# A Cross-Sectional Study of Risk Factor Evaluation for Coronary Artery Disease in Type II Diabetic Patients 

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#### Abstract

Background - The Framingham study on the heart is one of the first and largest studies on the identification of risk factors for coronary artery disease (CAD). The American Heart Association (AHA) has planned a standard table to predict the risk of CAD based on this study. The risk factors used in this study included age, total cholesterol, HDL-C, systolic heart pressure, cigarette smoking, diabetes and left ventricular hypertrophy based on ECG. We used this table to evaluate the risk of CAD in type II diabetic patients in a crosssectional study in a diabetes clinic in Tehran. Methods - The patients were divided into four groups according to the evaluated risk. As in the evaluation of the risk of other risk factors like obesity (WHR, BMI), triglycerides, LDL-C and DBP were studied and their relation to the rate of the risk was calculated by statistical tests like linear regression, ANOVA one-way in SPSS.V6 software. Results - The increase of the ten-year risk was obvious among the studied patients, consisting of 91 women and 48 men. The rates of the five-year and ten-year risk in men were much higher than those in women. The risk factors studied in all the patients had a high rate. For example in $36.4 \%$ of the patients the rate of HDL-C was $\leq 35 \mathrm{mg} / \mathrm{dl}$. The proportion of total cholesterol to HDL-C, which is an important risk factor for CAD, was $6.18 \pm 1.76$ for men and $5.97 \pm 2.12$ for women. There was no meaningful relation between the 10 -year and 2 -year risk with WHR, BMI and TG, but a meaningful relation was found between 5 -year and 2 -year risk with DBP ( $\mathrm{p}=0.0006$ and $\mathrm{p}=0.0001$ ) and LDL-C ( $\mathrm{p}=0.006$ and $\mathrm{p}=0.001$ ). Conclusion - Although the risk of CAD in diabetic patients is shown in this study, it seems that the real risk is more than that. On the other hand, the lack of a meaningful relation between WHR, BMI, TG and CAD risk can lower the value of this table. So, more detailed studies are needed for the future. (Iranian Heart Journal. 2002; 2(4)\&3(1): 4751)


Key words: diabetic patients $<$ coronary artery disease $<$ framingham study

> All studies have confirmed the increased risk of heart diseases in diabetic patients, especially in women. Atherosclerosis is more common among diabetic patients, and occurs earlier. Coronary artery disease involves $55 \%$ of diabetic patients. Also women suffering from diabetes do not benefit from the
relative protection against CAD before menopause. On the other hand, CAD together with CVD (cerebrovascular disease) and PVD (peripheral vascular disease) is the cause patients have a 35 percent mortality caused coronary artery disease, of $75 \%$ to $80 \%$ of diabetic adult deaths. According to a report, type I

[^0]diabetic by while this rate in non-diabetic individuals is about $4-8$ percent. The atherosclerotic process can be divided into two parts: part one with slow progress, which causes plaque formation in arterioles and causes stenosis, and part two with rapid progression, which causes thrombus and acute ischemia if the plaque is ruptured.
Among the risk factors, those which have greater effects in part one are called atherogenic factors (like high cholesterol and low HDL) and those which act on part two are called thrombogenic factors (like hypertension leading to plaque rupture). The term "risk factor" means any parameter which can be used for predicting the person's involvement with the disease. Of course, the relationship between the risk factor and the disease is not always a cause and effect-type relation. The studies on risk factors have mostly had a controlled pattern rather than being experimental studies. The Framingham heart study, started in 1948 is one of the earliest studies made in this field, and is still the best source of information, for risk factors of heart and vascular diseases. According to the current information the most trivial risk factors to modify are dyslipidemia, hypertension, cigarette smoking, and diabetes. Risk factors such as lack of physical activities, obesity and mental or spiritual factors are at the next levels of importance. Epidemiologic studies have shown that risk factors like dyslipidemia, hypertension and smoking act in a synergistic way, which means smoking increases the rate of CAD 1.6 fold. But when combined with hypertension and high cholesterol, it becomes 4.5 and 6 times more common respectively; and when combined with both of them, it becomes 16 times more common. The risk of CAD, if each of the risk factors of high cholesterol or hypertension exists, is 4 and 3 times greater and, if both risk factors exist, it is 9 times greater in comparison to a person
without a risk factor. The aim of this study is to screen the risk factors and to predict the probability of involvement with CAD in diabetic patients and to compare it with risk rates in our society based on the results of the Framingham study.

