ORIGINAL RESEARCH

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Rose Angina Score can really estimate myocardial perfusion scan results in both diabetic and non-diabetic patients?

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Aims

Cardiovascular diseases are among the most important causes of mortality and morbidity worldwide. There are different risk factors explained for cardiovascular diseases and diabetes mellitus (DM) is notable among them. There are different modalities for diagnosis and risk assessment of cardiovascular diseases such as myocardial perfusion imaging (MPI) but considering high price and low accessibility of this modality we decided to assess any possible association between MPI findings and Rose angina score (RAS) in both diabetic and non-diabetic patients.

Materials and methods

In this descriptive-analytic study we enrolled 585 diabetic and non-diabetic patients with angina pectoris referred to nuclear medicine department of Shahid Sadoughi hospital, Yazd, Iran for MPI. Patients demographic information along with MPI results and Rose angina questionnaire were obtained. Data were finally analyzed using SPSS ver.21 software using appropriate statistical tests.

Results

in this study, there were 294 diabetic and 291 non diabetic patients enrolled. 61.9% of non-diabetic patients had normal MPI results but this amount was only 38.8% among diabetic patients. Our study population did not differ based on age, gender and Rose angina score between diabetic and non-diabetic patients. Our results indicate that there is a statistically significant association between RAS and MPI findings in both diabetic (P-value=0.001) and non-diabetic (P-value=0.001) patients.

Conclusion

In present study we found a significant association between simple RAS questionnaire and MPI findings. We do not deny high accuracy and diagnostic value of MPI but we want to focus on clinical judgement of physicians prior to imaging modalities. We believe that in many cases, with a good clinical assessment such as RAS, many unnecessary and expensive modalities can be avoided.

Keywords

Rose angina score, Rose angina questionnaire, Diabetes mellitus, Myocardial perfusion scan, Cardiovascular disease, Coronary artery disease, Ischemia

Imprint

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Introduction

Cardiovascular diseases are one of the most common causes of death in almost whole world. They devote more than 30% of mortality in developed countries. Cardiovascular diseases cause mortality, morbidity and complications which put a heavy economic burden on society (1, 2).

Different factors are said to be involved in development of coronary artery diseases such as gender, age and genetics which are not adjustable. There are some other factors that can be controlled or even eliminated such as diabetes mellitus (DM), hypertension (HTN), obesity, smoking, hyperlipidemia (HLP), psychological tension and etc. (3-5).

Myocardial perfusion imaging (MPI) is one of non-invasive diagnostic modalities in field of cardiovascular imaging which can accurately detect ischemia in myocardium(6). In many studies it is said that MPI can avoid unnecessary economical payments for risk assessment of cardiovascular events(7). Accuracy of MPI has been reported differently in different investigations (8, 9).

During 1993 and 2001 stress cardiovascular imaging has increased to 3 fold as before. MPI has been

used 3 times more than stress echocardiography and 2 times more than exercise stress tests since 1996. Considering rapid development and application of this modality some insufficiencies have been also reported for this modality. In several clinical conditions MPI is the most common used modality for evaluating myocardial perfusion status(10, 11).

Although different diagnostic modalities such as exercise stress test, MPI, angiography ae really valuable in diagnosis of coronary artery disease (CAD), but the chance to use them is not prepare and equal for all people. In some regions and societies it seems that it is necessary to know importance and capabilities of other non-invasive, cheap, rapid and accessible modalities too(12).

For the first time Dr. Rose innovated a questionnaire to diagnose CAD and later was applied by other researchers in different regions as a very cheap modality for diagnosis of CAD. This questionnaire possess a sensitivity of 78 to 81 % and specificity of 94 to 97% compared to clinical judgement(13-15).

Nowadays DM is known as a comorbidity which is associated with an elevated risk of cardiovascular event and can lead to early death or disability followed by myocardial ischemia. Risk of cardiovascular events increase 2 to 4 folds in diabetic patients compared to non-diabetics. Diabetic patients have a more complicated cardiovascular disease at the time of primary diagnosis. MPI is a good screening method for coronary artery disease in diabetic patients(16, 17).

