



## CLINICAL EVALUATION AND CALCIUM SCORE AS METHODS FOR SELECTING PATIENTS ELIGIBLE FOR CT ANGIOGRAM

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### ABSTRACT

**PURPOSE:** Our aim was to compare the prognostic performance of computed tomography coronary angiography (CTA) and exercise electrocardiography (ex-ECG) in patients with suspected coronary artery disease (CAD). **METHODS:** We enrolled 60 patients (age  $61.3 \pm 10.4$  years, 40 men) with angina and no history of CAD. All underwent ex-ECG and CTA and were followed for 12 months. The endpoints were cardiac events - nonfatal myocardial infarction, cardiac death, and revascularization. **RESULTS:** ex-ECG and CTA were positive in 36 (60%) and 24 (40%) of 60 patients, respectively. Both ex-ECG and CTA were predictors of cardiac events (hazard ratio [HR]: 2,  $p < 0.0001$  and HR: 20, 95%  $p < 0.0001$ , respectively) and hard cardiac events (HR: 1.9, 95%  $p = 0.02$  and HR: 6.8;  $p < 0.0001$ , respectively), in a multivariate analysis, CAD with  $\geq 50\%$  stenoses detected by CTA was the only independent predictor of hard cardiac events. Ex-ECG provides a further risk stratification in the subset of patients with positive findings on CTA and a low to intermediate likelihood of CAD. Positive findings on CTA identify a shorter event-free period. **CONCLUSION:** CTA has a higher prognostic value compared with ex-ECG in patients with low to intermediate pre-test likelihood of CAD.

**Key words:** CTA, calcium score, risk, ischemic heart disease

### INTRODUCTION

The use of non-invasive CT coronary angiography (CTCA) has grown rapidly, because of its compelling images and its direct evidence of the extent, location and severity of obstructive lesions. The high negative predictive value (>95%) of CTCA supports its use as a reliable gatekeeper to invasive coronary angiography (5, 7, 12). However, CTCA should not be used indiscriminately because it requires potentially nephrotoxic contrast media, is associated with radiation exposure and involves considerable costs.

Established risk stratification algorithms include age, gender, chest pain typicality and traditional risk factors to classify patients into low (<10%), intermediate (10-90%) and high (>90%)

probability groups of obstructive coronary artery disease (CAD) (3, 9, 8, 7, 4). Several studies have indicated that the highest diagnostic benefit is obtained in patients with intermediate probability (5, 7, 12). A substantial proportion of patients fall into the intermediate probability category. The presence of coronary calcium, measured as the calcium score (CaSc) (1), is a strong marker of coronary atherosclerosis (10) and there is a direct relation between the magnitude of the coronary calcification and the presence of a coronary obstruction detected by invasive coronary angiography (6). Invasive coronary angiography studies have shown the incremental value of CaSc to clinical algorithms in predicting obstructive coronary artery disease,

however, only a few studies with the CTCA outcome exist (2, 11).

### Purpose

The purpose of this study was to evaluate the additional value of CaSc to clinical evaluation in symptomatic stable patients with suspected CAD in order to restrict referral for CTCA by reducing the number of patients with an intermediate probability of CAD.

### METHODS

We retrospectively included 100 symptomatic stable patients who underwent clinical evaluation and CaSc calculation and CTCA or invasive coronary angiography (ICA). Patients with history of percutaneous coronary intervention, coronary bypass surgery, myocardial infarction or nondiagnostic CTCA in the absence of ICA were excluded. Patients were classified as low, intermediate and high risk and further diagnostic testing with CaSc and CTCA was performed in the intermediate risk group.