## Methods

This cross-sectional study was done in university-affiliated hospitals in order to estimate the effects of risk factors of CAD in type II diabetic patients. The cases were 139 patients with NIDDM who had presented to the diabetes clinic. The risk of CAD involvement in these patients was studied according to the standard table of AHA in the Framingham heart studies. According to this table, the risk factors consist of age, total cholesterol, HDL-C, SBP (systolic blood pressure), cigarette smoking and LVH (left ventricular hypertrophy). The following formula can be used to calculate the total points. The points of each risk factor consisting of age in men and women, HDL-C, total cholesterol and SBP are determined according to the tables given by the AHA. The AHA has considered 4 points for smoking and 9 points for LVH. Given that the AHA table is suggested for all people in society, diabetes has also been considered as a risk factor, so for diabetes in men, 3 points and in women 6 points are allocated. After determining the point of each risk factor and working out the sum, we calculated the probability of 5 and 10year CAD involvement according to Table 6. In addition to this risk factor, LDL-C, TG, WHR, BMI and diastolic blood pressure were studied in all patients. The total cholesterol and HDL-C were measured by CHOD-PAP enzymatic method (mg/dl).
After gathering this information, we divided the patients into four groups according to their total points: (less than 10 points, 11 to 20,21 to 30 , and more than 30 points). This grouping was also
made according to risk of 5 and 10 -year CAD involvement. The relation between these groups and the rate of LDL-C, TG, TBP, BMI and WHR was studied by statistical tests of linear regression and one-way ANOVA. Finally, the results were analyzed by SPSS v. 6 statistical software.

## Results

There were 91 women and 48 men. The risk of CAD involvement at 5 and 10 years in men was more than that in women and had a meaningful difference ( $p<0.0001$, $p<0.001$ respectively). The results are shown in Tables 7 and 8 according to age. The 10 -year risk of involvement with diabetes shows an increase both in men and women in comparison with AHA statistics of risks at different ages in the society. This increase was much more apparent in women between 35 and 39 years old ( 3 to 4 times). The decrease of involvement risk for CAD, which was reported in the AHA table for ages 65 to 69 , was not seen in diabetic patients.
In men in most age groups, the risk of CAD involvement was more than nondiabetic men but it was the same at ages over 65 . The rate of 5 and 10 -year involvement in women before menopause ( $5.76 \pm 4.3$ and $12.02 \pm 7.82$ ) comparing to post-menopause $\quad(8.93 \pm 4.55 \quad$ and 17.71 $\pm 7.76$ ) had a meaningful difference ( $p<0.001$ and $p<0.0001$ ). But this difference was seen in men older than 45 . The descriptive study of the current information was made bearing in mind the importance of some risk factors like HDL used in calculation of the total points. The HDL-C of the patients was $41.39 \pm 9.96$ $\mathrm{mg} / \mathrm{dl}(38.7 \pm 7.92 \mathrm{in}$ men and $42.76 \pm 10.46$ in women), which had a reverse relation to the risk of CAD. Moreover, $36.4 \%$ (51) of the patients had an HDL less or equal to 35 $\mathrm{mg} / \mathrm{dl}$. The proportion of total cholesterol to HDL was $6.05 \pm 2$, which showed an obvious increased risk of CAD. This
proportion was calculated for both sexes: $6.18 \pm 1.76$ for men and $5.97 \pm 2.12$ for women. As mentioned in Methods, the patients were divided into four groups according to the calculated risk rate, and their relation to the variants were estimated. The determination of correlation coefficient did not confirm the linear relation between TG, BMI, WHR and the risk rate of CAD and also total sum, but the relation between LDL and DBP with these three variants was meaningful.
The relation between total sum with BMI and WHR was not meaningful with oneway ANOVA, but this variant had a meaningful relation with DBP and LDL (table 10). The analysis of one-factor variance between 5 -year rate of risk and DBP, LDL and TG, showed a meaningful difference but this method could only show the relation between LDL, DBP and 10 -year rate of risk. Linear regression was chosen in order to study the relations, and it only showed a meaningful relation between DBP, 5 and 10-year rate of risk and the total sum. The results are presented in table 10.

