

# FUTURE CARDIAC EVENTS IN NORMALLY DIAGNOSED GATED MYOCARDIAL PERFUSION SPECT (GSPECT)

*Amer H., Niaz K.*

*Jelani A.*

*Alqaseer M.*

*Saleem M.*

*Sheikh M.Y.*

King Abdulaziz Hospital, National Guard Health Affairs (NGHA),  
Al Ahsa, Kingdom of Saudi Arabia

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## Abstract

Coronary heart disease (CHD) is a major cause of mortality and morbidity in Europe and USA and its management consumes a large proportion of national healthcare budgets. Many studies had tested the prognostic value of a normal myocardial perfusion scintigraphy; they concluded that a normal MPI study is associated with a very low rate of future cardiac events. In view of the above this study is designed to determine the risk of future cardiac events after normal MPS in local population.

**Methods:** This was a retrospective observational registry performed in a single center in the Kingdom of Saudi Arabia. The data were collected from the nuclear medicine database identifying all the reported normal myocardial perfusion scans between January 2008 and December 2011 .

**Results:** There were 290 patients identified with normal cardiac nuclear scans in the pre-specified time frame. Basic patient demographics were outlined and the patients' charts were reviewed looking for any major cardiac events such as MI or sudden death. Mean follow up was 14.8 months. There were 2 patients that were admitted with NSTEMI and went on to have diagnostic angiograms. One of those two patients underwent percutaneous coronary intervention with stenting. The other patient had non-obstructive CAD and was advised for medical management only. These findings are consistent with a 0.7% risk of cardiac events after a negative scan

**Conclusion:** The above findings demonstrate that the risk of major cardiac events after a negative nuclear cardiac scan is low and is in keeping with the international statistics available.

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**Keywords:** Future events in normal MPI

## **Introduction**

Coronary heart disease is the most common cause of death in the United States (US) and Europe. [1], Acute coronary syndrome (ACS), a common complication of coronary heart disease, is associated with more than 2.5 million hospitalizations worldwide each year.[2] ACS describes clinical disorders ranging from ST-elevation myocardial infarction (STEMI) to non-ST-elevation myocardial infarction (NSTEMI) and unstable angina (UA).[3] It is estimated that a myocardial infarction (MI) occurs every 34 seconds in the US, and that one person dies each minute from a major coronary event.[4] It is a major public health problem worldwide. To our knowledge, there is no national data available from community based studies on prevalence of CAD in the Kingdom of Saudi Arabia (KSA). A study done by Al-Nozha MM and colleagues [5] about the status of Coronary artery disease in Saudi Arabia concluded that the overall prevalence of CAD in KSA is 5.5%. They suggested a national prevention program at community level as well as high risk groups should be implemented sooner to prevent the expected epidemic of CAD that we are seeing.

Many non-invasive techniques are available for the diagnosis of viable myocardium. Among these nuclear cardiology techniques are the most commonly used approach. Several nuclear imaging procedures are valuable in the diagnosis and management of heart disease, and collectively nuclear cardiology procedures are the most commonly performed studies in nuclear medicine, constituting about 40% of the total for the entire field [6]. A negative study excludes myocardial injury [7].

Many studies had tested the prognostic value of a normal myocardial perfusion scintigraphy, While in general the overwhelming majority of patients with normal MPS are low risk, it is important to point out that the precise level of risk after normal MPS varies widely and in many situations, exceeds the <1% threshold level [8].

This study is designed to determine the risk of future cardiac events after normal MPS in local population and the influence of clinical risk factors over the rate of future cardiac events.

The aim of this study is to determine the risk of future cardiac events after a normal myocardial perfusion scan (MPS) in the Saudi population and compare it with other similar studies that have been done in different population groups.

## **Materials and methods**

### **Study Population**

Chart review of all patients referred to the department of nuclear medicine for Myocardial Perfusion Scan between Jan. 2008 to Dec. 2011 at King Abdulaziz Hospital for National Guards-Al Ahsa

**Inclusion criteria:** Normal perfusion i.e. no perfusion defect whatsoever on MPS and normal function i.e. calculated left ventricular ejection fraction should be  $\geq 50\%$ .