Considering important role of MPI in diagnosis of CAD and also high expenses and low accessibility for a great percentage of patients along with accessibility and simplicity of Rose angina questionnaire, in this study we decided to investigate possible association between Rose angina score (RAS) and MPI results in diabetic and non-diabetic patients. We think that this study can help to clarify diagnostic importance of RAS in comparison to MPI.

Materials and methods

This study is a descriptive-analytic study performed on 585 diabetic and non-diabetic patients with angina pectoris referred to department of nuclear medicine of Shahid Sadoughi hospital, Yazd, Iran for myocardial perfusion scan during 2019. All patients signed an informed consent to let us use their medical information for research purpose. This study was designed and performed based on Helsinki declaration and is registered in committee of research ethics of Shahid Sadoughi university of medical sciences, Yazd, Iran with IR.SSU.MEDICINE.REC.1398.260 approval ID.

We included 300 diabetic and 300 non diabetic patients with angina pectoris that were referred to nuclear medicine department for MPI. 15 patients that were not available or their medical folder was corrupted were excluded and finally 585 complete folders were elected for further analysis.

MPI were done via Gamma camera device with 128 by 128 matrix in both rest and stress condition for all patients. All patients underwent physical stress and 20 to 25 milli curry Tc99m-MIBI was used for all images. MPI results were reported and categorized in a 5-point scale as normal, mild ischemia, moderate ischemia, severe ischemia and no perfusion.

A Rose angina score questionnaire was also used for all patients in which patients are categorized in 3 categories based on assessed risk as: score below 6 as low risk, score between 6 and 11 as moderate risk and score above 11 as severe risk. Patients angina pectoris is also categorized in 3 degrees as: 1) grade 2 definite angina (severe) in which patients feel pain while walking on even land rather than inclined ground. 2) grade 1 definite angina (moderate) in which patients answer all questions positive. 3) possible angina (mild) in which not all answers are positive but angina pain occurs while walking with hurry or on inclined ground.

All patient's demographic information including gender, age, comorbidities, Rose angina score and ischemia detected in MPI were recorded in a questionnaire and finally all data were analyzed using SPSS ver.21 software using appropriate statistical tests such as Chi-square, independent T test or paired T test. In all tests a P-value<0.05 was considered to be statistically significant.

Results

This is a descriptive-analytic study performed in 2019 to assess the relationship between Rose angina score and MPI results in diabetic and non-diabetic patients. Among 585 enrolled patients, 294 (50.3%) of them were diabetic and 291 of them (49.7%) were not diabetic. 399 (68.2%) of them were diagnosed with HTN and 75 (12.8%) patients remarked a history of prior myocardial infarction.

In our study population mean patients age was 58.33±10.8 and ranged between 24 and 87. Based on RAS, 201 (34.4%) of them had probable angina, 135 patients (23.1%) had grade 1 definite angina and 249

Table 1
Descriptive statistics of patients based on age and gender

	Women	Men	Mean age	Total	P-value	
Diabetic	198 (67.3%)	96 (32.7%)	58.89	294 (100%)	Gender = 0.1	Age = 0.2
Non-diabetic	177 (60.8%)	114 (39.2%)	57.76	291 (100%)		
Total	375 (64.1%)	210 (35.9%)	58.33±10.8	585 (100%)		

Table 2
Association between DM and HTN. HTN is significantly more in diabetic patients (P-value=0.001)

	History of HTN	No HTN	Total	P-value
Diabetic	237 (80.6%)	57 (19.4%)	294 (100%)	0.001
Non-diabetic	162 (55.7%)	129 (44.3%)	291 (100%)	
Total	399 (68.2%)	186 (31.8%)	585 (100%)	

Table 3
Association between DM and history of ischemia. there is a statistically significant association between DM and history of ischemia (P-value=0.04)

	History of HTN	No HTN	Total	P-value
Diabetic	45 (15.3%)	249 (84.7%)	294 (100%)	0.04
Non-diabetic	30 (10.3%)	261 (89.7%)	291 (100%)	
Total	75 (12.8)	510 (87.2%)	585 (100%)	

