Impact of Rest Myocardial Perfusion Imaging on Clinical Management of Non-High Risk Chest Pain in the VA Caribbean Healthcare System Emergency Department: 2006-2008

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Objective: To evaluate the appropriate clinical use of an acute rest myocardial perfusion imaging (R-MPI) in the initial emergency department (ED) evaluation of a patient presenting with chest pain (CP).

Methods: This is a retrospective study of patients evaluated with CP at the ED with an acute R-MPI. The data collected included medical history, clinical presentation, electrocardiogram, laboratory data, MPI results, confirmatory studies, disposition diagnosis and cost analysis.

Results: Three-hundred-sixty-six (366) patients were evaluated. The population studied had a mean Thrombolysis in Myocardial Infarction (TIMI) score of 2 and predominance of patients in the Virginia Commonwealth University (VCU) CP Category-Scale between level 3 and 4 (34% and 49% respectively). The risk of acute coronary syndrome (ACS) was significantly higher in patients with abnormal compared to normal studies (50% versus 0.4%; P < .0005; RR, 129.5; 95% CI, 18 to 924). There were a total of 14 and 19 major adverse cardiovascular events (MACE) events during the follow-up of 30-days and 1-year respectively. There were no cardiovascular fatalities. The risk of MACE at 30-days was significantly higher in patients with abnormal compared to normal studies (12% versus 0.4%; P < .001; RR, 32; 95% CI, 4.2 to 240), as well as with 1-year of follow-up (14% versus 1.6%; P < .001; RR, 9.1; 95% CI, 3.1 to 27).

Conclusion: Using acute R-MPI in the evaluation of non-high risk patients presenting with CP is a safe, reliable and cost-effective strategy to be used in the ED to predict ACS and future MACE. [*P R Health Sci J 2016;35:9-15*]

Key words: Acute Rest Myocardial Perfusion Imaging, Chest Pain, Coronary Artery Disease, Acute Coronary Syndrome, Emergency Department

Coronary artery disease (CAD) is the leading cause of adult mortality in the USA claiming approximately 500,000 lives each year. Every year more than 8-million patients present to an emergency department (ED) within the USA, with complains of chest pain (CP) or other symptoms suggestive of myocardial ischemia (1). The clinician must distinguish between those who have an acute coronary syndrome (ACS) that require more aggressive and urgent therapy compared to other more benign conditions that may be managed conservatively and without hospital admission. The optimal evaluation approach requires a balance between a cost-effective care and patient safety. The inappropriate disposition of a patient with ACS from the ED has been associated with increased mortality and liability (2, 3). On the other hand, leaning towards a more cautious management may lead to overutilization of resources and excessive hospitalizations.

Current assessment and stratification of patients presenting to the ED with CP includes clinical history, physical examination, electrocardiogram (ECG) and cardiac markers (CMs) of myocardial necrosis (Figure 1) (4). A growing number of EDs have developed chest pain units (CPU) with structured processes including the use of accelerated diagnostic protocols (ADP). The ADP consists of serial ECGs and CMs obtained over a 6 to 12-hour period (4). A negative evaluation consists of negative CMs against acute myocardial infarction (AMI), ECG without ischemic changes or absence of recurrent resting angina symptoms that would confirm the diagnosis of an ACS. After this ADP period to exclude higher risk patients with definite ACS,