**Exclusion criteria:** Abnormal perfusion i.e. a perfusion defect on MPS and/or abnormal function i.e. left ventricular ejection fraction  $< 50\%$ .

### **Data Collection methods, instruments us, measurements**

Patients charts were reviewed through Jan. 2008 to Dec. 2011. Information was collected through a Performa. Myocardial perfusion scan is performed using pharmacological stress on Forte double head gamma camera by Philips Medical Systems Inc. MPS images were interpreted via semiquantitative visual interpretation using short axis, vertical long axis and horizontal long axis views. Normality was assigned using 20 segments MPS images. Each segment was scored by using 5 point scoring system (0=normal, 1=equivocal, 2=moderate, 3= severe reduction of uptake, 4= absence of detectable tracer uptake). A summed stress score (SSS) was obtained by adding the score of 20 segments of the stress MPS images. A SSS of  $< 4$  was considered normal.

### **Follow-up**

The charts of all the patients who fulfilled the criteria were reviewed for at least one year (mean follow up period 14.8 months) after a normal MPS for any admission regarding MI, or cardiac death. Telephonic interview was performed to ask for any procedure performed like CABG, PTCA or any treatment outside the king abdulaziz hospital or other intervention related to cardiology.

### **Data Management and Analysis Plan**

- Descriptive results are presented by mean $\pm$ SD for continuous variables.
- Number (%) are reported for categorical variables .

Percentage cardiac event among normal MPS are meaned by using Binomial distribution.

## Results

### Demographic data of the patients

There were 290 patients identified with normal cardiac nuclear scans in the pre-specified time frame. 103 of these patients were male accounting for 35% of the total population . Average age at the time of examination was  $60.6 \pm 11.8$  years and the highest age group was between 66 and 70 years (Figure 1)

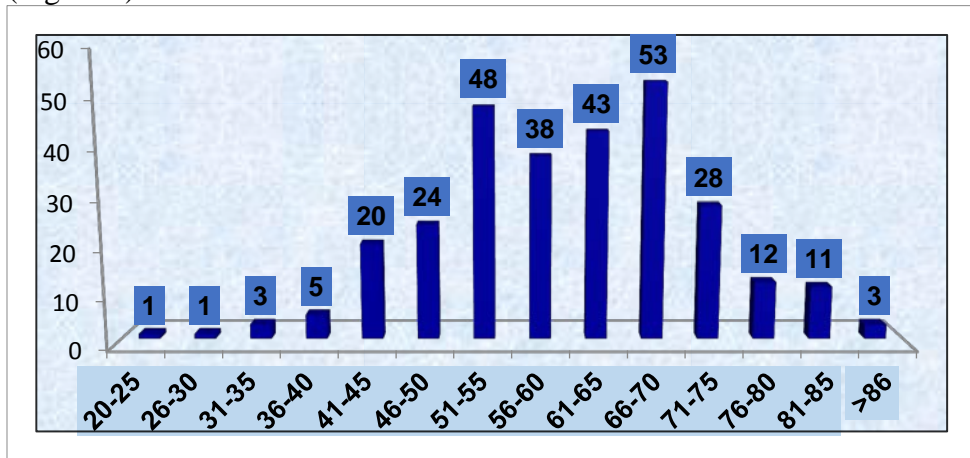


Figure 1 Age-wise distribution in the different age groups

### Risk factors for CAD

The patients were presented with one or more risk factors. Out of the 290 patients, 61% were diabetic, 75.2% were hypertensive, 65.5% were dyslipidemic, 2.8% had a significant positive family history of IHD, 7.2% were smokers, and 24.1% had history of CAD. 2.1% of the total patient populations had prior CABG. 2.4% of the patients had prior percutaneous coronary intervention (PCI) (Figure 2).

