaluated for Coronary Artery Disease (CAD) as revascularization can improve heart failure in this subset of people. Endothelial dysfunction, increased permeability of smaller coronary vessels due to endothelial dysfunction, Renin Angiotensin Aldosterone system (RAAS) and Sympathetic Nervous System (SNS) activation are also contributory to the development of heart failure.

In diabetics with heart failure early detection and treatment are important. Systemic hypertension is

the most important cause of heart failure in diabetics. Almost 75% of patients with Type 2 diabetes mellitus have systemic hypertension. The classical signs of heart failure may not be present, especially in heart failure with preserved ejection fraction. Dyspnea on exertion is the most prominent symptom in these patients. A six minute walk test is vey revealing in detection and assessing the progress of treatment in patients with heart failure. The brain natriuretic peptide is 96% sensitive and 72% specific for the detection of heart failure.

The treatment of heart failure in diabetics entails mainly a good glycemic control. Thiozolidinediones are useful in early stages of diabetes mellitus but not when the heart failure is established owing to their propensity for fluid retention.[3] The mainstay of treatment of heart failure is the Angiotensin Converting Enzyme Inhibitors (ACEI) and the Angiotensin Receptor Blocker drugs (ARB). Beta blockers, especially the third generation ones like Carvedilol and Labetolol, block the beta 1, beta 2 and the alpha 1 receptors. Lastly, the diuretic drugs have their important role in the management of heart failure in diabetics.

Diabetic Autonomic Neuropathy

Diabetic Autonomic Neuropathy or Cardiac Autonomic Neuropathy in diabetics (CAN) is one of the most important and serious complication of diabetes mellitus.[4] It is common and often missed during the clinical evaluation of the patient. Approximately, 20% of diabetics have autonomic neuropathy and it may even precede the other complications of diabetes mellitus. The cardiovascular manifestations of CAN are many. Other manifestations in diabetic autonomic neuropathy are the gastrointestinal, genitourinary, metabolic and pupillary.

The five year mortality in CAN is five times more compared to the patients without neuropathy. One study has quoted the 2.5 year mortality with diabetes and CAN to be 27.5% and the five year mortality to be 53%. In contrast, diabetics with no CAN, have a five year mortality of only 15%. It has been reported that 29% of the deaths in those with CAN are sudden. The main clinical manifestations of CAN in those with diabetes mellitus are:

1. Exercise Intolerance
2. Resting tachycardia
3. Intra operative cardiovascular lability
4. Orthostatic Hypotension
5. Silent myocardial ischemia (SMI) or the Cardiac Denervation syndrome.

Resting tachycardia is the presence of sinus tachycardia in patients who are totally rested and not on any drugs that can alter the heart rate like beta blockers or parasympatholytic drugs. [5] Intra operative cardiovascular lability is the presence of severe hemodynamic disturbances like unprecedented hypotension or sudden spurt of hypertension during general anesthesia in patients undergoing major surgery. It is increased 2 -3 fold in patients with diabetes.[6] Orthostatic hypotension is the presence of a fall in systolic blood pressure of 20 mm Hg or more and a fall in diastolic blood pressure of 10 mm Hg or more after three minutes of assuming the erect posture. Silent myocardial ischemia is the presence of ischemic ECG changes without any clinical symptoms or a positive treadmill stress test in the absence of symptoms during the period of ischemia. [7]

An interesting corollary to this would be the question as to whether we need to screen diabetics for Coronary artery disease. The question also leads us to the next step as to why we need to screen them if at all.

It is a known fact that the prognosis is worse in diabetics with coronary artery disease than in those without. Screening for CAD helps in risk stratification of patients. It also motivates the patient to

adhere to medical therapy. Those patients with high risk feature on screening benefit by revascularization. Screening also indicates the need to intensify medical treatment with beta blockers or ACEI.

