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Relationship between Duration of Diabetes Mellitus and Gensini Score in Patients Undergoing Diagnostic Coronary Angiography

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Gensini (G score) is one of the most widely used scoring systems in cardiology. It is an objective method to determine the coronary artery disease severity according to angiographic findings. The aim of this work was to assess the relation between G score and the chronicity of diabetes mellitus (DM) in cases undergoing coronary angiography.
Methods: This prospective cohort research was carried out on 300 cases with diabetes mellitus (DM) on antidiabetic treatment who were referred to diagnostic coronary angiography for suspected coronary artery disease. G score was calculated for measurement of the coronary artery disease severity. During the period from October 2020 to Aril 2022

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Results: Age, smoking, chronicity of DM, cholesterol, triglycerides test, and electrocardiogram were statistically prominent positively related with G score, while female gender was statistically significant negative relation with it. Also. Mean G score was statistically prominent higher in cases with ischemic changes than in cases without ischemic changes. Therefore, the chronicity of DM was statistically significant predictor of G score.
Conclusions: significant positive relation between the G score and the chronicity of DM.

Keywords: Chronicity of DM mellitus; gensini score; diagnostic coronary angiography.

1. INTRODUCTION

Coronary artery disease (CAD) is considered one of the most common diseases. Developing countries contributed to 80 percent of cardiovascular disease (CVD) deaths. Nearly half of all middle-aged males and one-third of all middle-aged women in the United States are predicted to experience CHD symptoms at some point in their lives. While CVD continued to rise during the 20th century, it started falling off after the Framingham research revealed that smoking, high blood pressure, and high cholesterol are all preventable risk factors [1,2].

DM mellitus (DM) is a chronic condition caused by a genetic predisposition and environmental variables that prevent the body from producing enough insulin or using it correctly [3].

Age, hypertension, dyslipidemia, obesity, physical inactivity, and stress are all risk factors for coronary artery disease (CAD) and DM as well, making the rising prevalence of type 2 DM a growing risk factor of CAD [4].

Type 2 DM can double or even quadruple the likelihood of CHD. Atherosclerotic vascular disease, which can affect the heart and other vascularized organs, is more common in diabetic cases [5,6].

More than 80% of deaths and 75% of hospital admissions in diabetic people are caused by CAD. It has also been found that diabetic cases are at a higher risk of having a plaque rupture. Females with DM no longer benefit from the protective female gender effect and may even be at a higher risk for CAD than males with DM [7,8].

The Gensini (G score) is a popular metric used by cardiologists. The severity of CAD can be objectively assessed with this technique. Cases without coronary artery disease (the non-CAD group) have a luminal stenosis score of 0. Each lesion is given a nonlinear score depending on the degree of stenosis, which is shown by the diameter reduction of the lumen. The area of each lesion in the coronary tree is then multiplied by a factor that reflects its functional significance. The total number of lesions is added to form the G score [9,10].

The aim of this work was to assess the relation between G score and the chronicity of DM in cases undergoing coronary angiography.

2. PATIENTS AND METHODS

This prospective observational research was carried out on 300 cases diagnosed with DM on antidiabetic treatment who were referred to diagnostic coronary angiography for suspected CAD who have symptoms suggestive of coronary artery disease and /or abnormal noninvasive stress tests based on exercise electrocardiographic testing or myocardial perfusion imaging test. During the period from October 2020 to April 2022.

Exclusion criteria were cases with severe CAD, history of (CABG), prior revascularization by percutaneous intervention, acute coronary syndrome, acute heart failure, acute ischemic stroke or transient ischemic attack, peripheral vascular disease.