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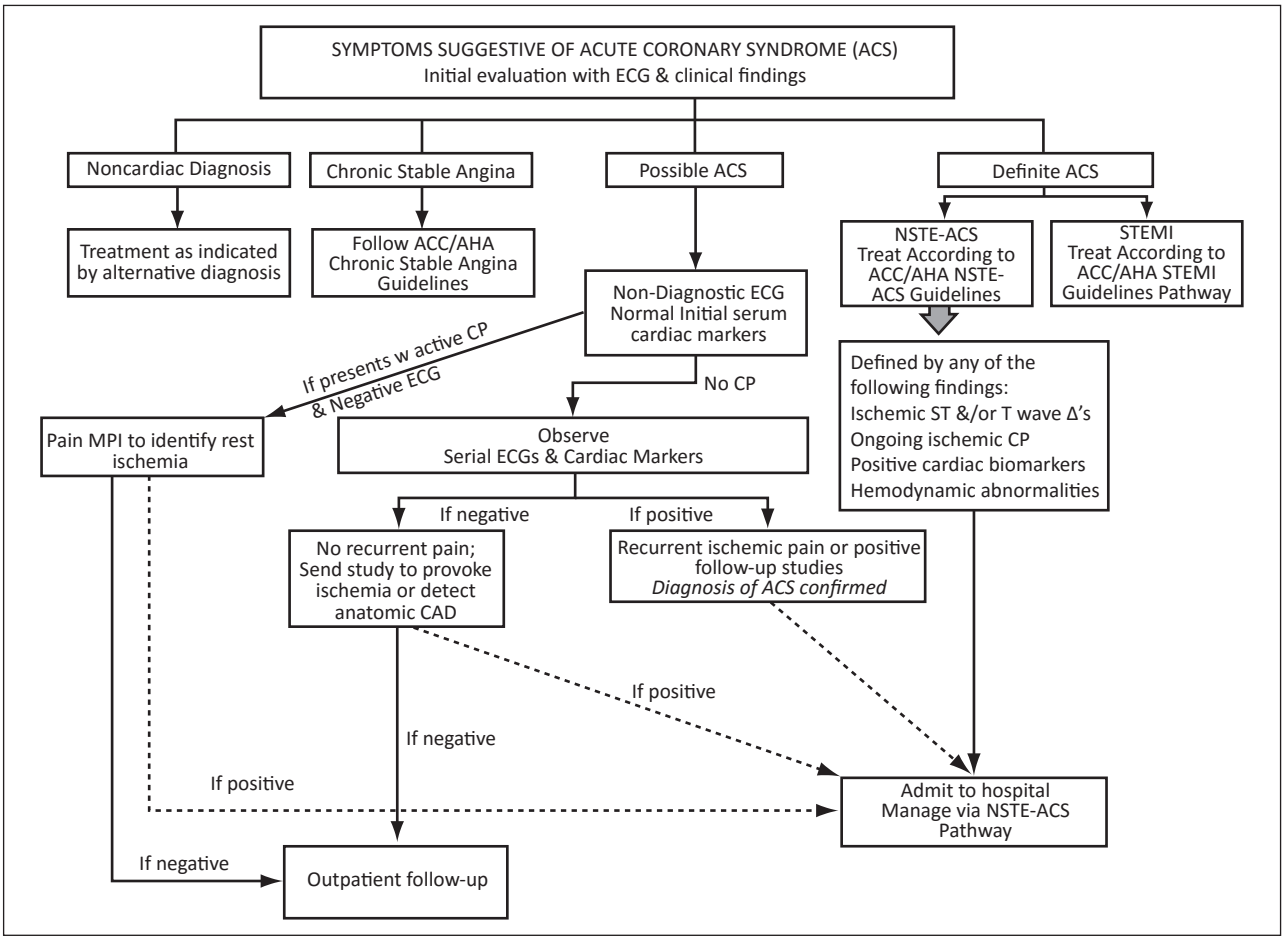

Figure 1. Evaluation of patients presenting with symptoms suggestive of ACS, according to ACC/AHA Practice Guidelines for NSTE-ACS; 2007 Update 4. This figure was modified to illustrate the two alternative non-invasive evaluations of ischemia (orange boxes). The acute R-MPI strategy is selected for patient presenting with active CP with an initial negative CM test and a non-diagnostic ECG for ischemia. In general abnormal findings should trigger admission for a more aggressive management and negative findings favor ED disposition for outpatient follow-up.

the rest of the patients may be further stratified with the use of different non-invasive stress testing strategies or imaging studies that have been proved as safe and effective according to the American College of Cardiology/American Heart Association (ACC/AHA) Guidelines (4-7). The goal of these non-invasive procedures is to further assess the likelihood of an ACS by excluding stress provoked ischemia or by confirming the absence of obstructive CAD. Positive confirmatory tests have increased likelihood of ACS with proven increased risk of future short-term adverse cardiovascular events. The cost-effectiveness of an ADP with exercise treadmill testing (ETT) included within the ED has been demonstrated when compared with the standard care of hospital admission for observation and further cardiac work-up (8-11).