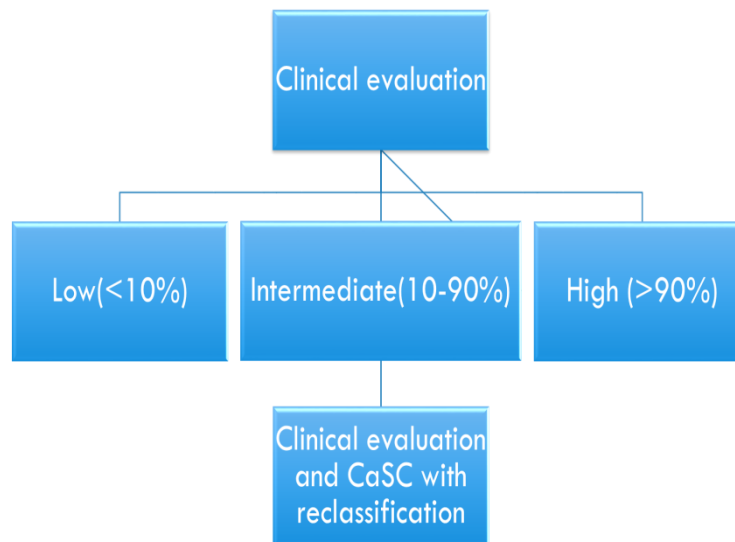
The outcome was obstructive CAD ( $\geq 50\%$  diameter narrowing) assessed by ICA or CTCA in the absence of ICA. We divided the patients into two groups: 1. clinical evaluation consisting of typical chest pain, gender, age, risk factors ;(1) clinical evaluation with CaSc. A stepwise reclassification of patients with an intermediate probability of CAD (10-90 %) was

done. Reclassification was made using net reclassification improvement – sum of the proportion of correctly reclassified patients minus incorrectly reclassified patients.

### RESULTS

**Table 1.** Baseline clinical characteristics of the population.

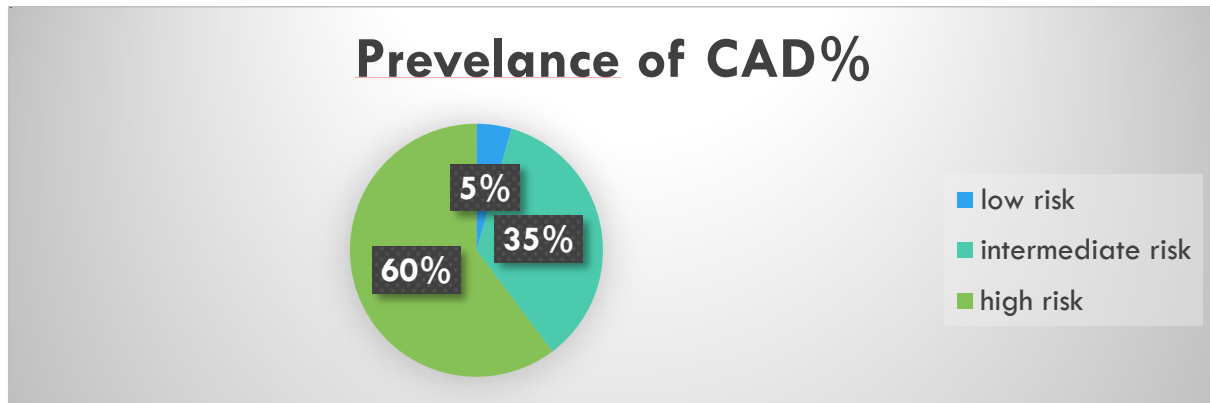
Male gender	58%
Age, yrs	59
Chest pain	
Typical	36%
Atypical	41%
Non – angina	23%
Current smoker	27%
Diabetes mellitus	16%
Family CVD	46%
Hypercholesterolemia	55%
Hypertension	50%
Calcium score	71
Pre – test probability of CAD	55%
Prevalence of CAD	49%



**Figure 1.** Reclassification algorithm. Clinical evaluation with CaSc calculation is made in the intermediate subgroup outlined with clinical evaluation

By using the first model 9% of the patients were classified – 5% to the low and 4% to the high probability category of CAD. With the stepwise approach in the intermediate risk subgroup the

number of patients in it can be reduced by 29% - 24% into the low risk group and 14% in the high risk group, reducing the need for CTCA by 38% in total.



**Figure 2.** Prevalence of CAD using clinical and Ca Sc classification.

Low risk patients had small percentage of coronary artery disease – 5%. In the intermediate risk group the prevalence of CAD also is small – only 35% but in the high risk population it reaches 60%. This confirms that Ca Sc classification added to adequate clinical evaluation is an adequate tool for evaluation of the patients with ischemic heart disease.

### CONCLUSION

Pre – test probability estimation with clinical algorithm classified most of the patients as being in the intermediate risk group – 91%. The addition of CaSc provided incremental diagnostic information and reclassified patients to low or high probability groups.

A significant reduction (29%) of patients remaining in the intermediate probability category is observed. For them a further non – invasive testing (CTCA) is recommended. Patients eligible for CTCA can be easily identified by using risk chart based on clinical evaluation and CaSc.

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