All cases in the research were subjected to complete history taking (Hypertension: systolic pressure >140 mm Hg and/or a diastolic pressure >90 mm Hg at least 2 times, or using antihypertensive medication, DM: fasting blood glucose (FBG) > 126mg/dl, or 2-h blood glucose ≥ 200 mg/dl, or glycosylated hemoglobin A1C (HBA1c) level ≥ 6.5%, or under the active treatment with insulin or oral hypoglycemic agents [11], chronicity of DM, family history of ischemic heart disease: Premature CAD in a close relative (men under 55 and women under 65), a high risk physical exam (Full general and local examination with special attention on pulse rate, rhythm, and blood pressure [systolic and diastolic]), and a high risk family history. Electrocardiogram (ECG): 12-lead

electrocardiography, laboratory tests (Lipid profile (TG, cholesterol), complete blood count (CBC), fasting and post prandial blood sugar, and serum creatinine.)

Diagnostic coronary angiography [12]: Using 6-French right and left cardiac catheters, we performed a Judkins method coronary angiogram in the absence of nitroglycerin. Percentage of luminal diameter stenosis, also known as the G score, was used to visually determine the degree to which the coronary arteries were narrowed [9] and was worked out to determine the degree of CAD. The number of stenotic sections, their luminal narrowing, and their location within the coronary tree are all taken into account.

Gensini (G score) = ∑ (points for each segment x weighing factor)

Each coronary stenosis was first assigned a severity score, which was then used in the G score calculation. One point is awarded for a narrowing of less than 25%, two points for a narrowing of 26–50%, four points for a narrowing of 51–75%, eight points for a narrowing of 76–90%, sixteen points for a narrowing of 91–99%, and 32 points for complete blocking. After that, the severity of the lesion is calculated by multiplying the raw score by a weighted value that the branch of the coronary tree it is a part of (5 for the LM coronary, 2.5 for the proximal portion of the LAD coronary, 2.5 for the proximal segment of the circumflex artery, 1.5 for the middle section of the LAD coronary artery, 1.0 for the RCA, the distal part). Finally, the G score was determined by adding the results from each coronary section [13].

2.1 Statistical Analysis

Statistical analysis was performed using IBM's SPSS Statistics for Windows, Version 26 (IBM, Armonk, NY, USA). The Shapiro-Wilk test was performed to ensure that the data were normally distributed. Categorical variables were expressed as frequency and percentage, while quantitative variables were expressed as mean and standard deviation, median, interquartile range, minimum and maximum as applicable. Parametric and non-parametric continuous data were compared across groups using the T and Mann Whitney tests, respectively, for independent samples. Parametric continuous data involving three or more groups was compared using one-way ANOVA followed by Bonferroni's post hoc analysis, whereas nonparametric continuous data was compared using Kruskal-Wallis tests followed by Dunn's post hoc analysis. Pearson's and Spearman's relation coefficients were used to analyze bivariate relationships. To analyze the impact of DM chronicity on G score (R2), a linear logistic regression model was developed. When the probability level was less than 0.05, it was considered significant.

3. RESULTS

Demographic characteristics, chronicity of DM (years), history of smoking and hypertension of the studied sample, laboratory investigations, ECG changes of the present studied sample, G score in the current research were presented in Table 1.

There was statistically prominent positive relation regarding age, smoking, chronicity of DM, cholesterol, TG and ECG with G score, while female sex showed significant negative relation with it. Fig. 1

The mean G score was higher in cases with ischemic changes (than in cases without ischemic changes ($p< 0.001$) Table 2.

Chronicity of DM is statistically significant predictor of G score ($p < 0.001$) Table 3.

4. DISCUSSION

In the current research, there were 197 males and 103 females, ranging in age from 31 to 87 years old. Several earlier studies have reported, Ghem et al. [14] . found that male gender was a risk factor for developing a severe coronary atherosclerosis. Wei et al [15] .showed that older cases have severe coronary artery disease, more complex coronaries and have multivessel coronary artery lesions which agrees with the current research. In the current research the mean chronicity of DM was 13.97 ± 7.570 years (range from 2 to 35 years), the mean Gensini (G score) was 36.96 ± 33.303, (range from 0 to 143).

Ul Amin et al [16]. enrolled 321 Clinically diagnosed cases of DM on proper anti-diabetic treatment in this research. Found a significant positive relation between the G score and the chronicity of DM was observed in their research. Also reported diabetic chronicity was 12.46 ± 4.86 years, (range between 5 to 27 years) which is concordant with the present research.

