Original Article

A Study of Demographic and Clinical Features of Patients Referred to the Nuclear Medicine Department of a Military Hospital for Myocardial Perfusion Scintigraphy

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(Received 26 December 2008, Revised 16 February 2009, Accepted 2 March 2009)

ABSTRACT

Introduction: It seems that demographic and clinical features of patients referred for myocardial perfusion scintigraphy (MPS) is different among populations and healthcare settings. The purpose of the current study is to evaluate the clinical features and risk factors of patients referred for myocardial perfusion scintigraphy to a military hospital.
Methods: As a cross-sectional study, the clinical and laboratory data of all patients who were referred for MPS were recorded. MPS was performed using ^{99m}Tc-Sestamibi or Thallium-201 (Tl-201) as the radiotracer.
Results: From March 2005 to March 2006, the data of 1392 consecutive patients were recorded. The mean age of the patients was 55.3±14.8 years. 45.6% of the patients had no major risk factor, while 38.5% had one and 15.9% had two risk factors. Hypertension was the most common risk factor, while cigarette smoking was reported by eight percent of the patients. The method of stress protocol was dipyridamole infusion in 69.2%, Treadmill exercise test in 28.4% and dobutamine infusion in 2.4% of the cases. The sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy of MPS in detection of angiographically positive CAD were 88.5%, 71.4%, 94.3%, 46.8% and 75.3%, respectively.
Conclusion: In our population hypertension is the most frequent risk factor, so extensive social programs should be implemented aiming at controlling this variable, in order to prevent its possible cardiac complications. Cigarette smoking is less common than general population, which could be due to social characteristics of the target community and their beliefs, so this distinctiveness should be well defined and promoted. The differences in the pattern of cardiovascular symptoms and risk factors can be considered as indirect evidences to the fact that the pattern of referral for MPS in our country is significantly different from those in developed countries, a fact that warrants further evaluation in order to confirm its appropriateness based on the validated international guidelines.

Key words: Myocardial perfusion scan, Ischemic heart disease, Risk factors, Demographic data, Military hospital

Iran J Nucl Med 2009; 17(1): 34-40

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INTRODUCTION

In most nations, ischemic coronary heart disease is one of the leading etiologies of mortality (1). The predisposing or risk factors for these diseases are categorized into two main classes: The first group consists of those factors which are not modifiable or changeable –including age, gender and family history- and the second group consists of potentially modifiable or treatable risk factors –e.g. hypertension (HTN), dyslipidemia (DLP), diabetes mellitus (DM), obesity, and cigarette smoking (CS) (2-4).

During the past decades, remarkable advances in the fields of medical imaging and diagnostic techniques have provided strong potential to detect functional as well as anatomically significant coronary artery diseases (CAD), one of the most common and clinically applicable of which is myocardial perfusion scintigraphy (MPS). This technique which was introduced in early 1970's as a diagnostic tool for CAD. Based on numerous studies in 1980's extended its applications as a highly significant prognostic modality for prospective risk stratification of patients suspected or confirmed to suffer from CAD (4). The technique has the potential to evaluate the extent and severity of perfusion abnormalities in different myocardial segments and coronary territories, and along with clinical or electrocardiographic findings obtained from prerequisite exercise or pharmacologic stress intervention inherent to the technique, has a high sensitivity and specificity for the evaluation of myocardial perfusion status (4-6).

In order to perform appropriate and effective interventions to reduce the risk of CAD in a particular population, it is mandatory to determine the predisposing factors of the disease in the specific settings of the given population and direct the measures to affect the most significant risk factors more rigorously. It seems that demographic and clinical features of patients referred for myocardial perfusion scintigraphy is different among populations and healthcare settings. Hence, the purpose of the current study is to study the clinical features and CAD risk factors of patients referred for MPS to the department of nuclear medicine of a military hospital.

METHODS

As a cross-sectional study, the clinical and laboratory data of all patients who were referred for MPS to our department were recorded. After obtaining verbal consent, all patients underwent systematic history taking, physical examination and review of the past medical records. All interviews were performed by a physician blinded to the MPS interpretations. Subsequently, as it was requested by the referring physician, myocardial perfusion SPECT was performed with no additional intervention. A commercial MIBI kit (AEOI, Tehran, Iran) was used and the labeling and quality control procedures were performed according to the manufacturer's instructions.

All patients underwent post-stress and at-rest protocol using three different methods of stress: Exercise (ETT), dipyridamole infusion or dobutamine infusion. During all these three protocols of stress, electrocardiographic monitoring was performed and the results were interpreted as positive (when characteristic electrocardiographic changes during or immediately after ETT, dipyridamole infusion or dobutamine infusion were seen) or negative (without any electrocardiographic change during or immediately after ETT, dipyridamole infusion or dobutamine infusion) electrocardiographic stress test.