Acute rest myocardial perfusion imaging (R-MPI) has been described as a reliable tool for assessment of ACS. This strategy consists of injecting technetium-99m radiopharmaceutical for imaging with a single-photon emission computed tomography. The radiopharmaceutical is taken up by the myocardium and distribute in proportion to tissue perfusion with negligible redistribution as it is trapped in the cardiac myocyte. This allows injecting the material to the patient in the ED, while experiencing symptoms, with delayed imaging after stabilization. The images obtained subsequently gives a "snapshot" of myocardial perfusion at the time of the injection.

Since the implementation of acute R-MPI protocol as a method to evaluate patients with symptoms of possible ACS in our ED , its contribution as an integral part of the initial clinical evaluation and triage decision-making at the Veterans Affairs Caribbean Healthcare System (VACHS) ED has not been established. This acute R-MPI strategy for this purpose is not commonly used in Puerto Rico and there is lack of supporting evidence. For this reason, this research project will evaluate the appropriateness of use of this diagnostic strategy, determine its diagnostic value and assess its cost-effectiveness.

Patients and Methods

This research study was approved by the Institutional Review Board of the VACHS. The study was a retrospective

record review of the whole universe of adult patients evaluated at the ED of the VACHS with an acute R-MPI study starting from January 2006 (when the strategy was implemented) to December 2008.

Our CP protocol consists of an initial arrival ECG and CMs with serial testing of both every 4-hours x 2, or up to at least 8 hours of the onset of CP or equivalent AMI symptoms. We perform both, an initial point of care troponin assessment and central troponin for serial testing. Rest MPI is recommended for atypical CP presentations, with no ECG ischemic changes, past Q-wave MI scars and absence of high risk features. Ideally the injection should be performed with active CP or less than 2-hour resolution. In average, the time from injection to imaging is 1-hour.

The patients' data obtained from the VACHS computerized patient record system was de-identified. Data obtained included age, gender, history of diabetes, smoking status, CAD, congestive heart failure (CHF), ECG findings upon arrival, presence of chest pain symptoms upon arrival, blood pressure upon arrival, most recent lipid profile, CMs, acute R-MPI findings, ED disposition, need for admission, discharge diagnosis, results of follow-up confirmatory studies, and the development of MACE that included non-fatal MI, need for urgent coronary revascularization, or cardiac death related to the initial ED evaluation or up to 1-year of follow-up. The acute R-MPI was considered normal (against acute ischemia) if there was no perfusion abnormality or no new perfusion defect in patients with prior fixed MI defects (upon comparing with prior reference study). Studies interpreted as presenting a defect consistent with artifact from attenuation, after considering defect location and the absence of associated wall motion abnormalities, were considered normal according to the interpretation criteria of the reading expert. Presence of any other defects was considered as abnormal and suggestive of ischemia.

To evaluate the appropriate selection of patients referred for acute R-MPI the research team used the Virginia Hospital/Virginia Commonwealth University VCU CP Category-Scale (14) as reference. The VCU CP Category-Scale is a protocol guide that categorizes all patients with CP into 1 of 5 risk strata based on the probability of ACS derived from clinical and ECG variables; level-1, AMI; level-2, myocardial infarction/unstable angina (MI/UA); level-3, probable UA; level-4, possible UA; level-5, non-cardiac chest pain (Table 1)(14). The VCU CP Category-Scale protocol uses the addition of acute R-MPI only for level 3 and 4 as a risk stratification tool for a more effective and safer patient disposition. To assess how incorporating acute R-MPI into the ED evaluation affected the triage decision-making process, the correlation of the acute R-MPI test results versus the admissions data was analyzed. Evaluation of the results of follow-up confirmatory invasive (cardiac catheterization) and non-invasive studies was obtained for further correlation with the acute R-MPI findings. Noninvasive studies used included stress MPI, ETT, stress echocardiogram and coronary computerized tomography angiography. The research team also reviewed the medical records up to 1-year after the R-MPI study searching for MACE to assess the prognostic value of this study.