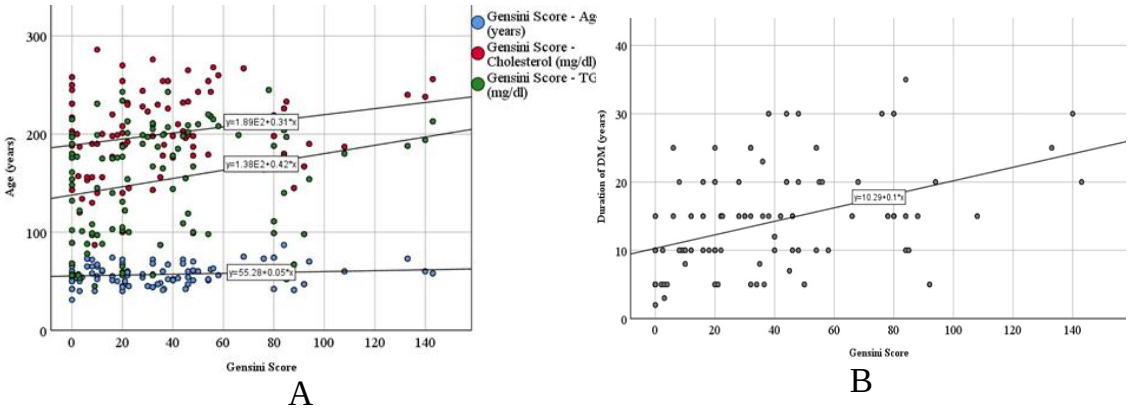

Fig. 1. Relations of Gensini score with age, cholesterol and triglycerides (A) and chronicity of DM mellitus (B)

Table 1. Demographic characteristics, chronicity of DM (years), history of smoking and hypertension, laboratory investigations, ECG changes of the studied cases, Gensini score in the current research

(n= 300)		**Mean ± SD**
Age (years)		57.01 ± 9.944
BMI (kg/m2)		27.77 ± 2.042
Chronicity of DM (years)		13.97 ± 7.570
Creatinine (mg/dl)		1.24 ± 0.174
Cholesterol (mg/dl)		200.46 ± 9.586
TG (mg/dl)		153.70 ± 4.332
G score		36.96 ± 3.303
Gender	Male	197 (65.7%)
	Female	103 (34.3%)
History of smoking		143 (47.7%)
History of hypertension		183 (61.0%)
ECG		
No ischemic changes		37 (12.3%)
Ischemic changes		263 (87.7%)

Data are presented as Mean ± SD, frequency (percentage) BMI: body mass index, DM: DM mellitus, TG: triglycerides

Table 2. G score measurement according to ECG changes in the current research

	No ischemic changes (n= 37)	**Ischemic changes (n= 261)**	**95% CI**	**P**
G score	1.82 ± 3.196	41.95 ± 32.633	-44, -36	**< 0.001***

*Data are expressed as mean ± standard deviation. ***** P is significant when < 0.05*

Table 3. Stepwise linear regression analysis of effect of chronicity of DM on Gensini score

	R^2	**B**	**Constant**	**95% CI**	**P**
Chronicity of DM (years)	19.0%	1.917	10.228	1.464, 2.370	< 0.001*

*DM: DM mellitus, * P is significant when < 0.05*

In the current research, In accordance with the current research, Ul Amin et al. [16]. calculated the mean G score to be 71.99 ± 44.12, (range between 4 and 226).

Nurkalem et al. [17]. 235 cases with coronary ischemia were included. DM affected 69 people (about 29%). Of the 166 participants without DM who underwent an oral glucose tolerance test

(OGTT), 76 (46%) were found to have normal glucose tolerance (NGT), 68 (41%) were found to have impaired glucose tolerance ([IGT] group II IGT), and 22 (13%) were found to have diabetic glucose tolerance (DGT). Group III (n = 91) was formed by adding the DGT cases to the preexisting diabetics. Group I had a mean G score of 43.20 24.92, Group II of 54.22 42.61, and Group III of 60.59 38.21. So, Nurkalem et al [17].reported a linear relation between the coronary artery disease severity and abnormal glucose tolerance, which is concordant with the current research, although we used the chronicity of DM instead of glucose tolerance test.