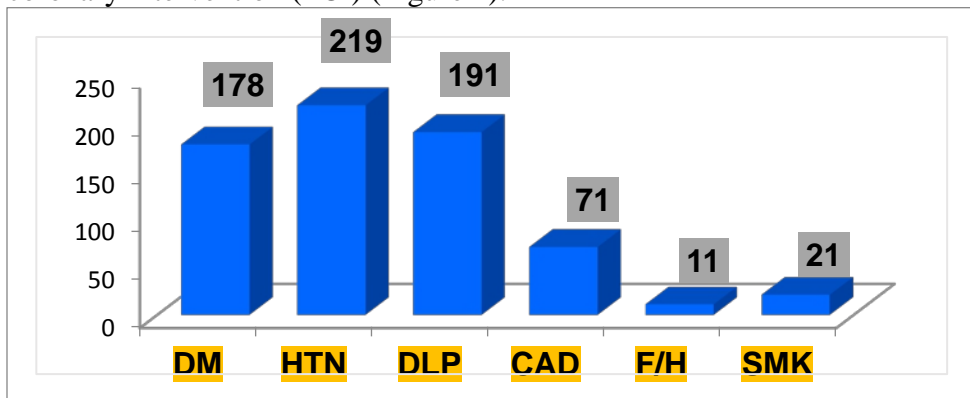


Figure 2 Risk factors for the patients , HTN constitute the majority. (DM; Diabetes Mellites, HTN; Hypertension, DLP; Dyslipidemia, CAD; coronary artery disease, F/H; family history of CAD, SMK; Smoking).

## Follow up Data

There were 2 patients that were admitted with NSTEMI and went on to have diagnostic angiograms. One of those two patients underwent percutaneous coronary intervention with stenting (Figure 3 and 4). The other patient had non-obstructive CAD and was advised for medical management only. These findings are consistent with a 0.7% risk of cardiac events after a negative scan.

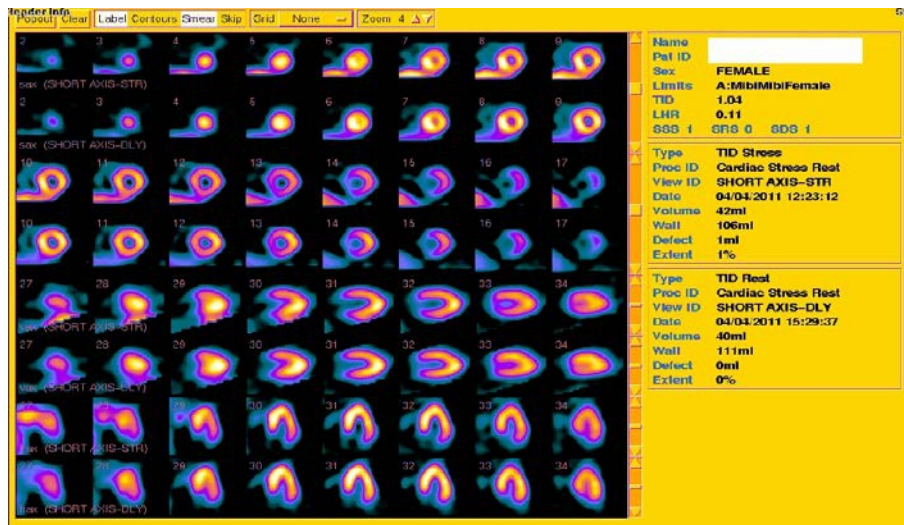


Figure 3 PATIENT A Myocardial Perfusion Scan for a patient referred as a suspected coronary artery disease shows normal sized left ventricular cavity with normal perfusion of left ventricular myocardium 04/04/2011

