APPLICABILITY OF APPROPRIATE USE CRITERIA FOR MYOCARDIAL PERFUSION SCAN IN INDIAN SCENARIO

Gopi Krishna Kenchi, N. Kavitha, Madhur K Srivastava

Abstract:

Background: *Appropriate usage Criteria (AUC) for nuclear imaging exams were created by American College of Cardiology (ACC) e American Society of Nuclear Cardiology (ASNC) to allow the rational use of tests. Little is known whether these criteria have been followed in clinical practice.*

Objective: *To evaluate whether the medical applications of myocardial perfusion scintigraphy (MPS) in a tertiary cardiology hospital were suitable to the criteria of indications proposed by the American medical societies in 2009.*

Methods: *We included records of patients who undergone MPS, from April 2016 up to August 2016. Demographic characteristics, patient's origin, coronary risk factors, clinical presentation, ECG, 2d echocardiogram, TMT and AUC of medical applications were studied. The criteria were evaluated by two independent cardiologists and, in doubtful cases, defined by a medical expert in MPS.*

Results: *Total no of cases included in the study were 334 patients. Mean age was 62 ± 10 years. Of the 334 records reviewed, 201 (60.17%) studies were performed in men and 133 (39.8%) were performed in women. With ACC 2009, 168 (50.29%) were considered appropriate indications and 166 (49.70%) were considered inappropriate and uncertain indications. The AUC Sensitivity is 78.8%, Specificity of 58.7%, Positive Predictive Value of 37.5% and Negative Predictive Value of 89.8%.*

Conclusions: *In 63(18.8%) of patients MPS investigation is used appropriately to detect the CAD according to ACC& ASNC guidelines of 2009.*

Keywords: *AUC-Appropriative usage criteria, Myocardial perfusion scan, Risk factors.*

INTRODUCTION

The advances in medical knowledge and technological development have increased the diagnostic capacity of medical tests. These improvements have led to a marked increase in the use of imaging tests and, consequently, in the associated costs. In the United States, a study with

patients treated by Medicare, during 1993-2001, showed a mean annual increase of 6.1% in the number of cardiac stress imaging tests, whereas the increase in cardiac catheterization was 2% and percutaneous coronary interventions were less than 1%, for the total number of individuals with acute myocardial infarction[1]. Four million myocardial perfusion scintigraphy (MPS) tests were performed in 1998; in 2008 this number was 8 million [2]. This increase in the volume of diagnostic image procedures, higher than any other medical procedure in the United States, led to the need to create instruments that suit the clinical practice with respect to the most recent scientific evidence [3]. For this purpose, the American College of Cardiology Foundation (ACC) and the American Society of Nuclear Cardiology (ASNC) published in 2005 the Appropriateness Criteria for Single-Photon Emission Computed Tomography (SPECT) Myocardial Perfusion Imaging [4]. In June 2009, a revised and updated version was published among other scientific communities. This revised edition was titled Appropriate Use Criteria for Cardiac Radionuclide Imaging [5].

Studies worldwide have tested the application of these appropriateness criteria with the aim of assessing the quality of assistance and guiding strategies for improvement [6]. The aim of this study was to assess whether the medical use of MPS in a private nuclear medicine department of a tertiary cardiology hospital was appropriate, according to the criteria of indications proposed by the American medical associations in 2009.

METHODS

This was a retrospective review of 334 medical records of consecutive outpatients subjected to resting and stress (physical or pharmacological) MPS scans, according to clinical indication, performed between April 2016 and August 2016. The analyzed variables included the following: demographic characteristics, patients' origin

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Gopi Krishna Kenchi[1], N.Kavitha[2], Madhur K Srivastava
[1]Senior Resident, Department of Cardiology, NIMS, India
[2] Professor& HOD, Department of Nuclear Medicine, NIMS,India
[3] Asst. Prof, Department of Nuclear medicine, NIMS,India
Corresponding author: Gopi Krishna Kenchi
Email: drgopikrishna44@gmail.com

(outpatient or inpatient), coronary risk factors, and appropriateness of the use of the test according to the 2009 ACC/ASNC appropriateness criteria.

