

## CORRELATION BETWEEN DURATION OF DIABETES AND SEVERITY OF CORONARY ARTERY DISEASE

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### Contribution

GAS designed the study and manuscript writing. SAS and WK did data collection. MK did review and statistical analysis. All authors contributed equally to the submitted manuscript.

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### ABSTRACT

**Objective:** To determine correlation between duration of diabetes and severity of coronary artery disease (Gensini score) in patients, undergoing coronary angiography at tertiary care cardiac hospital.

**Methodology:** A cross sectional study was conducted at Department of Cardiology, Tabba Heart Institute, Karachi from 17 September 2014 to 17th March 2015. All type 2 diabetic patients with 5 years or more duration of either gender with age 40 to 70 years, who had co-morbid like hypertension, smoking, and dyslipidemia been included in the study. The severity of coronary artery disease was found determined on Modified Gensini score correlate with duration of diabetes. The data was analyzed using SPSS version 17.0. Pearson correlation, univariate, and multiple linear regressions were applied.

**Results:** Coronary artery disease was found more than double in men as in women. In female patients mean Gensini score was  $63.43 \pm 45.25$  whereas in male it was much higher ( $84.40 \pm 57.26$ ). The mean Gensini score in patients of age  $\leq 60$  years was higher than patients' with age  $> 60$  years. The male gender and duration of diabetics were found strong relation with the Gensini score.

**Conclusion:** The duration of diabetic mellitus and male gender are positively correlated with the Modified Gensini score and appears to be the important determinants of severity of coronary artery disease (CAD).

**Key Words:** Duration of diabetes mellitus, Severity of coronary artery disease, Gensini score, Coronary angiography.

## INTRODUCTION

The Coronary artery disease (CAD) is always counted as a major cause of morbidity and mortality all over the world especially in Asian countries which have the highest burden of this disease.<sup>1</sup> In 2012 it was confirmed that CAD is a major cause of hospitalization all over the world.<sup>2</sup> The risk factors associated in the development of CAD has been documented in different studies. Major risk factors are age, male gender, smoking, high blood cholesterol, hypertension, diabetic mellitus and family history of CAD.<sup>3,4</sup>

Diabetic mellitus although a disease of metabolic syndrome but due to its strong predilection for atherosclerosis, it is also now known as vascular disease. It is estimated that prevalence of diabetic in adults (20-79 years of age) all over the world in 2010 was counted 6.4%.<sup>5</sup> In another survey conducted in 2011, it was estimated that around 366 million people are suffering with diabetic mellitus and with high incidence of it, it is expected that in 2030, the disease will effect around 552 million population of the world.<sup>6</sup>

The diabetic is the most important risk factor for the development of CAD, which is common in 25-30% of acute myocardial infarction patients and it makes a poor prognosis.<sup>7</sup> Literature proves that mortality is much higher in diabetic patients with CAD as compared to non-diabetics. The relative risk of diabetic for cardiac death in male is 3-5 times higher comparing with the general population. In an interventional study, it is proving statistically significant, that sustained chronic hyperglycemia is the main cause for the cardiovascular complications. It is directly associated with the severity of stenosis and extension of coronary lesion in patients having type 2 diabetics.<sup>8</sup>

The documented major risk factor for the type 2 diabetic are high BMI, physical in-activity and dietary pattern, whereas common risk factors for the type 2 diabetics and CAD are high lipid profile, hypertension, smoking, family history of CAD and newly diagnosed specific genes.<sup>9</sup>

Gensini has developed a scoring system, which is a numerical value for the degree of stenosis in CAD.<sup>10</sup> This scoring is validated and it does not ignore even very trivial lesion in coronary artery. It involves both exponential qualification of site-specification severity and a disproportionate emphasis as disease in proximal segments. The Gensini score can easily utilized for correlation between severity of CAD and other individual risk factor markers.<sup>11</sup> Severe CAD was defined as having Gensini score of 20 or more. There is dearth of local data regarding the association between duration of diabetes and severity of coronary artery disease, therefore, aim of this study was to determine correlation between duration of diabetes and severity of coronary artery disease (Gensini score) in patients, undergoing coronary angiography at tertiary care cardiac hospital.