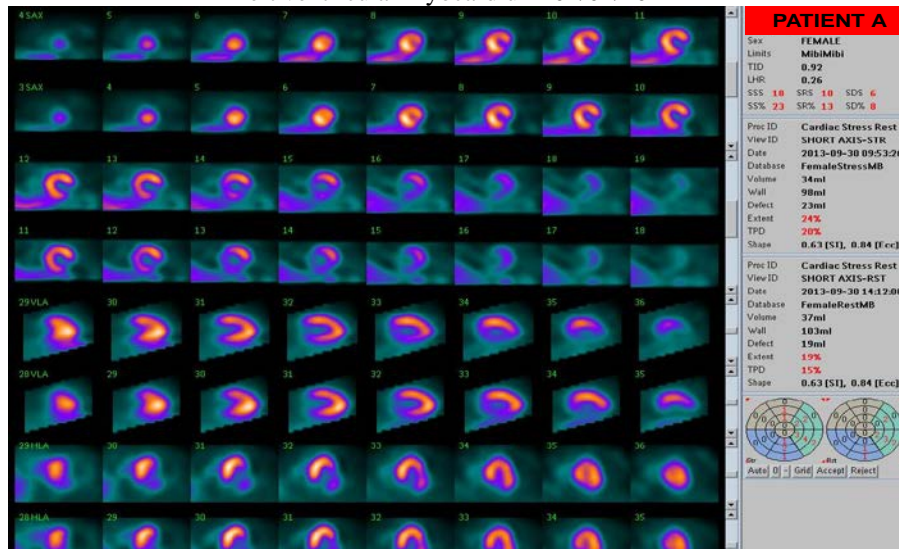


Figure 4 PATIENT A Myocardial perfusion scan for the above patient after he has developed a cardiac event is suggestive of fixed perfusion defect, medium size, involving the apical lateral, mid and basal inferolateral walls of the left ventricular myocardium. Findings suggest disease affecting LCX territory. 30/09/2013.

The other patient had non-obstructive CAD and was advised for medical management only (Figure 5 and 6). These findings are consistent with a 0.7% risk of cardiac events after a negative scan. Reviewing the data of the two patients who developed future events showed that they have multiple risk factors complicated their normal lives and both were sharing the same risk factors involving DM, HTN, Dyslipidemia and history of coronary artery disease (CAD) and both cases were females.

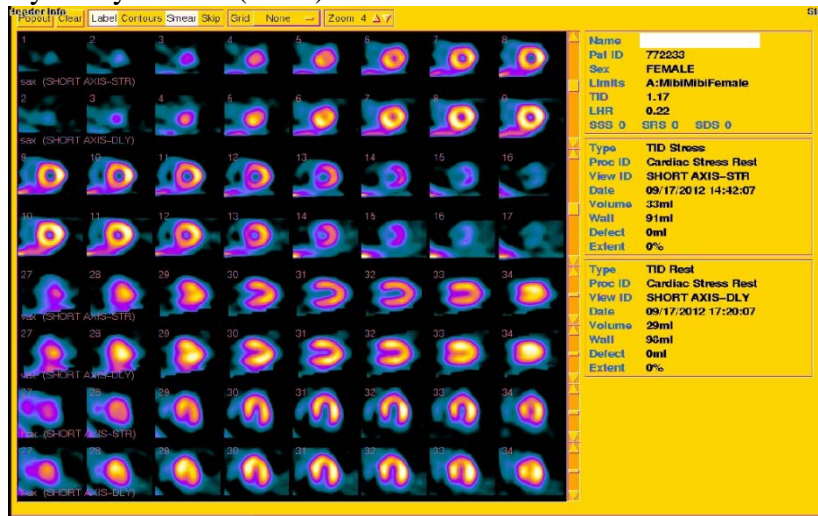


Figure 5 Myocardial perfusion scan for a patient who developed a cardiac event in the form of NSTEMI is suggestive of reversible perfusion defect, small size, involving the apical lateral, apical anterior walls of the left ventricular myocardium. 17/09/2012.