A partial cost effectiveness analysis was calculated using the average cost of potential unnecessary hospitalization compared to the added cost of this acute R-MPI strategy in the ED. The hospitalization cost was obtained from determining the length of stay (LOS) and fees related to the care of patients admitted with a Diagnostic Related Group (DRG) code 313 corresponding to CP. This cost analysis included average fees related to bed locations, imaging studies, pharmacologic treatment, laboratory studies, and other fees. The costs of the ED workup were similar for both strategies, except for the fee of an acute R-MPI and the use of an additional outpatient stress MPI (for patients discharged with a negative R-MPI). These costs were obtained

Table 1. VCU CP Category-Scale: Acute chest pain diagnostic treatment pathways at the Virginia Commonwealth University Medical Center, according to the CP risk category level (reproduced and modified with the permission from Annals of Emergency Medicine: Tatum JL, Jesse RL, Kontos MC, et al. Comprehensive strategy for the evaluation and triage of the chest pain patient. Ann Emerg Med 1997;29:116–125. The table was modified by adding the Diagnostic Criteria column).

Primary risk assignment	Probability of MI	Probability of UA	Diagnostic criteria	Disposition	Diagnostic strategy
Level 1: AMI	Very high	Very high	Ischemic ST elevation Acute posterior MI	Treat and admit to coronary ICU	Presenting ECG
Level 2: Definite or highly probable ACS	High	High	Ischemic ECG Acute CHF Known CAD with Atypical symptoms	Admit to cardiac ICU	Serial ECGs and enzyme markers
Level 3: Probable ACS	Moderate	Moderate	Non-ischemic ECG and either: Typical symptoms > 30 min, no CAD, or Atypical known CAD	Observation Fast track rule-in protocol ED work	Serial ECGs and enzyme markers Rapid Tc-99m agent perfusion imaging
Level 4: Possible UA	Low	Low to moderate	Non-ischemic ECG and either: Typical symptoms <30 min, or atypical symptoms		Rapid Tc-99m agent perfusion imaging: abnormal, admit to cardiac ICU and perform angiography normal, perform stress evaluation
Level 5: Very low suspicion for AMI or UA	Very low	Very low	Evaluation must clearly document a non-cardiac etiology for the symptoms	ED evaluation as deemed necessary	Appropriate referral

Table 2. Baseline patient characteristics

Characteristics	All patients (N = 366)
Age (years)	
Mean + SD	64 + 14
Range	23-97
Gender	
Male	345 (94%)
Female	21 (6%)
Diabetes Mellitus	110 (30%)
HTN	289 (79%)
Smoker	77 (21%)
CAD	106 (29%)
Serial Troponin tests (mean)	2.1
ECG findings	
Normal	218 (61.6%)
Non-significant ST or T wave changes	102 (29%)
Q wave MI scars	9 (2.5%)
Acute ischemic changes	25 (7%)
CHF findings	2 (0.5%)
TIMI score (mean) category	
Low risk (0-2)	217 (60%)
Intermediate (3-4)	138 (38%)
High (5-7)	9 (2%)
Framingham CV 10-year risk (ATP III)	
Low risk <10%	77 (22.5%)
Intermediate risk 10-20%	75 (22%)
High risk ≥ 20%	190 (55.5%)
VCU CP Category-Scale Level frequency	
Level-1	0 (0%)
Level-2	50 (13.7%)
Level-3	124 (34%)
Level-4	180 (49%)
Level-5	12 (3.3%)
LVEF% (mean + SD)	61% + 10%
Total Rest MPI at ED	366
Rest MPI (+)	107 (29%)
Admitted	88 (83%)
Left against advise	4 (4%)
Transferred to a non-VA hospital	1 (1%)
Discharged home	14 (13%)
Rest MPI (-)	259 (71%)
Discharged home	250 (97%)
Admitted	
CP related	7 (2.7%)
Non-CP related	2 (0.3%)
Confirmatory Studies in Abnormal	74 (84%)
MPI patients hospitalized (N=88)	
Coronary angiography	41 (55%)
Stress MPI	28 (38%)
ETT (ECG)	1 (1%)
Coronary Computer Tomography Angiography	4 (5%)
Confirmed CAD with Coronary Angiography which led to Inpatient Revascularization (N=41)	7/41= 17%
PCI	3/7= 43%
CABG	4/7= 57%

from the VACHS billing department and VA billing codes for imaging studies.