Yaseen et al. [18]. included 84 diabetic individuals who sought out elective coronary angiography at the catheterization lab. The measured levels of fasting insulin and the G score were related using statistical testing.

All cases have been dealing with DM for a long time (10.194.9 years, all type II). Cases were stratified into four categories based on their G scores: The first group has normal coronary arteries (score of 0), the second has mild CAD (scores of 1-5), the third has moderate CAD (scores of 16-30), and the fourth has severe CAD (scores of 31-72). The insulin levels of cases with CAD were prominent higher than those of cases with normal coronaries, and the insulin levels of cases with severe CAD were prominent higher than those of cases with mild and moderate CAD, and the insulin levels of cases with moderate CAD were prominent higher than those with mild CAD. According to the results of the current research, Yaseen et al. [18] . insulin levels were found to have a positive linear relationship with G score for coronary artery disease severity in cases with type 2 DM.

A research by Gaber et al. [19] assessed DM as one of the major risk factors for CADs, and this research found a statistically significant positive relation between HbA1c levels and G scores, which measures the severity of CAD in diabetic cases. DM is also known to cause microvascular and possibly macrovascular complications.

Regarding dyslipidemia in the current research the total cholesterol level and TG had significant positive relation with Ginsini score. This agreed with Tarchalski et al. [20] results who found that the extent of coronary atherosclerosis is positively related with atherogenic lipids, i.e. total cholesterol, low-density lipoprotein, cholesterol and TG.

In the current research, age, smoking, chronicity of DM, cholesterol, TG, and ECG were statistically prominent positively related with G score, while female gender was statistically prominent negatively related with G score. Additionally, the mean G score was statistically prominent higher in cases with ischemic changes (41.95 ± 32.633) than in cases without ischemic changes (1.82 ± 3.196). Therefore, as a stepwise linear regression analysis, the chronicity of DM was statistically significant predictor of G score.

In accordance with the present research, Saleem et al. [21]. reported a positive significant relation between the G score and chronicity of DM. In addition, Ul Amin et al. [16]. observed a significant positive relation between the chronicity of DM and the G scores. The chronicity of DM and the G scores were observed to be much greater in the older ages. The G scores for the female and male subgroups were found to be statistically equivalent at 73.31± 45.71 Vs.71.36 ± 43.45, respectively. There was no relation between smoking and DM severity or length of time with the G score. On contrary to the present research, Su et al. [22]. showed that Gensinic score was not related with the chronicity of DM, blood pressure and other factors like age, sex, and smoking status. This controversy with the present research and the previously mentioned studies could be explained by the difference in case selection in the research.

Limitations: The sample size was relatively small. The research was in a single center. didn't specify if the cases had type 1 or type 2 DM and whether the diabetic status was controlled or not controlled.

5. CONCLUSIONS

The Gensini score is positively related to DM chronicity. Given this association, risk categorization of individuals with CAD should take into account not only the presence of DM but also the chronicity of DM.

