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A Review Article in:

Serum Cholesterol level in Diabetes Mellitus type 2 patients

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1. Introduction

Diabetes mellitus is taken from the Greek word *diabetes*, meaning siphon - to pass through and the Latin word *mellitus* meaning sweet. (DM) is a metabolic disease, involving inappropriately elevated blood glucose levels. DM has several categories, including type 1, type 2, maturity-onset diabetes of the young (MODY), gestational diabetes, neonatal diabetes, and secondary causes due to endocrinopathies, steroid use, etc. The main subtypes of DM are Type 1 diabetes mellitus (T1DM) and Type 2 diabetes mellitus (T2DM), which classically result from defective insulin secretion (T1DM) and/or action (T2DM). T1DM presents in children or adolescents, while T2DM is thought to affect middle-aged and older adults who have prolonged hyperglycemia due to poor lifestyle and dietary choices. The pathogenesis for T1DM and T2DM is drastically different, and therefore each type has various etiologies, presentations, and treatments [1].

In the islets of Langerhans in the pancreas, there are two main subclasses of endocrine cells: insulin-producing beta cells and glucagon secreting alpha cells. Beta and alpha cells are continually changing their levels of hormone secretions based on the glucose environment. Without the balance between insulin and glucagon, the glucose levels become inappropriately skewed. In the case of DM, insulin is either absent and/or has impaired action (insulin resistance), and thus leads to hyperglycemia. [2]

T1DM is characterized by the destruction of beta cells in the pancreas, typically secondary to an autoimmune process. The result is the absolute destruction of beta cells, and consequentially, insulin is absent or extremely low. T2DM involves a more insidious onset where an imbalance between insulin levels and insulin sensitivity causes a functional deficit of insulin.

Insulin resistance is multifactorial but commonly develops from obesity and aging [3].

The most common complications associated with diabetes are macrovascular (e.g., coronary heart disease, peripheral vascular disease, and cerebrovascular disease) and microvascular (e.g., retinopathy, nephropathy, and neuropathy). Coronary heart disease accounts for more than 55% of deaths in patients with type 1 and type 2 diabetes and is the main cause of excess mortality in individuals with diabetes [4].

Dyslipidemia and hypertension are major modifiable risk factors for T2DM and related CAD, which account for more than 87% of disability in low- and middle-income countries. Furthermore, prediabetes (an intermediate metabolic state between normoglycemia and T2DM) has also been found to be associated with an increased risk for cardiovascular disease [5].

In this review we will discuss the level of serum cholesterol among diabetic patients.

2. Literature review

A Study showed that 13% of men and 24% of women with diabetes mellitus had increased total plasma cholesterol levels,compared with 14% of men and 21% of women without diabetes mellitus. The prevalence of high bad cholesterol levels in men and women with diabetes mellitus (9% and 15%, respectively) did not differ significantly from the rates in non diabetic men and women (11% and 16%, respectively) [6].

The prevalence of low good cholesterol level in those with diabetes mellitus was almost twice as high as the prevalence in nondiabetic individuals (21% versus 12% in men and 25% versus 10% in women, respectively). Thus, both men and women with diabetes had an

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increased prevalence of hypertrigyceridemia and low HDL cholesterol levels, but their total cholesterol and LDL cholesterol levels did not differ from those in non-diabetic counterparts [7].

Your HDL cholesterol is good (and able to help lower your risk of heart disease). If it 1.6 mmole/L (60 mg/dl) or more. And your LDL cholesterol is optimal if it is less than 2.6 mmole/L (100 mg/dl).

A study conducted on 100 diabetic patients showed that majority of type 2 DM patients (85.3%) showed high serum cholesterol level, while 32% of the type1 DM patients showed high serum cholesterol level. According to the CDC, 97% of adults with diabetes have one or more lipid abnormalities while the prevalence of diabetic dyslipidemia varies from 25% to 60% in other studies. This variation in prevalence may be due to differences in body mass index and possibly genetic variation [13].

Another study found that 20 % in the test group had elevated total cholesterol levels as compared to 8 % in the control group . The mean total cholesterol levels were 142.5mg/dl SD+39.342 mg/dl in the non-diabetic group 160.89 mg/dl SD +57.094 mg/dl in the diabetic group . There was an extremely high statistical difference between the two groups [14].