For statistical analysis the data was summarized using the mean value for continuous data and percentages for categorical data. CHI square analysis, ANOVA variance analysis and Pair sample t-test were used to establish correlation and significance among the studied variables. Data was analyzed using descriptive statistics. To determine the diagnostic value of acute R-MPI for assessment of ACS, the research team considered true positives those patients with a final discharge diagnosis of ACS, either by the use of confirmatory studies with evidence of ischemia or the presence of significant obstructive CAD, the development of MACE and/or a clear documentation of UA impression without the prior supporting evidence. To determine the prognostic value the research team considered true positives those patients with an abnormal acute R-MPI and evidence of MACE at 30-days and 1-year. The limited cost-effectiveness analysis was calculated using two parameters, total savings (S) and Additional Cost due to Inappropriate Patient Selection (ACIPS):

$$S = [\text{cost of admissions} - (\text{cost of an acute R-MPI} + \text{cost of a complete MPI})] \times (\text{number of patients with normal acute R-MPI not admitted})$$

$$ACIPS = (\text{cost of an acute R-MPI}) \times (\text{number of patients on VCU CP Category-Scale levels 1, 2 and 5})$$

Results

A total of 380 patients were evaluated with an acute R-MPI strategy for assessment of myocardial ischemia during the above study period. From these, a total of 376 were from ED to rule out ACS. Ten cases were excluded in view of imaging cancellation related to AMI diagnosis or clinical deterioration. The final number of patients included in the study was 366 with an age range from 23 to 97 years and with a mean age of 64 years. The patients were predominantly male (94%). All of the patients included had initial negative CMs for AMI, most of them had CP upon arrival (85%) and most of them had absence of acute ischemia on baseline ECG (93%). Patient demographics, conditions, cardiovascular risk characteristics and findings are presented in Table 2. The majority of the patients (60%) had a low-risk TIMI score category (from 0-2) for short–term risk of major cardiovascular events. Interestingly, 29% of the patients had known CAD and 55% had a 10-year Framingham cardiovascular risk considered as high (≥ 20% event risk) according to the ATP-III guidelines. Three-hundreds-and-four (304) patients met criteria to be classified between Level 3 (probable ACS) and Level 4 (possible ACS) according to the VCU CP Category-Scale (34% and 49% respectively). The acute R-MPI results relation with the category of the VCU CP Category-Scale and the TIMI Score is shown in Figure 2. As shown in the graphs there was a significant inverse correlation between abnormal R-MPI findings with the category level of the VCU CP Category-Scale ($p<0.0001$) and a positive correlation with the severity of the TIMI score ($p<0.0001$).

From the total of 366 patients, 71% had a normal acute R-MPI and only 29% were positive. Of the 259 patients with normal acute R-MPI studies, the majority (97%) were discharged from the ED. Of the patients with a normal acute R-MPI, 7 were admitted to further exclude ACS from which 100% had a