The appropriateness criteria are composed of scenarios or clinical indications that include most cases observed in nuclear medicine cardiac tests. Each of these scenarios is scored on a scale of 1 to 9: I) 7 to 9, classified as appropriate (the test is generally acceptable and consists in a reasonable approach to the scenario); II) 4 to 6, uncertain or possibly appropriate, may be acceptable, i.e., it is a reasonable approach to the indication, and uncertainty also implies the need for further investigation or data on patients to definitely categorize the procedure as appropriate or not and to update the criterion; III) 1 to 3, inappropriate, not a reasonable approach to the indication [8]. The appropriateness criteria were created by the American College of Cardiology together with several medical associations, according to the modified Delphi method used by the RAND Institute of the University of California in Los Angeles (RAND/UCLA) [4], which includes the following four steps: (a) listing of the clinical indications for which the test can be used, (b) review of the clinical indications by a panel of interdisciplinary experts and rating of the indications, (c) meeting of the panel of experts with extensive discussion on the clinical indications and new rating, and (d) tabulation of the indications with their respective scores [9].

As recommended by the appropriateness criteria [5], patients were classified as symptomatic if the physician indicated the test due to thoracic pain syndrome, anginal equivalent, or electrocardiogram (ECG) findings indicative of ischemia. The following are examples of symptoms related to thoracic pain: a feeling of chest tightness, heartburn, pain in the shoulder, palpitations, pain in the jaw, and new anomalies on ECG indicative of ischemic heart disease. Symptoms such as dyspnea or reduced tolerance to exertion, which are coherent with coronary artery disease (CAD), were also considered as anginal equivalent.

With regard to the variables under study, patients were considered hospitalized if they were in the emergency room or in any hospital unit. Ages, sex, arterial hypertension, diabetes mellitus, were the variables analyzed according to the information contained in the admission records for the test in the nuclear medicine sector. The reports of the tests considered as normal or not, according to the presence of ischemia, were also analyzed.

The appropriateness of the use of MPS was assessed by two independent physicians and indications were allocated to one of the 67 scenarios provided in the updated document of indications [5] and classified as follows: (A) appropriate, (U) uncertain, and (I) inappropriate. If consensus between the two examiners was not reached, the opinion of a third physician, nuclear medicine physician or certified cardiologist with more than 10 years of experience in the field was used.

The present study was approved by the Ethics Committee.

Statistical Analysis

The results of the variable age are presented as mean ± standard deviation and the remaining results are expressed in percentages. Comparisons were performed using the Mann-Whitney test for age and the chi-squared and Fisher's exact tests for the remaining variables. Probability values < 0.05 were considered statistically significant. The statistical analyses were performed using the Minitab, version 17.

RESULTS

Of the 334 patients under study, the mean age was 62 ± 10years. Male patients accounted for 60.17% (N = 201) of the tests. The most prevalent risk factor for coronary disease was arterial hypertension in 245 (73.3%)] and diabetes mellitus in 187 (55.9%) patients. The demographic characteristics are described in Table 1.

Table 1: Demographic characteristics of the sample (N = 334)

Variables	**N (%)**
Age (mean ± SD)	62 ± 10
Sex	
Male	201 (60.17)
Comorbidities	
HTN	245(73.3)
Diabetes	187 (55.9)

As shown in Table 2, according to the 2009 criteria, 168 (50.2%) were classified as appropriate, 81 (24.4%) as uncertain, and 85 (25.4%) as inappropriate [Fig 1, 2].

Table 2: 2009 ACC appropriateness criteria

Variables	N (%)
Appropriate	168 (50.2)
Inappropriate	85 (25.4)
Uncertain	81 (24.4)