## METHODOLOGY

A cross sectional study was conducted at Department of Cardiology, Tabba Heart Institute, Karachi for six months from 17th September 2014 to 17th March 2015. All the diabetic patients of either gender with age 40 to 70 years had co-morbid conditions like hypertension, smoking, and dyslipidemia were included in the study. Inform consent was taken from each individuals regarding willingness to participate in the study and institutional ethical review committee approval was taken. A pre tested questionnaire having demographic and variables of the study were filled. All patients were underwent coronary angiography. Severity of coronary artery disease was found on coronary angiography according to Modified Gensini score and angiography report was analyzed with duration of diabetes. The data was entered and analyzed using SPSS version 17.0. Mean $\pm$ SD were calculated for quantitative variables whereas frequency and percentage were calculated for qualitative variable. Scatter plot and Pearson correlation coefficient was calculated between the Gensini score and duration of diabetes. Gensini score by patients' characteristics and diabetes duration classes was assessed by applying t-test or ANOVA. Univariate and multiple linear regressions were applied to assess the relationship of patients' characteristics and Gensini score.  $P \leq 0.05$  was considered as significant.

## RESULT

Out of 113 patients selected for this study, 77 (68.14%) were male, mean age of study subjects was  $60.24 \pm 8.41$  years, with range of 30 (40 – 70) years. The age was stratified in two groups. About 65(57.5%) patients were in  $\leq 60$  years age group and 48(42.5%) patients were in  $>60$  years age group. Among total study subjects, it was observed that 85 (75.2%) were hypertensive, dyslipidemia was present in 31 (27.4%) and 17 (15.0%) patients were smokers. The mean duration of diabetic was  $12.26 \pm 5.97$  years, with range of 25(5–30) years. The side of artery involved was observed among all study subjects, right side was involved in 66 (58.4%) patients and left side was involved in 47(41.6%) patients. The duration was also bifurcated according to gender and age groups and results are presented in table 1.

The Gensini score according to gender, age groups, duration of disease groups, hypertension, dyslipidemia, smoking and dominance of side involved are presented in table 2. For patients who had diabetics for the last 5-10 years, the mean Gensini score was  $67.12 \pm 44.09$ , it was  $81.36 \pm 64.64$  for patients who had diabetic between 11-15 years, mean score was  $99.54 \pm 64.05$  for patients who had disease between 16-20 years, and the mean Gensini score was  $101.88 \pm 44.46$  for patients who had disease  $> 20$  years. Scatter plot between Ggensini score and duration of diabetic is presented in figure 1. Correlation was found to be 0.204 which is statistically significant at with p-value of 0.03.