Once we are convinced of the need to screen a selected population of diabetics, the next question is when to screen these patients for CAD. Those patients who want to start a moderate to high intensity exercise program and are at increased risk of CAD as follows need to be screened. These risks are:

1. Age more than 35 years
2. Age more than 25 years with diabetes mellitus more than 10 years
3. Type 1 diabetes mellitus of 15 years duration.
4. Any additional risk factors for CAD
5. Existence of microvascular disease as Retinopathy or Nephropathy
6. Presence of Autonomic neuropathy
7. Peripheral vascular disease

Silent myocardial ischemia (SMI) is another known and dreaded complication of diabetes mellitus and need to be diagnosed early in the course of the disease to prevent major adverse cardiovascular events subsequently. The methods of diagnosing SMI are as follows:

1. Treadmill stress testing
2. Nuclear stress imaging – SPECT
3. Dobutamine stress echocardiography
4. Screening for atherosclerosis by observing the Coronary artery calcium score or assessing the Carotid intima medial thickness.

The recommendations for management of SMI in patients with diabetes mellitus are as follows:
In type 1 or 2 diabetes mellitus in patients with age >60 years or diabetes mellitus of >15 years duration, tests for SMI are to be done.
- If found to have severe ischemia, coronary angiography is advised. Beta blockers and ACEI are to be started and the treatment with statins needs to be intensified.
- If the ischemia is moderate to mild, tailored medical treatment is advised.
- If no ischemia is detected, the patient is screened for subclinical atherosclerosis and the treatment with statins intensified appropriately.

Coronary Revascularization in Diabetes mellitus - Current Concepts. [8]

Coronary revascularization in diabetes mellitus can be either with a Percutaneous Coronary Intervention (PCI) or Coronary Artery Bypass Surgery (CABG). We shall see the salient demerits of both these modes of therapy.

Percutaneous Coronary Intervention (PCI)

Patients with diabetes mellitus have a high rate of in-stent restenosis. The incidence with bare metal stents has been quoted to be approximately 37%. Even with drug eluting stents, diabetics have worse outcome and in-stent thrombosis was more than in non-diabetic patients.

Coronary Artery Bypass Surgery (CABG)

The 30 day CABG mortality was higher in patients with diabetes mellitus than in non-diabetic patients. The incidence of sternal wound infections was also higher in patients with diabetes mellitus.

PCI vs CABG

It has been reported that there is no significant difference in mortality between PCI and CABG in non-diabetic patients. In patients with diabetes mellitus the mortality was lower in the CABG group (23%) compared to the PCI group (29%). CABG is found to be superior to PCI in patients with diabetes mellitus and multivessel disease in terms of MACE and mortality. The European Myocardial Revascularization Guidelines suggest CABG in all diabetics with extensive CAD.

Medical management vs Revascularization

In stable coronary artery disease, trials have shown that diabetic patients who have no high risk features on coronary angiogram may be managed with intensive medical treatment. This would be an adequate and valuable strategy in these patients than revascularization.

Acute Coronary Syndrome (ACS)

In Acute coronary syndrome, diabetic patients have a worse outcome - both with ST elevation and Non ST elevation myocardial infarctions. The 30 day mortality in them is higher than in non-diabetics. Early invasive strategies seen in studies (FRISC II, TACTICS) showed grater benefit for diabetic patients in terms of risk reduction in 6 months as evidenced by a decrease in death, myocardial infarction or re-hospitalization for ACS. (Invasive vs Conservative Strategy). Revascularization was definitely better in diabetic patients compared to non-diabetics.

Clinical Recommendations in Diabetics with CAD

The clinical recommendations in patients with diabetes mellitus in light of previous studies are as follows:

- Aggressive cardiovascular preventive strategies and adequate control of blood sugar needed
- Multiple parameters used for a decision on when and how to proceed to coronary revascularization based on various factors as follows:

* Clinical presentation
* Team work and discussion
* Threshold for CABG should be low in diabetics
* Use of drug eluting stents recommended in diabetics
* Early invasive strategy is favored
* Potent platelet inhibitors like Prasugrel and Ticagrelor maybe in favor.

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