

VALIDATION OF PROGNOSTIC AND NEGATIVE PREDICTIVE VALUES OF NORMAL CARDIAC PERFUSION STUDY IN THE LOCAL POPULATION

Maseeh uz Zaman, Sharjeel Usmani, Kashif Niyaz, Shahid Kamal, Abid Hameed

Karachi Institute of Radiotherapy And Nuclear Medicine (KIRAN), Karachi, Pakistan.

PJR July - September 2009; 19(3): 77-79

ABSTRACT

The aim of this study was to evaluate the prognostic value of a normal MPI in our population. **PATIENTS AND METHOD:** This study included 413 patients with normal MPI (with adequate stress) performed with sestamibi. Out of 413 patients, 217 were male and 196 were female with mean age 52.4 ± 9.8 years (median 52 years). The study was indicated for chest pain diagnosis in 330 (80%) and for the assessment of functional capacity in remaining 83 (20%) patients. The cardiac risk factors were prevalent including hypertension in 92 (22.3%), diabetes in 52 (12.6%) and dyslipidemia in 52 (12.6%). Furthermore, 21.5% patients had >2 risk factors. 248 (60%) individuals underwent dynamic stress following Bruce or Modified Bruce Protocol and end points were achievement of >85% target heart rate, chest pain or appearance of significant ECG changes. Remaining 165 (40%) individuals had dipyridamole intervention (standard protocol). A stress-rest (one day protocol) SPECT study was acquired using single head ECAM (Siemens) or double head Toshiba GCA-7200A gamma cameras. These patients were followed up for 18 months \pm 5 months and occurrences of hard cardiac events (MI or cardiac death) were asked on telephone. **RESULTS:** The observed cardiac deaths were 3/413 (0.73%) and non-fatal MIs were seen in 4/413 (0.97%) on 18 months follow up. The observed cardiac mortality rate for patients with normal MPI was 0.73%. Risk adjusted (controlling for age, sex and type of stress) overall cardiac survival exceeded 99.27%. For women and men, the average cardiac survival was 99% and 99.5% respectively ($p=0.001$). Additionally for patients undergone exercise, the annualized survival rate was 99.6% and 98.8% for those who had dipyridamole intervention. **CONCLUSION:** A normal sestamibi SPECT study with adequate stress is associated with annualized cardiac death rate of 0.5% and a negative predictive value of 98.33%. Furthermore, these statistics of our population are comparable with most of the published studies.

Keywords: Normal Myocardial Perfusion Scan; Negative predictive value; Prognostic value; Event rate

Introduction

For the last three decades myocardial perfusion imaging (MPI) has become an important tool not only in the diagnosis but also in the decision making regarding the management of coronary artery disease. It is considered as the door keeper for the cardiac catheterization. Numerous studies have shown an event rate of < 1% per year for a normal MPI with

adequate stress.¹⁻⁴ In Pakistan, nuclear cardiology was started in the early nineties and since then an enormous growth has been observed in the last 15 years as seen in the USA and EU countries. To the best of our knowledge no study from Pakistan so far has been found in the literature depicting the prognostic value of a normal cardiac perfusion scan. The aim of this prospective study was to evaluate the prognostic value of normal myocardial perfusion scan in our population.

Correspondence : Dr. Maseeh uz Zaman
Head, Nuclear Medicine Section,
KIRAN, Scheme 33,
Karachi.
Ph: 34646601-4
E-mail: mzaman63@hotmail.com

Patients and Methods

This study included 413 patients with normal MPI (with adequate stress) performed with sestamibi at Karachi Institute of Radiotherapy And Nuclear Medicine (KIRAN) from January 2002 onward. Out of 413 patients, 217 were male and 196 were female with a mean age 52.4 ± 9.8 years (median 52 years) (Fig. 1).