**Table1: Demographic variables of Study Participants (n=113)**

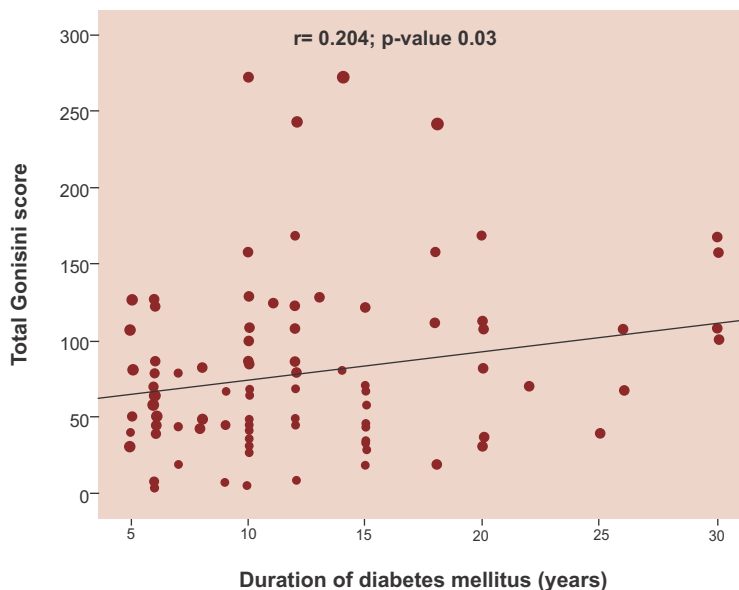
Variables	n(%)
<b>Age (years)</b>	
Mean $\pm$ SD	60.24 $\pm$ 8.411
Age = 60 years	65 (57.5%)
Age > 60 years	48 (42.5%)
<b>Gender</b>	
Female	36 (31.9%)
Male	77 (68.1%)
Mean HbA1c	8.94 $\pm$ 1.923
<b>Mean duration of diabetes mellitus (mean <math>\pm</math> SD)</b>	
All Subjects	12.26 $\pm$ 5.976
Male subjects	11.74 $\pm$ 5.92 years
Female subjects	13.36 $\pm$ 6.02 years
Subjects with age = 60 years	11.55 $\pm$ 5.77 years
Subjects with age > 60 years	13.21 $\pm$ 6.17 years
<b>Duration of diabetic mellitus</b>	
i. 5 -10 years	57 (50.4%)
ii. 11 - 15 years	35 (31%)
iii. 16 - 20 years	13 (11.5%)
iv. > 20 years	8 (7.1%)
<b>Comorbid</b>	
Hypertension	85 (75.2%)
Dyslipidemia	31 (27.4%)
Smoking	17 (15%)
<b>Mean Gensini Score (mean <math>\pm</math> SD)</b>	77.72 $\pm$ 54.42

**Table 2: Distribution of Gensini score According to Gender, Age, Duration of DM, Hypertension, Dyslipidemia and Smoking (n=113)**

Variables	n	Mean $\pm$ SD	P value
<b>Gender</b>			
Female	36	63.43 $\pm$ 45.25	0.056
Male	77	84.4 $\pm$ 57.26	
<b>Age</b>			
= 60 Years	65	75.15 $\pm$ 44.19	0.562
> 60 years	48	81.2 $\pm$ 66.15	
<b>Duration of diabetes mellitus</b>			
5 -10 years	57	67.12 $\pm$ 44.09	0.111
11 - 15 years	35	81.36 $\pm$ 64.64	
16 - 20 years	13	99.54 $\pm$ 64.05	
> 20 years	8	101.88 $\pm$ 44.46	
<b>Hypertension</b>			
No	28	79.73 $\pm$ 40.46	0.823
Yes	85	77.06 $\pm$ 58.49	
<b>Dyslipidemia</b>			
No	82	75.07 $\pm$ 52.65	0.402
Yes	31	84.74 $\pm$ 59.18	
<b>Smoking</b>			
No	96	76.78 $\pm$ 53.35	0.663
Yes	17	83.06 $\pm$ 61.62	

\*P-values are based on ANOVA

**Figure 1: Correlation Between Gensini Score and Duration of Diabetes (n=113)**



Univariate linear regression analysis with Gensini score as dependent variable and patients characteristics such as age, male gender, duration of diabetes, hypertension, dyslipidemia, and smoking as independent variables showed significant relationship of Gensini score with age, male gender, and duration of diabetes. Multivariate linear

regression with Gensini score as dependent variable and age, male gender, and duration of diabetes as independent variables showed gender and duration of diabetes were found significant. Multiple linear regression model is presented in table 3.