Fig. 1: Bar diagram showing the variables of Table 2

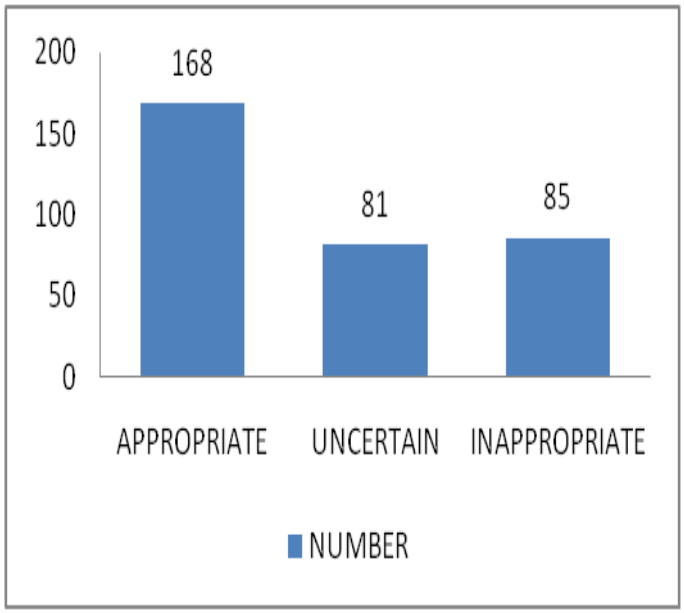
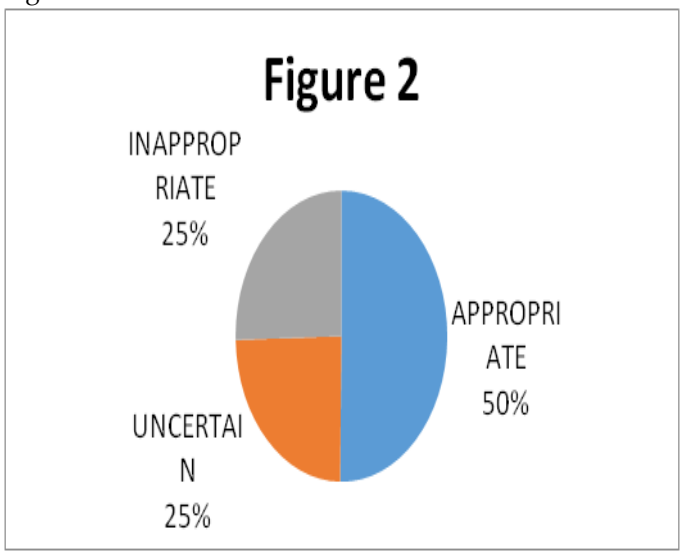


Fig. 2:

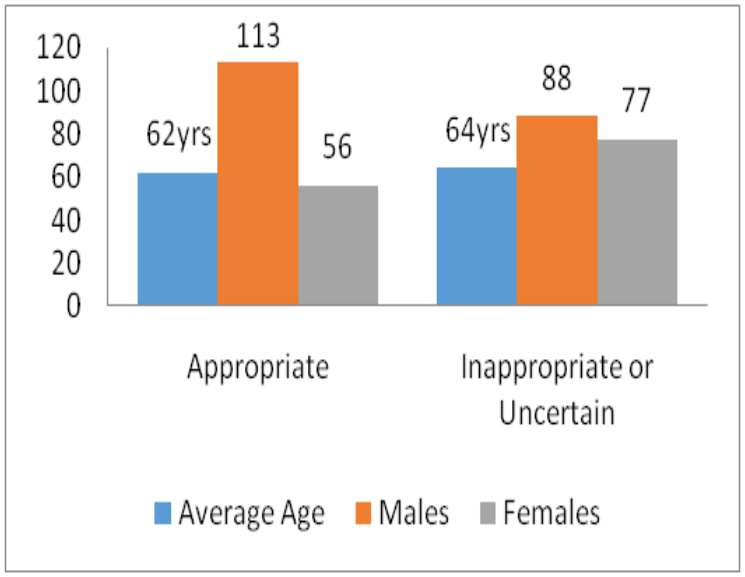


Out 168 patients with appropriate Myocardial perfusion scans, 113 were Males and 56 were Females with average age of 62 ± 10 yrs.Out of 158 patients with uncertain scans or inappropriate scans, 88 were Males and 77 were Females with an average age of 64 ± 7yrs (Table 3, Fig.3).

Table 3: Sex difference among study subjects

	Appropriate	Inappropriate or Uncertain	p Value
Age	62 ± 10yrs	64 ± 7 yrs	
Sex			
Male	113	88	0.00
Female	56	77	0.006

Fig. 3: Bar diagram showing the variables of Table 3

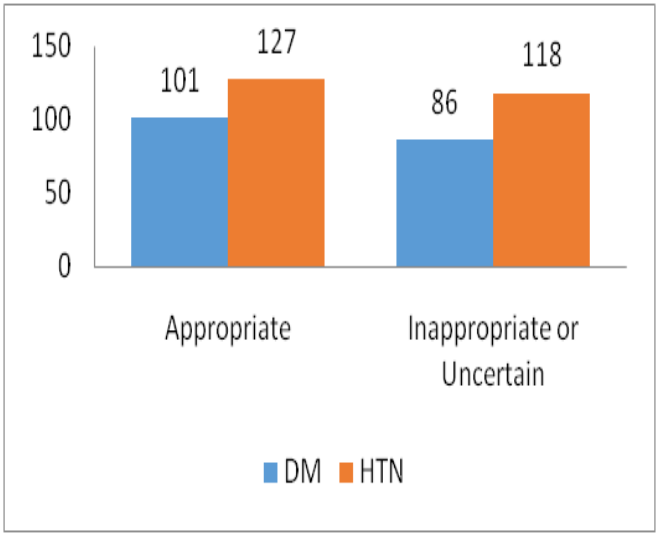


Out 168 patients with appropriate Myocardial perfusion scans, 101 had DM and 127 had HTN. Out of 158 patients with uncertain scans or inappropriate scans, 86 had DM and 118 had HTN (Table 4, Fig. 4)