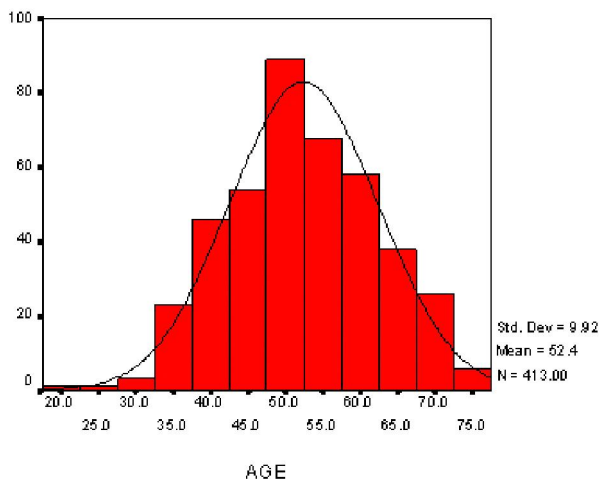


Figure 1. Histogram showing the age distribution of the study population.

The study was indicated for chest pain diagnosis in 330 (80%) and for the assessment of functional capacity in remaining 83 (20%) patients. The cardiac risk factors were prevalent including hypertension in 92 (22.3%), diabetes in 52 (12.6%) and dyslipidemia in 52 (12.6%). Furthermore, 21.5% patients had 2 or more than 2 risk factors (Fig. 2 and 3).

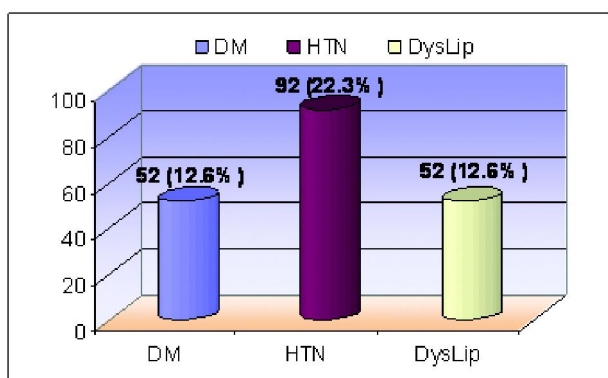


Figure 2: Histogram showing risk factor distribution in the study sample.

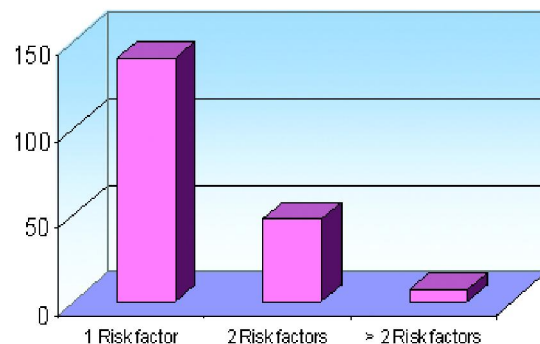


Figure 3: Broader distribution of risk factors among study population.

248 (60%) individuals underwent dynamic stress following Bruce or Modified Bruce Protocol and end points were achievement of $>85\%$ target heart rate, chest pain or appearance of significant ECG changes. Remaining 165 (40%) individuals had dipyridamole intervention (standard protocol).

A stress-rest (one day protocol) SPECT study was acquired using single head ECAM (Siemens) or dual head Toshiba GCA-7200A gamma cameras. These patients were followed up for 18 months \pm 5 months and occurrence of hard cardiac events (i.e. MI or cardiac death) was asked on telephones.

Results

The observed cardiac deaths were 3/413 (0.73%) and non-fatal MIs were seen in 4/413 (0.97%) on 18 months follow up (Fig. 4).

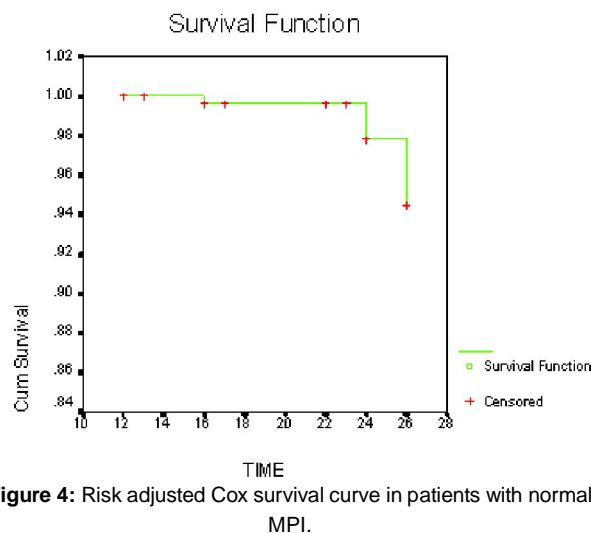


Figure 4: Risk adjusted Cox survival curve in patients with normal MPI.