CONSENT AND ETHICAL APPROVAL

The research was done after approval from the Ethical Committee Faculty of Medicine, Tanta University Hospitals, Tanta, Egypt. The participant gave his or her informed consent.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Townsend N, Wilson L, Bhatnagar P, Wickramasinghe K, Rayner M, Nichols M. Cardiovascular disease in Europe: Epidemiological update 2016. Eur Heart J. 2016;37:3232-45.
2. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Heart disease and stroke statistics-2016 Update: A report from the american heart association. Circulation. 2016;133:38-360.
3. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. Global Burden of Disease and Risk Factors. Washington (DC).
1. New York: The International Bank for Reconstruction and Development / The World Bank
2. Oxford University Press
3. Copyright © 2006, The International Bank for Reconstruction and Development/The World Bank Group.; 2006.
4. Haffner SM, Lehto S, Rönnemaa T, Pyörälä K, Laakso M. Mortality from coronary heart disease in subjects with type 2 DM and in nondiabetic subjects with and without prior myocardial infarction. N Engl J Med. 1998;339:229-34.
5. Gu K, Cowie CC, Harris MI. Mortality in adults with and without DM in a national cohort of the U.S. population, 1971-1993. DM Care. 1998;21:1138-45.
6. Fuller JH, Shipley MJ, Rose G, Jarrett RJ, Keen H. Mortality from coronary heart disease and stroke in relation to degree of glycaemia: the Whitehall research. Br Med J (Clin Res Ed). 1983;287:867-70.
7. Nesto RW, Rutter MK. Impact of the atherosclerotic process in cases with DM. Acta Diabetol. 2002;39:22-8.
8. Moreno PR, Murcia AM, Palacios IF, Leon MN, Bernardi VH, Fuster V, et al. Coronary composition and macrophage infiltration in atherectomy specimens from cases with DM mellitus. Circulation. 2000;102:2180-4.
9. Gensini GG. A more meaningful scoring system for determining the severity of coronary heart disease. Am J Cardiol. 1983;51:606-15.
10. Neeland IJ, Patel RS, Eshtehardi P, Dhawan S, McDaniel MC, Rab ST, et al. Coronary angiographic scoring systems: An evaluation of their equivalence and validity. Am Heart J. 2012;164:547-52.
11. Association AD. 2. Classification and diagnosis of DM: standards of medical care in DM—2018. DM care. 2018;41:13-27.
12. Douglas PS, Hoffmann U, Patel MR, Mark DB, Al-Khalidi HR, Cavanaugh B, et al. Outcomes of anatomical versus functional testing for coronary artery disease. N Engl J Med. 2015;372: 1291-300.
13. Goyal BM, Sharma SM, Walia M. B-type natriuretic peptide levels predict extent and coronary artery disease severity in non-ST elevation acute coronary syndrome and normal left ventricular function. Indian Heart J. 2014;66:183-7.
14. Ghem C, Sarmento-Leite RE, de Quadros AS, Rossetto S, Gottschall CA. Serum bilirubin concentration in cases with an established coronary artery disease. Int Heart J. 2010;51:86-91.
15. Wei S, Gao C, Wei G, Chen Y, Zhong L, Li X. The level of serum bilirubin associated with coronary lesion types in cases with coronary artery disease. J Cardiovasc Med (Hagerstown). 2012;13:432-8.
16. Ul Amin R, Ahmedani MAM, Karim M, Raheem A. relation between G score and Chronicity of DM in cases undergoing coronary angiography. Cureus. 2019;11: 4010-25.
17. Nurkalem Z, Hasdemir H, Ergelen M, Aksu H, Sahin I, Erer B, et al. The relationship between glucose tolerance and coronary artery disease severity using the G score. Angiology. 2010;61:751-5.
18. Yaseen RI, Beda MY, Ibrahim FA. Relation between Coronary artery disease severity and Insulin Resistance in Diabetic Cases. Egypt J Hosp Med. 2021;84: 2084-9.
19. Gaber AH, Elkholy TM, Aziz EA, Helmi MM. Glycosylated haemoglubin level and coronary artery disease severity. Med J Cairo Univ. 2014;82:87-93.
20. Tarchalski J, Guzik P, Wysocki H. Relation between the extent of coronary atherosclerosis and lipid profile. Mol Cell Biochem. 2003;246:25-30.
21. Saleem T, Mohammad KH, Abdel-Fattah MM, Abbasi AH. Association of glycosylated haemoglobin level and DM mellitus chronicity with the coronary artery disease severity. Diab Vasc Dis Res. 2008;5:184-9.

22. Su G, Mi S, Tao H, Li Z, Yang H, Zheng H, et al. Association of glycemic variability and the presence and coronary artery disease severity in cases with type 2 DM. Cardiovasc Diabetol. 2011;10: 19-25.

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