Table 4
Descriptive results associated with frequency of different MPI abnormalities in both diabetic and non-diabetic patients

	Normal	Mild ischemia	Moderate ischemia	Severe ischemia	No perfusion	P-value
Diabetic	114 (38.8%)	99 (33.7%)	30 (10.2%)	36 (12.2%)	15 (5.1%)	0.001
Non-diabetic	183 (62.9%)	45 (15.5%)	24 (8.2%)	24 (8.2%)	15 (5.2%)	
Total	297 (50.8%)	144 (24.6%)	54 (9.2%)	60 (10.3%)	30 (5.1%)	

Table 5
There is no statistically significant association between RAS and DM (P-value=0.93).

	Mild (probable angina)	Moderate (grade 1 definite angina)	Sever (grade 2 definite angina)	Total	P-value
Diabetic	102 (34.7%)	69 (23.5%)	123 (41.8%)	294 (100%)	0.93
Non-diabetic	99 (34%)	66 (22.7%)	126 (43.3%)	291 (100%)	
Total	201 (34.4%)	135(23.1%)	249 (42.6%)	585 (100%)	

Table 6
Association between RAS and MPI results in diabetic patients. There is a significant association between RAS and MPI abnormalities in diabetic patients (P-value=0.001)

	Mild	Moderate	Severe	Total	P-value
Normal	66 (57.9%)	24 (21.1%)	24 (21.1%)	114 (100%)	0.001
Mild ischemia	36 (36.4%)	33 (33.3%)	30 (30.3%)	99 (100%)	
Moderate ischemia	0 (0%)	12 (40%)	18 (60%)	30 (100%)	
Severe ischemia	0 (0%)	0 (0%)	36 (100%)	36 (100%)	
No perfusion	0 (0%)	0 (0%)	15 (100%)	15 (100%)	
Total	102 (34.7%)	69 (23.5%)	123 (41.8%)	294 (100%)	

Table 7
Statistically significant association between RAS and abnormal MPI findings in non-diabetic patients (P-value=0.001)

	Mild	Moderate	Severe	Total	P-value
Normal	90 (49.2%)	54 (29.5%)	39 (21.3%)	183 (100%)	0.001
Mild ischemia	9 (20%)	12 (26.7%)	24 (53.3%)	45 (100%)	
Moderate ischemia	0 (0%)	0 (0%)	24 (100%)	24 (100%)	
Severe ischemia	0 (0%)	0 (0%)	24 (100%)	24 (100%)	
No perfusion	0 (0%)	0 (0%)	15 (100%)	15 (100%)	
Total	99 (34%)	66 (22.7%)	126 (43.3%)	291 (100%)	

patients (42.6%) had grade 2 definite angina. Considering MPI results, 297 patients had normal results, 144 (24.6%), 54 (9.2%), 60 (10.3%) and 30 patients (5.1%) had mild ischemia, moderate ischemia, severe ischemia and no perfusion respectively.

In our study, among diabetic patients 198 (67.3%) of them were women and 96 (32.7%) of them were men. Mean diabetic patients age was 58.89 years. There were 177 (60.8%) women and 114 (39.2%) men within non diabetic patients. Mean age of non-diabetic patients was 57.76 years. Based on performed analysis there was no significant difference between diabetic and non-diabetic patients based on gender (P-value-0.1) and age (P-value=0.2). table No.1 below shows descriptive statistics associated with patient's gender and age.

In this study 80.6% of diabetic patients had HTN and 55.7% of non-diabetic patients had HTN. With a P-value of 0.001 it means that diabetic patients had a significantly higher rate of HTN. table No.2 shows the association between DM and HTN in our study.

Our results show that there is also a significant association between history of ischemia and diabetes. Association between DM and history of ischemia is summed up in table No.3.

Chi-square analysis results indicate that there is a statistically significant difference between diabetic and non-diabetic patients in terms of abnormalities of MPI. As also seen in table No.4, 62.9% of non-diabetic patients had normal MPI and only 38.8% of diabetic patients had normal MPI results.

As seen in table No.5 below our results indicate that there is no statistically significant difference between diabetic and non-diabetic patients based on their RAS (P-value=0.93).