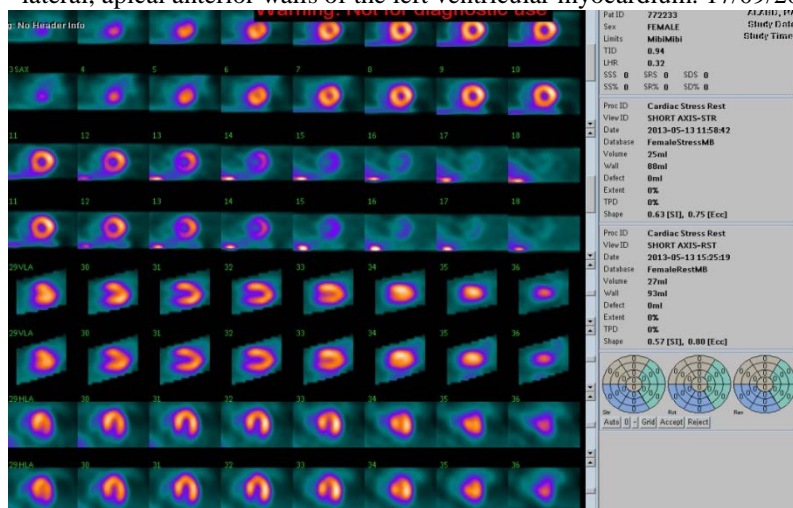


Figure 6 Same patient mentioned above (Figure 5) with improvement in the myocardial perfusion throughout left ventricular myocardium. Status post therapy.

## Discussion

To our knowledge this study was the first effort to be done in the Saudi population, to determine the risk of future cardiac events after a normal Myocardial Perfusion Scan and utilising the Tc-99m sestamibi as the radiopharmaceutical. The result obtained in this study was 0.7% risk for future cardiac event after a normal scan with a small however a representative sample formed of 290 patients all of them were Saudi national, 35% of whom were male gender.

The results obtained in this study are not significantly different from many studies that have published. The patients were followed up in the cardiac clinic in our institution. Those patients that failed to follow up or were discharged from the clinic received a phone call to enquire about any further cardiac events that occurred after their normal cardiac scan.

Many studies had tested the prognostic value of a normal myocardial perfusion scintigraphy, Hachamovitch R et al underwent a study including 7,376 consecutive patients with normal exercise or adenosine MPS. The highest risk subgroups had a maximal event rate of 1.4% to 1.8%/year. That is, a 1% per year risk of death (1/100 per year) and a 0.8% per year risk on non-fatal MI (1/125 per year). [9]

Another study was done by Louise D et al, 2007 entitled as The Prognostic Value of Normal Exercise Myocardial Perfusion Imaging and Exercise Echocardiography: A Meta-Analysis. Where only patients who underwent exercise (not pharmacologic stress) were included in the meta-analysis. 8008 patients were included in the meta-analysis. The negative predictive value (NPV) for MI and cardiac death was 98.8% (95% confidence interval [CI] 98.5 to 99.0) over 36 months of follow-up for MPI, and 98.4% (95% CI 97.9 to 98.9) over 33 months for echocardiography. [10]

A recent cohort study done by Van Tosh A, comprised 457 women evaluated for suspected CAD who had normal pharmacologic stress (82) Rb PET MPI. no patient had clinically evident CAD. Follow up was done for 7 years and during that 11 deaths non ischemic, 3 non fatal myocardial infarctions, 3 percutaneous coronary interventions and 1 coronary artery bypass operation. Average risks of death and initial non fatal cardiac events were 0.72 and 0.47% per year respectively. Cardiac events were associated with a history of diabetes ( $p < 0.0003$ ) and a family history of CAD ( $P < 0.05$ ). They concluded that a normal PET study is associated with a very low rate of future cardiac events. Women with a diabetes and family history of CAD are more likely to sustain events and require close surveillance for the development of coronary disease.[11]

While in general the overwhelming majority of patients with normal MPS are low risk, it is important to point out that the precise level of risk after normal MPS varies widely and in many situations, exceeds the  $<1\%$

threshold level. Studies in patients undergoing pharmacological stress, a population at higher risk and more co morbidities have reported hard event rates of 1.3-2.7% per year [12,13] suggesting that underlying clinical risk and prior CAD may influence event rates after normal MPS.

## **Conclusion**

It is concluded that a normal MPI study is associated with a very low rate of future cardiac events. However the above findings demonstrate that the risk of major cardiac events after a negative nuclear cardiac scan is low and is in keeping with the international statistics available.

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