## Conclusion

Not only have a variety of risk factors been confirmed for CAD but also multi-variant formulas have been used in order to predict the CAD risk. The importance of the relation between diabetes and coronary artery disease is confirmed by the results of two great studies: Framingham and MRFIT (Multiple Risk Factor Intervention Trial). The Framingham study found that diabetes increases the age-related risk for cardiovascular disease two-fold in men and three-fold in women.
Although this study does not concern so much future problems in determining the rate of risk to CAD, the calculation of the rate of 5 and 10-year risk of CAD according to AHA formula, which shows the increase of the risk compared to
healthy people, confirms the current information. The fact that the involvement risk for CAD in pre-menopausal diabetic women is several times more shows the loss of the defensive role of hormones in diabetes. As other studies have also shown the increase in CAD after menopause, hormone replacement therapy (HRT) is presented for its effect on the heart, and more studies are needed in order to have more exact analysis on the advantages and disadvantages for diabetic patients.
The total serum cholesterol is an obvious risk factor for CAD. In the MRFIT study in more than 350,000 middle-aged American males, the CAD risk was increased directly when total cholesterol in serum was increased. About $2 / 3$ of the blood cholesterol is found in LDL. In nondiabetic people the higher concentration of LDL has caused CAD. ${ }^{12,14}$ The existence of a linear relation between LDL and the risk of CAD in this study confirms these facts, as does a reverse relation between HDL and risk of CAD. The proportion of LDL to HDL is a simple method to predict the risk of coronary artery disease. ${ }^{16,12}$ The information from the lipid research clinic and Framingham studies showed that if this proportion is $6 / 4$ or more in men, it means a 2 to 14 -percent increase in CAD risk compared to predicted risk of cholesterol or LDL. For women the proportion of $5 / 6$ or more causes a 25 $45 \%$-increase in the CAD risk. The proportion of cholesterol to HDL in our study in both sexes can easily show the high risk for CAD.
Although there was a meaningful relation between TG and the 5 -year risk for CAD, the irrelevance of TG to the 10 -year rate and total sum is a point for further study. The other studies also have not precisely defined the role of TG's atherogenicity. In non-diabetics, some relation
between high serum TG and CAD exists. But most epidemiological studies have failed to verify its role as an independent risk factor. However some sources claim a
normalized TG level would reduce the risk of CAD.
The meaningful relation between diastolic blood pressure and risk of CAD shows the importance of controlling high blood pressure in diabetic patients. Hypertension is a very well known risk factor. ${ }^{12,18}$ Systolic blood pressure is as important as diastolic blood pressure for coronary artery disease, as isolated systolic hypertension is a great risk factor for CAD and stroke. The metanalysis of 9 studies with a 10 -year follow-up showed that the relative risk of CAD in people suffering from diastolic blood pressure of 105 mmHg is almost 5 times more than that in people with DBP of 76 mmHg . In other words, for every 7.5 mmHg in DBP, there was a $29 \%$ risk for CAD. The increase of WHR and BMI in our study did not have a meaningful relation to risk of CAD, while the information of the Framingham study and that of other studies have shown a relation between CAD and excess body weight. ${ }^{4,12,19-21}$ Moerover, lipid diffusion in body seems to be a cause, while the patient suffering from central obesity takes more risks. The Nurse Health Study found that the risk of CAD progress among American women had been increased: in BMI more than $29 \mathrm{~kg} / \mathrm{m} 2$ to 3.3 times and in BMI between $25-29 \mathrm{~kg} / \mathrm{m} 2$ to 1.8 times in comparison with BMI under 21. furthermore central obesity is more susceptible to the risk of coronary disease. Nevertheless, according to our study design and the limited cases, a broader study on the relations between obesity and coronary artery disease is necessary.
Diabetes exists with other risk factors for CAD which are mostly modifiable, but even if the risk factors are considered all together, the increased risk for CAD cannot be justified. In other words, even after considering age, hypertension, cigarette smoking, hypercholesterolemia and LVH factor, diabetes remains as an independent risk factor. On the other hand, the decrease of risk factors in diabetic
patients may cause other risks. For example, anti-hypertensive drugs could have some side-effects on glucose tolorance or serum lipid levels. Thus ADA (American Diabetes Association) has suggested maintaining a normal body weight, suitable diet, exercise and also control of risk factors like dyslipidemia in diabetic patients as the first actions to be taken.

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