If viability assessment was requested by the referring cardiologist, a dose of 111 MBq (3 mCi) Tl-201 was used for the stress study and a dose 37 MBq (1 mCi) Tl-201 for the rest study (stress re-injection redistribution protocol). For the remaining cases, a dose of 740 MBq (20 mCi) of ^{99m}Tc-sestamibi was used for the stress study and a dose of 740 MBq (20 mCi) ^{99m}Tc-sestamibi for the rest

study. Image acquisition was performed with a rotating, single head ADAC gamma camera. All data acquisitions (rest and stress for three different protocols of stress) employed low energy, high resolution parallel hole collimation with step and shoot mode, matrix size of 64 × 64 × 16, and using a roving 38.0-cm2 detector mask.

Two nuclear medicine physicians blinded to other clinical data interpreted SPECT data considering the presence (*abnormal scan*) or absence (*normal scan*) of myocardial perfusion abnormality (including either ischemia or infarction) and final diagnosis was reached by consensus. Stenoses of higher than 50 percent were considered angiographically significant.

Statistical Analysis

Data were expressed as mean values ± 1 standard deviation (SD). All statistical analyses were performed using SPSS 11.5 for Windows software. Statistical significance was set as a p value of ≤ 0.05.

RESULTS

From March 2005 to March 2006, the data of 1392 consecutive patients were assessed. The mean age of the patients was 55.3±14.8 years, the distribution of which among different age groups is shown in Table 1. Overall 756 cases (54.3%) were female, while 636 (45.7%) were male. Table 2 shows the frequency of different cardiovascular risk factors and also symptoms among the cases. In the studied population, 45.6% of the patients had no major risk factor, while 38.5% had one and 15.9% had two risk factors.

The method of stress protocol was dipyridamole infusion in 956 cases (69.2%), Treadmill exercise test in 392 patients (28.4%) and dobutamine infusion in 33 cases (2.4%). In 426 (54.7%) cases the baseline ECG was normal, while in 353 (43.7%) patients abnormal baseline ECG was observed (missed data: 593). One hundred thirty eight patients had recent (less than 6 months) history of angiographic evaluation. Among this subgroup of patients, 21 cases had normal angiography, while 117 patients had different degrees of CAD: Eight (6.8%) patients with significant LM (Left Main) Lesion, 99 (84.6%) patients with significant LAD (Left Coronary Artery) lesion, 64 (54.7%) cases significant RCA (Right Coronary Artery) lesion, and 64 (54.7%) patients with significant LCX (left Circumflex Artery) lesion. Forty (34.2%) patients suffered from single vessel disease, 41 (35%) two vessel disease, and 36 (30.8%) three vessel coronary disease.

Table 1. Distribution of the patients based on the age range

Number of patients (Percentage)	Age range
13 (0.95%)	**20-30**
140 (10.3%)	**31-40**
337 (24.7%)	**41-50**
317 (23.2%)	**51-60**
333 (24.4%)	**61-70**
203 (14.9%)	**71-80**
21 (1.5%)	**>80**

In 1191 (86.2%) cases, MPS was done using ^{99m}Tc-MIBI, while in 191 patients Tl-201 was used. The stress protocol consisted of dipyridamole infusion in 956 patients (69.2%), ETT in 392 patients (28.4%), and dobutamine infusion in 33 patients (2.4%). Final interpretation of the MPS was normal in 551 (39.9%) of the cases and abnormal (with evidences of different degrees of ischemia or infarction) in the remaining patients. In our sample of patients, the sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy of MPS in detection of angiographically positive CAD were 88.5%, 71.4%, 94.3%, 46.8% and 75.3%, respectively. Table 3 summarizes the frequency of paraclinic findings in the

studied population. The proportion of abnormal scans was significantly higher in male patients (66.7%), as compared to the females (54.4%) (p<0.001).

Table 2. The frequency of cardiac symptoms and risk factors in the studied population.

Risk Factor		Number of patients (Percentage)	
Hypertension		428 (30.9%)	**M:** 142 (22.3%)* **F:** 286 (37.8%)*
Dyslipidemia		410 (28.1%)	**M:** 164 (25.8%)* **F:** 246 (32.5%)*
Diabetes Mellitus		235 (17.0%)	**M:** 93 (14.6%)* **F:** 142 (18.8%)*
Cigarette Smoking		103 (8.0%)	**M:** 87 (13.7%)* **F:** 16 (2.1%)*
Chest pain	**Typical**	310 (22.3%)	**M:** 142 (22.3%) **F:** 168 (22.4%)
	Atypical	589 (42.3%)	**M:** 251 (39.5%) **F:** 338 (45%)
	No chest pain	489 (35.1%)	**M:** 242 (38.1%) **F:** 247 (32.8%)

* Percentage in gender (M: 636, F: 756)