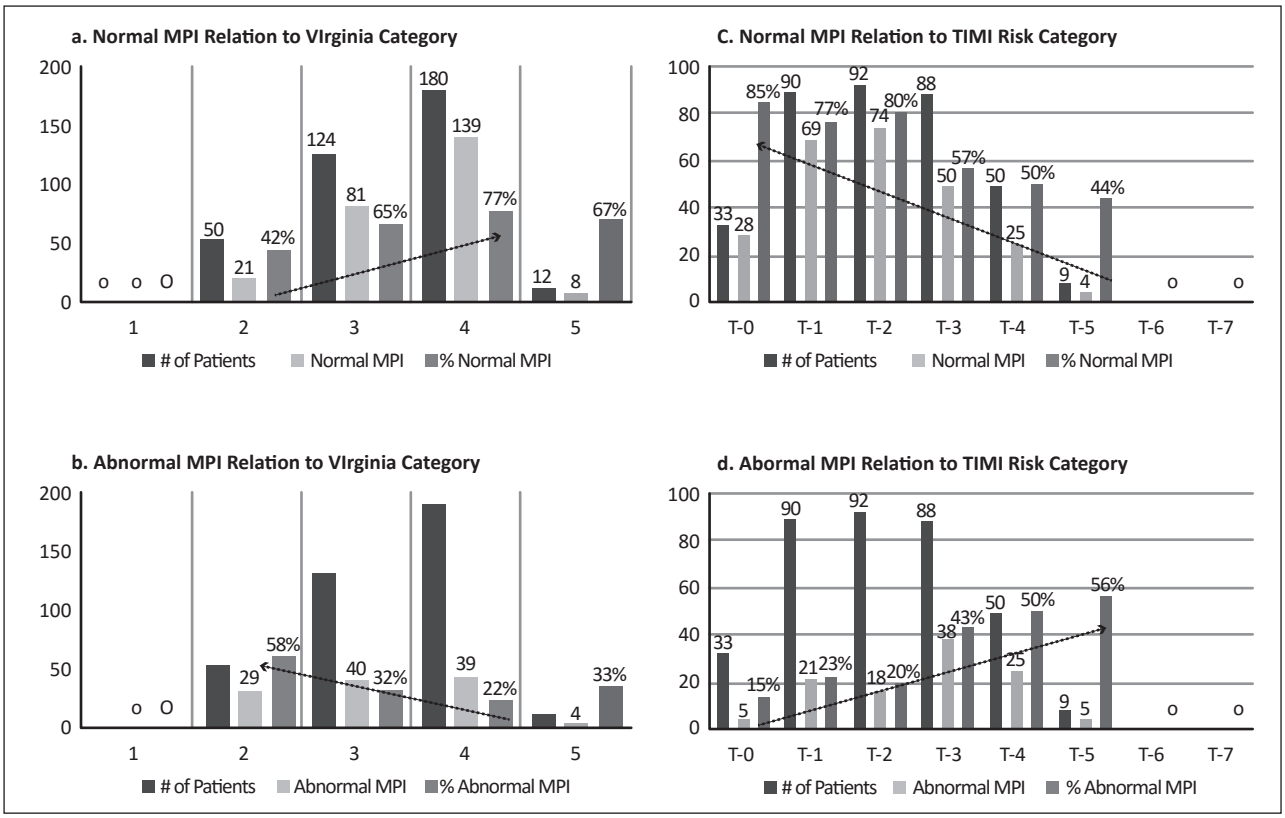

Figure 2. Figure 2a & 2b demonstrate the relation between acute R-MPI results with the VCU CP Category Scale level, where the frequency of normal R-MPI study increases with higher VCU category level, compared with an inverse relationship with abnormal R-MPI (p<0.0001); Figure 2c & 2d demonstrate the relation between R-MPI results and the severity of the TIMI score, where the frequency of normal R-MPI increase with lower TIMI score and the inverse relation with abnormal R-MPI (p<0.0001).

negative confirmatory test (either by stress MPI or with cardiac catheterization, with 6 and 1 respectively). Recurrence of CP while in the ED was the most common cause of admission despite a negative initial R-MPI.

From a total of 107 patients with an abnormal acute R-MPI consistent with possible ischemia, 88 (82%) were hospitalized, 4 (4%) left against medical advice, 1 (1%) was transferred to a non-VA hospital for admission and 14 (13%) were discharged from the ED with a final impression of a non-cardiac CP or a lower risk stable angina. Of the 8 patients discharged with the impression of a non-cardiac CP 100% had a negative stress MPI evaluation upon early follow-up (f/u) evaluation. Of the patients admitted with abnormal acute R-MPI 84% (74/88) had a confirmatory test, being coronary angiography the most frequent (55%) study (although some may have had other confirmatory non-invasive tests). Correlation of the ischemic and/or coronary territory was established in 45% (33/74) of the patients evaluated. Lack of correlation was usually related to absence of obstructive CAD lesion (>50%) or ischemia on a confirmatory stress MPI. Of the patients with a confirmatory coronary angiography 17% (7/41) underwent inpatient coronary revascularization.

Table 3 shows the type of cardiovascular events occurring within 30-days and 1-year of the initial ED encounter as categorized by the results of the acute R-MPI (normal versus abnormal). Table 4 shows the acute R-MPI diagnostic value for the presence of ACS at 30-days and at 1–year of follow up. Nine patients with serial CMs diagnostic for AMI, despite initial negative CMs, had initial abnormal MPI upon presentation consistent with 100% sensitivity for AMI diagnosis. The risk of ACS was significantly higher in patients with abnormal compared to normal studies (50% versus 0.4%; P < .0005; RR, 129.5; 95% CI, 18 to 924). The diagnostic value of this study for predicting ACS at 30-days and 1-year of the initial evaluation was as follows: sensitivity, 98% and 93%; specificity, 83% and 83%; negative predictive value (NPV), 99.6% and 98.5%; and a positive predictive value (PPV), 50% and 50%, respectively.