Remembering main goal of our research which was to evaluate any possible association between RAS and MPI abnormality, we separately analyzed our data for this association in both diabetic and non-diabetic patients. As seen in table No.6, there is a significant association between RAS and MPI abnormality in diabetic patients.

Our findings show the same significant association between RAS and MPI findings in non-diabetic patients too (P-value=0.001). The results are summed up in table No.7.

Discussion

There are 200 million people living with diabetes around the world. Risk of cardiovascular involvement in diabetic patients in 2 to 4 times more than non-diabetic population (18, 19). In European and American guidelines DM is considered equal to cardiovascular involvement. Prevalence of coronary artery diseases among diabetic patients has been reported to be 43 to 53% regardless of gender (19). Considering high quality and value of MPI along with lack of accessibility for all patients and high expenses, in this study we decided to see if simple RAS questionnaire can be associated with MPI findings in diabetic and non-diabetic patients or not.

In this study we found that there is a statistically significant association between MPI findings and RAS in both diabetic and non-diabetic patients. There was a significant correlation between HTN and history of ischemia with DM. our both diabetic and non-diabetic populations were not different based on age, gender or RAS.

In a study performed in Iran by Habibian et al., regression analysis results showed a positive and powerful correlation between RAS and HTN, DM, smoking and gender (20). Other similar studies also showed the same results (21). Our study was a bit different because they investigated general population but we enrolled susceptible patients with angina pectoris which were going to undergo MPI.

A large population of 6498 patients above 35 years old were studied by Sadeghi et al. and researchers reported that prevalence of coronary artery disease was 37.5% in women and 22.2% in men based on RAS questionnaire. They found that prevalence of coronary artery disease increases by age. They also reported that documented myocardial infarction based on electrocardiogram is recorded higher in men compared to women but the prevalence based on RAS was higher in women in all age groups (22).

Poudel et al. investigated 100 patients with chest pain referred to emergency department. They found that RAS questionnaire possess 63.8% true positive and 33.3 true negative for diagnosis of MI. true positive MI cases after cardiology consult was reported to be 71.6% which indicates reliability of Rose questionnaire (23).

In a comprehensive study performed by Hui et al. on 1957 patients with coronary artery disease, 619 of them were diabetic. They found that there is no significant difference between diabetic and non-diabetic patients based on their RAS questionnaire which is in accordance with our results (24).

Another similar study performed by Rahman et al. showed that history of HTN and myocardial ischemia in diabetic patient is significantly higher in compar-

ison to non-diabetic patients but similar to present study, RAS was not significantly different between diabetic and non-diabetic patients(14).

It seems that performing an appropriate screening before MPI can reduce number of unnecessary scans. This risk assessment method seems to be useful in diabetic patients with higher risk of silent ischemia too.

Park et al. revealed that risk RAS questionnaire is similar to coronary CT angiography in risk assessment of coronary artery diseases. Their study also indicated that DM, HTN, family history and history of previous ischemia is significantly correlated with severity ischemia (25) ar.

Considering all mentioned above findings, it seems that although MPI is a really powerful and acceptable modality but it still cannot be completely replaced with physical examination, history taking and clinical judgement of physicians. By this study we did not want to deny usefulness and high value of MPI but we wanted to attract attention and focus on clinical judgement. We believe that by having appropriate medical knowledge and a good clinical insight, physicians can get even better results out of paraclinical modalities.

Conclusion

Our results showed that RAS is associated with severity of perfusion defect detected via MPI. We conclude that in patients with high risk angina pectoris such as diabetic patients, hypertensive patients and patients with history of previous ischemia, by means of appropriate use of RAS, it is possible to avoid unnecessary MPI.

We do not claim that RAS is a more powerful tool for assessment of coronary artery disease compared to MPI, but we think that a good clinical judgement and insight can avoid unnecessary expenses and can lead to a better application of imaging modalities.

Statement on ethical issues

Research involving people and/or animals is in full compliance with current national and international ethical standards.

Conflict of interest

None declared.

Author contributions

The authors read the ICMJE criteria for authorship and approved the final manuscript.

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