Table 4: Diabetics and hypertensives among study subjects

Variable	DM – N (%)	HTN – N (%)
Appropriate Scans	101 (60.1)	127(75.5)
Inappropriate or Uncertain Scans	86(54.4)	118(74.6)
p Value	0.29	0.00

Fig.4: Bar diagram showing the variables of Table 4

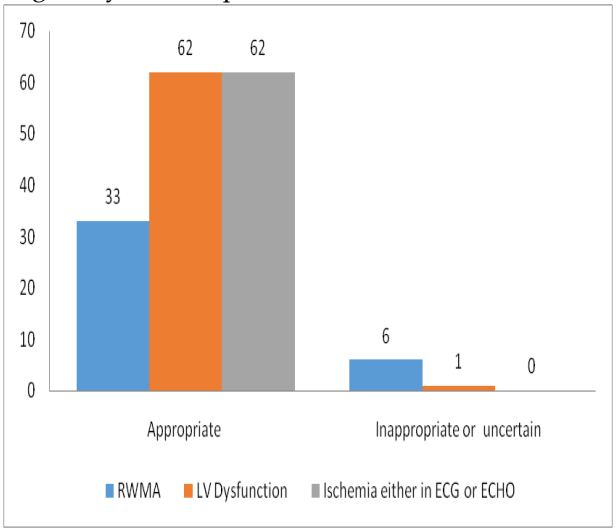


Out 168 patients with Appropriate Myocardial perfusion scans, 33 patients had RWMA, 62 patients had Ischemia either in ECG or ECHO and 62 had LV Dysfunction. Out of 158 patients with either Uncertain or Inappropriate scan 6 patients had RWMA, 5 patients had Ischemia either in ECG or ECHO and 1 patient had LV Dysfunction. (Table 5, Fig. 5)

Table 5: Myocardial perfusion scan details

	Appropriate	Inappropriate or Uncertain	p value
RWMA	33	6	0.00
Ischemia either in ECG/ ECHO	62	0	0.00
LV Dysfunction	62	1	0.00

Fig.5: Myocardial perfusion scans details



DISCUSSION:

The appropriateness criteria were developed by the ACC and ASNC with the purpose of assisting physicians and institutions, as well as reducing healthcare costs.

In the present study, the clinical indications for MPS showed a percentage of 50.2% appropriateness according to 2009 ACC, in a private cardiology hospital. The AUC Sensitivity is 78.8%, Specificity of 58.7%, Positive Predictive Value of 37.5% and Negative Predictive Value of 89.8%.The high NPV of AUC in the present study indicates the accuracy of AUC criteria.

The use of the appropriateness criteria has proved to be useful for the evaluation of the quality of requests for complementary tests [12].

The study by Gibbons et al [1], ACC/ASNC appropriateness criteria was applied to 78% of the clinical indications for MPS 2009 ACC. the sample only included hospitalized patients. The hospitalized patients often have more serious diseases, for which the use of scintigraphy is better established, probably contributed to higher rate of appropriate requests in the group of inpatients.

The study conducted by David E Winchster et al [19] concluded that when compared to symptomatic patients, MPI for asymptomatic patients were more commonly inappropriate; however, the prevalence of ischemia was similar between the groups

The update of criteria and the conduction of more studies are necessary for the inclusion of more indications. The rational use of complementary tests in cardiology is one of the major challenges experienced by clinical practitioners today [18-20]. Although technology has allowed these methods to aggregate an increasing amount of valuable information, its indiscriminate use may not contribute in changing the outlined strategy, and may even add costs and risks inherent to the techniques, such as exposure to contrast media or radiation [21,22]. The search for quality directly involves the refinement of clinical referrals as a way of selecting patients who are most likely to benefit from these tests [23,24].

CONCLUSION:

In 63 (18.3%) of patients MPS investigation is used appropriately to detect the CAD according to ACC& ASNC guidelines of 2009.

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