There was a total of 14 and 19 MACE during the follow-up of 30-days and 1-year respectively. There were no cardiovascular fatalities. The risk of MACE at 30-days (12% versus 0.4%; P < .001; RR, 32; 95% CI, 4.2 to 240) was significantly higher in patients with abnormal compared to normal studies as well as with 1-year of follow-up (14% versus 1.6%; P < .001; RR, 9.1; 95% CI, 3.1 to 27). The diagnostic value of this study for predicting MACE at 30-days and 1-year of the initial evaluation was as follows: sensitivity, 93% and 79%; specificity, 74% and 74%; PPV, 12.3% and 14%; and NPV, 99.6% and 98.5%, respectively.

Table 3. Cardiovascular Events occurring within 30-days and 1-year of the initial ED encounter according to MPI findings.

Events	MPI (+) N= 106	MPI (-) N= 259	P-Value	RR (95% CI)
Non-fatal MI 30 Day	10	1	0.002	24.4 (3.2-188.5)
Revascularization 30 Day	7	1	0.008	17.1 (2.1-137.3)
MACE 30 Day	13	1	0.001	31.8 (4.2-239.8)
MACE 1-Year	15	4	<0.001	9.1 (3.1- 27.0)
ACS 30 Day	53 (50%)	1 (0.4%)	<0.0005	129.5 (18.1-924.4)
ACS 1-Year	53*	4	<0.0005	32.4 (12.0-87.2)

*no additional events after 30 days

Table 4. Acute R-MPI Diagnostic and Predictive Value for Presence of ACS or MACE at 30-days and at 1-year of follow-up.

	30-days ACS	1-year ACS	30-days MACE	1-year MACE
Prevalence of Events	54 (14.8%)	57 (15.6%)	14 (3.8%)	19 (5.2%)
Sensitivity	98%	93%	93%	79%
Specificity	83%	83%	74%	74%
Negative Predictive Value	99.6%	98.5%	99.6%	98.5%
Positive Predictive Value	50%	50%	12.3%	14%

The estimated cost of a DRG-313 admission was $11,441.27 for a LOS of 3.4 days. The estimated cost associated to the acute R-MPI strategy taking in consideration the costs of the R-MPI (code 78451) and the confirmatory stress MPI outpatient procedure (code 78452) was $615.15. From 259 patients with negative R-MPI, a total of 89% within the VCU CP Category-Scale level 3 and 4 (probable or possible ACS) were discharged from ED. Relevant to this assessment, 7 patients with normal R-MPI were admitted. Therefore, using a normal acute R-MPI study as an additional criterion to decide admission, for patients in a VCU CP Category-Scale between level 3 and 4, resulted in 86% reduction of hospital admission, with an estimated cost savings per patient of $10.826.12. The total savings (S) calculated for 224 patients was $2,425,050.88. Conversely, 17% of all patients evaluated, or 62 patients, which were retrospectively classified within VCU CP Category-Scale level 2 and 5, underwent an unnecessary acute R-MPI strategy for a calculated additional cost due to inappropriate patient selection (ACIPS) of $23,573.02. Appropriately, no patients with VCU CP Category level-1 (high-risk AMI) underwent the acute R-MPI.

Discussion

The reason for missing ACS diagnosis in the ED is not entirely understood and has been related to atypical clinical presentations, lack of prior CAD, lack of ECG ischemic changes and younger age (2,3). Other than the ECG, we have no early appropriate (sensitive) markers for assessment of ischemia, besides the delayed elevation of CMs when associated to myocardial necrosis. Acute R-MPI in patients presenting with atypical CP and negative ECG for ischemia has been described as a reliable tool for assessment of ACS, also with complementary diagnostic and prognostic value (12-20).

Our data demonstrated that the VACHS ED selection of patients for acute R-MPI was appropriate. A positive acute R-MPI clearly correlated with higher TIMI score and a lower VCU CP Category level meaning that the acute R-MPI was able to identify a population with a higher risk for cardiovascular disease. Up to 98.5% of patients with negative MPI were free of ACS (including MACE) at 12-months, which was a statistically significant difference from the 50% event rate in the patients with positive scans. This compares with 97% and 50% respectively, previously reported by Kosnik et al (12).