**Table 3: Multiple Linear Regression Analysis for Relation of Gensini Score with Other Factors**

Variables	Coefficient (B)	P values	95% Confidence Interval for B	
			Lower	Upper
Age (years)	0.285	0.607	-.810	1.380
Gender (Male)	20.615	0.039*	1.107	40.124
Duration of DM	1.737	0.028*	.192	3.282

\*Statistically significant

Multiple R=0.49, R<sup>2</sup> = 0.249, adjusted R<sup>2</sup>=0.22

## DISCUSSION

Coronary heart disease (CHD) is counted as the highest cause of death all over the world. It is estimated that mortality due to ischemic heart disease was around seven million that is 12.8% of overall deaths. Diabetic is the main cause of cardiac disease and deaths. It is determined that as the duration of diabetic increases, the severity of CHD also increased.<sup>12</sup>The high prevalence of coronary artery disease in men is reported because of the factors like smoking exposure, which partly explains high ratio of males in our sample as compare to females (68% v/s 32%).<sup>13</sup>

The duration of diabetic was determined in many studies. In a study, it was mentioned that mean duration of diabetics was 12.83, mean HbA1c was 8.4±2.39.<sup>14</sup> Similarly, 47.3% were hypertensive, and 17.3% were smokers. In our

study, the mean duration of diabetics in patients was 12.26 ± 5.98 and mean HbA1C was 8.94 ± 1.92 which are similar to above study results. Hypertensives in our study were 75.2% which is much higher than the results quoted in above mention study. It may be because we have taken all the patients suffering with diabetic for more than 5 years and having co-morbid conditions as hypertension. However smokers in our study were similar to the above study as smokers in our study were 15%.

The duration of diabetics was our main target to determine that whether severity of cardiac disease directly affected with the longer duration of diabetics. In studies, 48% of the diabetics were relatively of shorter duration of 5-10 years. Our study results are similar to it as in our study 50.4% patients were suffering with diabetics for 5-10 years duration.<sup>15,16</sup>

In a study, the mean Gensini score was  $53.36 \pm 36.94$ . In our study the mean Gensini score was much higher as  $77.72 \pm 54.42$ .<sup>14</sup> It means our patients were more severe than the other studies as our range for Gensini score was 268(4-272). Our results also demonstrated that as the duration increases the Gensini score also increased, for duration 5-10 years the score was  $67.12 \pm 44.08$ , for duration 11-15 this score was  $81.36 \pm 64.63$ , for 16-20 years it was  $99.54 \pm 64.04$ , and for duration >20 years the score was  $101.88 \pm 44.45$ .<sup>14</sup>

In a study, a significant association was observed between Gensini score and duration of DM ( $r=0.362$ ,  $p=0.004$ ) and it had a positive linear correlation with the Gensini score.<sup>17</sup> Our study also demonstrated that Gensini score is positively and significantly correlated with duration of DM. ( $r=.204$ ,  $p=0.03$ ). Their study results also demonstrated a significant correlation between Gensini score and hypertension.<sup>17</sup> Our study results did not show any positive relationship between the two. However our results showed significant correlation between the Gensini score and male gender.

The correlation of severity of CAD was found moderate in patients less than 5 years of type 2 diabetes and a strong correlation were seen in more than 5 years of type 2 diabetes. The other conventional risk factors of CAD were not correlated well with severity of CAD. Numerous studies have shown that insulin resistance has key role in every phase of atherosclerosis and is closely linked to increased cardiovascular risk.<sup>18,19</sup> In an another study a strong correlation between insulin resistance and severity of CAD was observed, so there is need for reappraisal of insulin resistance as a most important risk factor for CAD.<sup>20</sup> It is documented that the peak effect of hyper insulinemia and insulin resistance probably appears at 4 to 5 years of diabetes mellitus which developed the CAD changes significantly if diabetic is more than 5 years old.

## LIMITATIONS

As it is a cross sectional study, having a small sample size, conducted in a single center on local subjects only are the main limitations of the study. Therefore, we may not confirm whether our findings can be generalized nationally and internationally or not.

## CONCLUSION

The duration of diabetic mellitus and male gender are positively correlated with the Modified Gensini score and appears to be the important determinants of severity of coronary artery disease (CAD).

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