The observed cardiac mortality rate for patients with normal MPI was 0.73%. Risk adjusted (controlling for age, sex and type of stress) overall cardiac survival exceeded 99.27%. For women and men, the average cardiac survival was 99% and 99.5% respectively ($p=0.001$). Additionally for patients undergone exercise, the annualized survival rate was 99.6% and 99.8% for those who had dipyridamole intervention.

Statistical Analysis

Baseline variables included in Cox regression analysis were as follow¹ clinical variables including age, sex, presence or absence of chest pain and coronary risk factors like diabetes, hypertension, smoking and hypercholesterolemia.

To determine the prognostic value of a test, all other information known regarding the patient prior to that time was included; the Cox proportional hazards model was used in fashion to determine statistical models. The dependant variables in the Cox proportional hazards analysis is the time to an event rather than the occurrence of the event within a determined time period. The threshold for entry of variables into model was $P<0.5$.

Discussion

Current state of the art interpretation of myocardial perfusion SPECT used risk stratification based on imaging results. Risk stratification with radionuclide perfusion imaging is powerful because the major determinant of cardiovascular disease prognosis is assessed by measurements of SPECT including amount of infarcted or viable myocardium.⁵ Similarly the annual event rate in patients with a normal myocardial perfusion scan is $<1\%$.⁶

In Pakistan, Nuclear Cardiology has shown tremendous growth in last two decades. The reason for this enormous growth is due to its high sensitivity, non-invasiveness and its precision in predicting the future outcome or risk stratification. In this study cardiac death rate for normal MPI was 0.73%. Similarly the annualized cardiac survival rate was 99.6%

(for exercise) and 98.8% (for dipyridamole). The negative predictive value of normal MPI was 98.33%. All these figures are comparable with most of the published data from abroad. We could not find on literature search any study depicting the negative predictive value on Pakistani population.

Conclusion

A normal sestamibi SPECT study with adequate stress is associated with annualized cardiac death rate of 0.5% and a negative predictive value of 98.33%. Furthermore, these statistics of our population are comparable with most of the published studies.

References

1. Leslee JS, Robert H, Salvador BN, Michael SL, Naomi A, Joy BBS et al. Prognostic value of normal exercise and adenosine Tc-99m Tetrofosmin SPECT Imaging: Results from the multi centre registry of 4,728 patients. *J Nucl Med.* 2003;**44**:134-9.
2. Berman DS, Shaw, LJ, Germano G. Nuclear Cardiology. In: Fuster V, Alexander RW, O'Rourke RA, eds. *Hurst's: The Heart.* 10th ed. New York, NY: McGraw-Hill; **2001**:525-65.
3. Berman D, Hachamovitch R, Lewin H, Friedman J, Shaw L, Germano G. Risk of stratification in coronary artery disease: Implication for stabilization and prevention. *Am J Cardiol.* 1997;**79**:10-6.
4. Shaw LJ, Berman D, Hachamovitch R, et al. Non-Invasive strategies for the estimation of cardiac risk: an observational assessment of outcome in stable chest pain patients. *Am J Cardiol.* 2000;**86**: 1-7.
5. Hendel RC. Diagnostic and prognostic applications for vasodilator stress myocardial perfusion imaging and the importance of radiopharmaceutical selection. *J Nucl Cardiol.* 2001;**8**:523-7.
6. Iskandar S, Iskandrian AE. Risk assessment using single photon emission computed tomographic Technetium-99m sestamibi imaging. *J Am Coll Cardiol.* 1998;**32**:57-62.