Cardiovascular disease (CVD) is the leading cause of death among adult diabetic patients. Type 2 diabetes is not diagnosed until complications develop, A study showed significant increased levels of total cholesterol in diabetic patients compared to non-diabetic subjects, this increase it may be due to an increase in the plasma concentration of VLD L and LDL, which may be caused by increasing hepatic production of VLDL or decreased removal of VLDL and LDL from the circulation [16].

Recent evidences suggests that low HDL cholesterol is an independent factor not only for cardiovascular disease but also for the

development of diabetes itself. These changes, and the presence of small dense LDL particles, probably contribute to accelerated atherosclerosis even before diabetes is formally diagnosed. In type 1 diabetes, hypertriglyceridemia may occur, but HDL cholesterol levels are often normal or even high unless glycemic control is poor or nephropathy is present. In addition, patients with diabetes show qualitative and kinetic abnormalities for all lipoproteins [8].

A number of factors may contribute to the alterations in lipid metabolism observed in patients with diabetes, including insulin deficiency or resistance, adipocytokines, and hyperglycemia. Many aspects of the pathophysiology and consequences of diabetes dyslipidemia remain unclear, but the mechanism by which hypertriglyceridemia arises is fairly well understood [9].

Low density lipoprotein (LDL), the major transporter of cholesterol within the blood, comprises a core of esterified cholesterol molecules enclosed in a shell of phospholipids and unesterified cholesterol, together with a single molecule of ApoB-100. LDL is taken up into cells via receptor-mediated endocytosis, which involves, first, the binding of LDL–ApoB-100 to the LDL receptor on the plasma membrane of hepatic and other tissues, then the internalisation of the LDL-receptor complex via endocytosis, followed by fusion with lysozymes, which contain a number of catabolic enzymes [9].

In patients with type 2 diabetes, the mean LDL-cholesterol level is comparable or slightly elevated relative to that in individuals without diabetes. However, the catabolism of LDL is substantially reduced, inducing a longer duration of LDL in plasma that may promote lipid deposition within artery walls. In patients with type 2 diabetes, the number of LDL B/E cell-surface receptors is significantly reduced, which may be

due to reduced insulin-mediated expression and could be responsible for observed impairments in LDL catabolism [10].

Patients with type 2 diabetes have a reduced plasma level of campesterol, a marker of cholesterol absorption, and increased plasma levels of lathosterol, a marker of cholesterol synthesis. Using peroral administration of isotopes, reduced cholesterol absorption and increased cholesterol synthesis have been demonstrated in patients with type 2 diabetes. The mechanisms responsible for these changes in cholesterol homeostasis are not yet clarified. In a study performed in 263 patients with type 2 diabetes, liver fat content was independently associated with plasma lathosterol [11].

The triglyceride-to-HDL cholesterol (TG/HDL) ratio has been investigated recently for various potential clinical uses in adult and paediatric populations. Previous research has demonstrated its positive associations with adverse cardio-metabolic risk factor profiles, metabolic syndrome and prediction of incident diabetes or its complications. This may occur as the TG/HDL ratio demonstrates an association with insulin resistance. A number of studies have shown that the TG/HDL ratio has a good correlation with the generally accepted methods to define insulin resistance and it is considered a surrogate marker of it [12].

3. Conclusion

Hyperlipidemia is the commonest complication of diabetes mellitus. Common lipid abnormalities in diabetes are raised TGs and total cholesterol.

The higher your blood cholesterol the higher risk of developing heart disease or having a heart attack.

A desirable level of blood cholesterol in adults is 150 mg/dl or less. Blood cholesterol level from 150-199 mg/dl are considered borderline. High level of 200 or above indicate high blood cholesterol levels.

Other major risk factors that have an impact on your cholesterol include:

- Your diet (saturated fats or unsaturated fats).
- Your weight (obesity).
- Smoking cigarettes.
- Blood pressure.
- Level of HDL and LDL cholestrerol.
- Family history.
- Being physically inactive.

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