DISCUSSION

In our country, cardiovascular diseases are the second cause of mortality of the population after accidents as the first one of death. Hence, it seems necessary to assess the population regarding the frequency of major cardiac risk factors, in order to establish appropriate preventive measures. Based on our study findings, in our country and military hospital setting HTN is the most common cardiac risk factor in patients suspected to suffer from CAD. This figure is similar to reports from developed countries: Hachamovitch et al have reported a prevalence of 43.3% for HTN in patients referred to their department of nuclear medicine for MPS, while the prevalence of DLP (40.6%), CS (16.0%) and DM (11.6%) were lower (7). These respective values were 47%, 36.0%, 24.0% and 18%, in another study (8). Another report from a general hospital in the northern east of Iran shows that HTN is seen in 53% of the cases, while DLP, DM and CS are reported in 37%, 29% and 20% of the cases, respectively (9).

One of the main differences between our study population and the reported feature of the developed countries is lower prevalence

rate of CS (8% versus 16%), which is more significant in the female patients (2.1%). This difference is related to cultural habits of patients. It seems that military personnel are less prone to CS behavior. Overall, the frequency of different risk factors in our studied population is lower than the report from the developed countries, a fact that means the overall risk stratification of patients in our country, when referred for MPS assessment, is lower. Also the number of major risk factors for each patient was remarkably lower in our population. Hachamovitch et al have reported that 23.3% of their patients had no major risk factor, while 36.6% had one and 40.1% had two risk factors. Also in another study by the same author, the mean number of major cardiac risk factors was reported to be 1.3 per patient, a number which is significantly higher than our study population (10). These findings may suggest that overall health status of military personnel is better than general population, although the age of the patients is an important confounding factor: the mean age of our patients when they are referred for MPS (55.3year) is considerably lower than that of the developed countries (62.8 year) (7).

Table 3. The frequency of paraclinic findings in the studied population.

MPS Result		Abnormal	Normal	Total
Angiography	Positive *	100 (72.5%)	17 (12.3%)	117 (84.8%)
	Negative	6 (4.3%)	15 (10.9%)	21 (15.2%)
	Total	106 (76.8%)	32 (23.2%)	138 (100%)
ETT Stress Test	Positive	64 (17.6%)	36 (9.9%)	100 (27.5%)
	Negative	100 (24.5%)	164 (48%)	264 (72.5%)
	Total	164 (42.1%)	200 (57.9%)	364 (100%)
Dipyridamole Stress Test	Positive	63 (7.0%)	16 (1.8%)	79 (8.8%)
	Negative	504 (57.9%)	287 (3.3%)	791 (91.2%)
	Total	567 (64.9%)	303 (35.1%)	870 (100.0%)
Dobutamine Stress Test	Positive	5 (16.2%)	1 (3.2%)	6 (19.4%)
	Negative	17 (54.7%)	8 (25.8%)	25 (80.5%)
	Total	22 (70.9%)	9 (29.0%)	31 (100.0%)

* At least one vessel involvement with more than 50% stenosis.

However, in the population studied by Hachamovitch et al, the frequency of different types of chest pain was relatively similar to our findings: No chest pain was reported by 38.4% of patients, typical chest pain and atypical/non-aginal chest pain was reported by 61.6% of patients. Also, similar to the study findings in developed countries, the prevalence of abnormal MPS was significantly higher in male patients, as compared to females (11).

The differences in the pattern of cardiovascular symptoms and risk factors can be considered as indirect evidences to the fact that the pattern of referral for MPS in our country is significantly different from those in developed countries, a fact that warrants further evaluation in order to confirm its appropriateness based on the validated international guidelines (12, 13). This concern will be of more significance by the fact that in our country the mean age of the patients when they are referred for MPS are considerably lower than that of the developed nations (7).

In our study, the same percentage of patients underwent dipyridamole infusion as the stress protocol as those in developed countries: Kim et al have reported that in their population, 70 percent of MPS scintigraphies were done using dipyridamole infusion as the stress protocol (14). However, as the mean age of our patients was significantly lower, it might be concluded that in the nuclear medicine community in Iran, there is less trend toward selection of exercise protocol as the stress phase of MPS. Also, the sensitivity, specificity, PPV, NPV and accuracy of MPS in our study was comparable with those previously reported by other investigators of our country in the setting of a teaching hospital (15). Hence, no major difference is noticed between the performances of the nuclear medicine department of a military hospital or a teaching hospital.

Study limitations: One of the main limitations of our study was the fact that coronary angiographies have been done by different cardiologists.

CONCLUSION

In our population hypertension is the most frequent risk factor, so extensive social programs should be implemented aiming at controlling this variable, in order to prevent its possible cardiac complications. Cigarette smoking is less common than general population, which could be due to social characteristics of the target community and their beliefs. This positive social attitude should be recognized and promoted.

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