In our experience, using the acute R-MPI strategy in patients with probable or possible ACS represented a cost savings per patient of $10,826.12 and a reduction in hospitalizations of 86%. In a similar study by Heller et al the reduction in hospital admissions was reported as 57%, with a mean cost savings per patient of $4,258 (13). In this multicenter trial multiple logistic regression analysis demonstrated abnormal acute R-MPI to be the best predictor of MI and significantly better than clinical data.

The research team acknowledges that a prospective study design can better establish the actual impact of acute R-MPI in the acute setting, by better delineation of inclusion and exclusion criteria for the appropriate patient selection. Acute R-MPI has some limitations when used to assess patients who have chest pain. Acute MI, acute ischemia, and prior MI all present as perfusion defects, and differentiation is not possible based on the rest image alone. Also, it is important to address that the sensitivity of the acute R-MPI is dependent on the extent, duration, severity, and reperfusion status of the ischemic process. Another factor affecting its sensitivity is the presence of ongoing CP or equivalent angina symptoms at the moment of injection. The test sensitivity decreases with the duration of pain free interval prior to injection, although it is not clear what is an appropriate cut-off time not significantly affecting its sensitivity.

Ideally, to assess a more objective correlation of abnormal acute R-MPI with actual presence of ACS and likewise obstructive CAD, all patients should have confirmatory studies. However, this may not be possible in all patients since the patient may refuse to undergo non-invasive or invasive procedures. In some cases, the physician may also avoid a confirmatory procedure if this procedure will not change the care of the patient in view of comorbidities and a higher risk for complications or in view of known severe CAD not amenable for intervention. It is also appropriate to mention, that it may be possible to have a resting ischemic event with an abnormal acute R-MPI in the absence of obstructive CAD, such as with a vasospastic angina from transient coronary artery spasm.

Conclusion

Overall, the use of acute R-MPI in the evaluation of patients presenting with CP of non-high risk probable/possible ACS, is a safe, reliable and cost-effective tool to be used in the ED to favor the diagnosis of ACS and to predict future MACE. The value of this strategy resides in the appropriate selection of patients presenting with active CP and categorized as non-high risk according to the NSTE-ACS ACC/AHA Guidelines (4) and/or the VCU CP Category-Scale (14).

Resumen

Objetivo: Evaluar el uso clínico apropiado de la imagen temprana de perfusión del miocardio al reposo (R-MPI por sus siglas en inglés) en la evaluación inicial de un paciente con dolor de pecho (DP) en el departamento de emergencias (DE). Métodos: Éste es un estudio retrospectivo de pacientes con DP evaluados con imagen temprana R-MPI en el DE. Los datos recogidos incluyeron historial médico, presentación clínica, electrocardiograma, laboratorios, resultados de MPI, estudios confirmativos, diagnóstico de disposición y análisis de costo. Resultados: Se evaluaron 366 pacientes. La población estudiada tenía un promedio de puntuación de TIMI de 2 y predominio de pacientes en la categoría 3 y 4 de la clasificación de DP de VCU (con 34% y 49% respectivamente). El riesgo del síndrome coronario agudo (SCA) era significativamente mayor en pacientes con estudios anormales versus los normales (50% contra 0.4%; P < .0005; RR, 129.5; CI de 95%, 18 a 924). Hubo un total de 14 y 19 acontecimientos cardiovasculares adversos mayores (ACAM) a 30-dias y a 1-año respectivamente. No hubo fatalidades cardiovasculares. El riesgo de ACAM a 30-dias era significativamente más alto en pacientes con estudios anormales versus los normales (12% contra 0.4%; P < .001; RR, 32; el CI de 95%, 4.2 a 240), igualmente a 1-año de seguimiento (14% contra 1.6%; P < .001; RR, 9.1; CI de 95%, 3.1 a 27). Conclusión: El uso de R-MPI temprano en la evaluación de pacientes de menos riesgo que presentan con DP en el DE es una estrategia segura, confiable y costo-efectiva para diagnosticar la presencia de SCA y de predecir ACAM a corto y a largo plazo.

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