

Prediction of the presence of significant coronary artery disease using 256 slice coronary CT angiography

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Purpose

Our purpose was to define which clinical parameters predict the presence of significant coronary artery disease among patients admitted for CCTA.

Ischemic heart disease remains one of the leading causes of death around the world [1]. The rapid evolution of the multi-detector computed tomography (MDCT) technology allowed for the non-invasive, high resolution imaging of the coronary arteries using coronary CT angiography (CCTA) [2,3]. The 256-slice CT represents the latest MDCT generation, which has a high sensitivity and specificity for detecting obstructive coronary artery disease (CAD) [4]. The main indication of CCTA is to rule out significant CAD. The technique is inherently non-invasive, therefore the patient population for CCTA must be carefully selected. Patients with a high pretest probability of obstructive CAD may benefit less from CCTA opposed to invasive coronary angiography (ICA) as they frequently need percutaneous intervention.

Methods and Materials

We retrospectively analyzed data of patients who underwent 256-slice CCTA in our institute between November 2010 and November 2011. Patients' baseline characteristics and presence of traditional risk factors were collected from scan reports and CRF's. Obstructive CAD was defined as $\geq 50\%$ diameter stenosis in the left main stem or $\geq 70\%$ in any other coronary segment. We used Mann-Whitney U test for non-parametric and Student's t test for parametric continuous variables and chi-square test for categorical variables in our univariate statistics.

In a prospective sub-study, patients with no history of CAD were enrolled. The clinical model included age, sex, symptoms, diabetes, hypertension, dyslipidemia, and smoking. Logistic regression model was used to define the independent predictors of significant CAD

Images for this section:

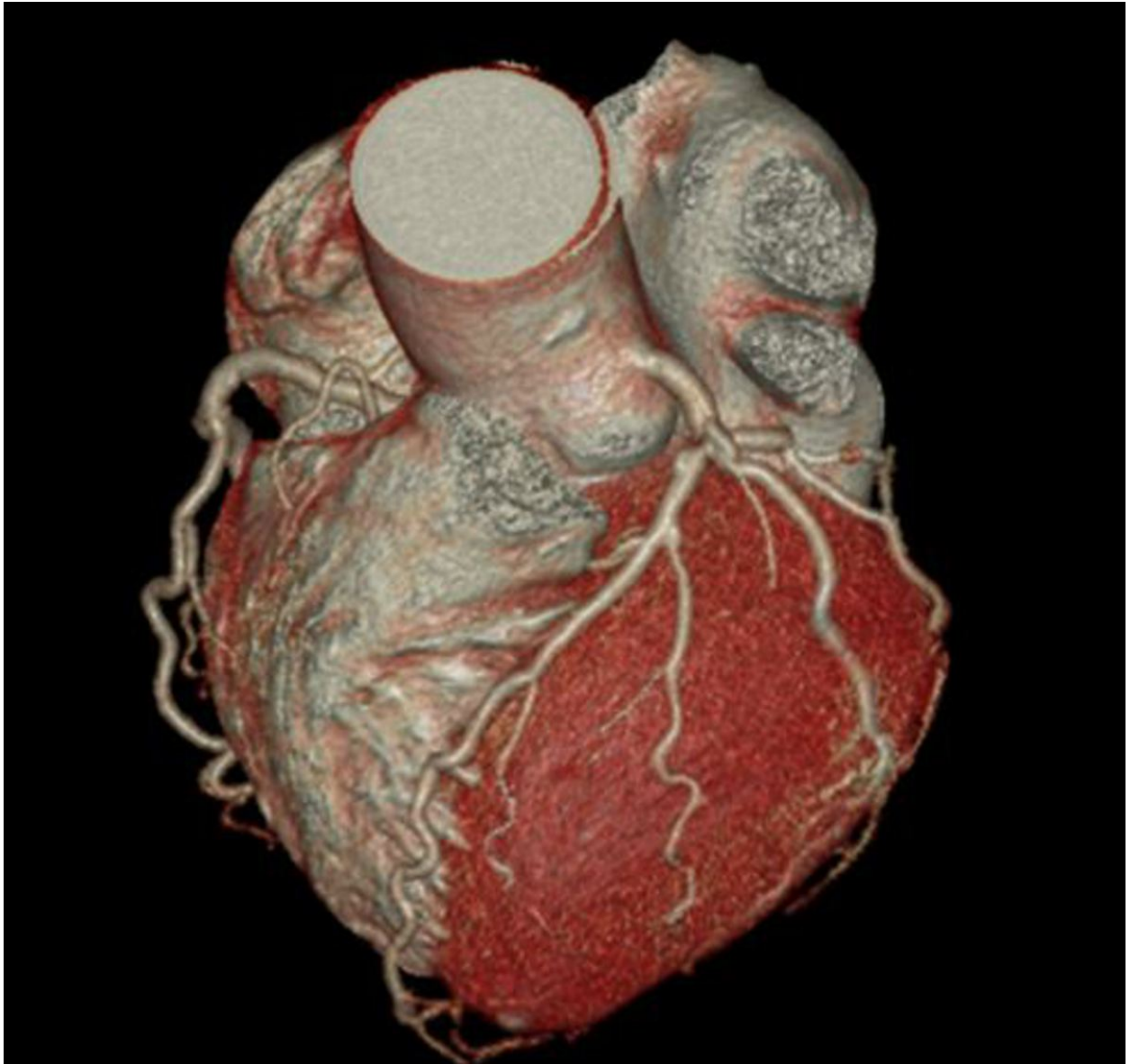


Fig. 1: 3D volume rendered image of a 43 year old female with mild coronary atherosclerosis.



Fig. 2: 3D volume rendered image showing the coronary outlines of a 62year old male with significant coronary artery disease.

Results

We included 1103 patients (680 men, mean age 58.5 ± 12.5 years) of whom 305 had obstructive CAD on CCTA [Table 1]. All investigated risk factors were significantly ($p < 0.001$) associated with the presence of CAD in univariate analysis [Table 1]. Among women age, history of CAD (both $p < 0.001$) and hypertension ($p < 0.01$) showed a significant association with the presence of significant luminal narrowing, while diabetes and BMI showed no significant association with obstructive CAD. On the other hand, among men all risk factors were significantly ($p < 0.001$) associated with the presence of obstructive CAD [Table 2].

Among patients with history of CAD 65.8% percent of the CCTA scans were positive (OR= 8.3 [95%CI=6.0-11.4]; $p < 0.001$).

In a prospective sub-study of patients with no history of CAD ($n=202$) age (every 10 years OR=2.3 [95%CI=1.5-3.8]; $p=0.0001$), diabetes mellitus (OR=2.9 [95%CI=1.1-7.7]; $p=0.004$) and male sex (OR=3.0 [95%CI=1.6-8.2]; $p=0.025$) were associated independently with obstructive CAD.

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Parameter	Significant stenosis		Non-significant stenosis		p	
	Female	Male	Female	Male	Female	Male
Életkor (év)	$66,0 \pm 10,0$	$64,0 \pm 9,7$	$60,0 \pm 11,8$	$55,0 \pm 12,7$	$< 0,001$	$< 0,001$
BMI (kgm ²)	$28,0 \pm 4,9$	$29,0 \pm 4,3$	$27,0 \pm 5,2$	$27,0 \pm 4,2$	$= 0,17$	$< 0,001$
CAD	34 (41,1%)	118 (53,2%)	32 (10,6%)	47 (10,9%)	$< 0,001$	$< 0,001$
PCI / CABG	25 (30,1%)	96 (43,2%)	17 (5,6%)	34 (7,9%)	$< 0,001$	$< 0,001$
AMI	17 (20,5%)	57 (25,7%)	9 (3,0%)	18 (4,2%)	$< 0,001$	$< 0,001$
HT	71 (85,5%)	198 (89,2%)	202 (68,6%)	273 (63,2%)	$< 0,01$	$< 0,001$
DM	22 (26,5%)	75 (33,8%)	57 (18,8%)	48 (11,1%)	$= 0,14$	$< 0,001$

Table 2: Table 2. shows the occurrence of the registered clinical parameters among females and males. P values show the correlation of the parameter with significant coronary stenosis within women and men.

Parameter	Significant stenosis	Non-significant stenosis	p
Male	222 (72,8%)	432 (58,8%)	< 0,001
Female	83 (27,2%)	303 (41,2%)	
Age (year)	63,9 ± 9,8	56,1 ± 12,6	< 0,001
BMI (kgm²)	29,0 ± 4,5	27,5 ± 4,7	< 0,001
CAD	152 (49,8%)	79 (10,7%)	< 0,001
PCI/CABG	121 (39,7%)	51 (7,0%)	< 0,001
AMI	74 (24,3%)	27 (3,7%)	< 0,001
HT	204 (88,4%)	481 (65,4%)	< 0,001
DM	97 (32,0%)	105 (14,5%)	< 0,001

Table 1: Table 1. shows the registered clinical parameters and there occurrence in our population. P values show the correlation of the parameter with significant coronary stenosis.

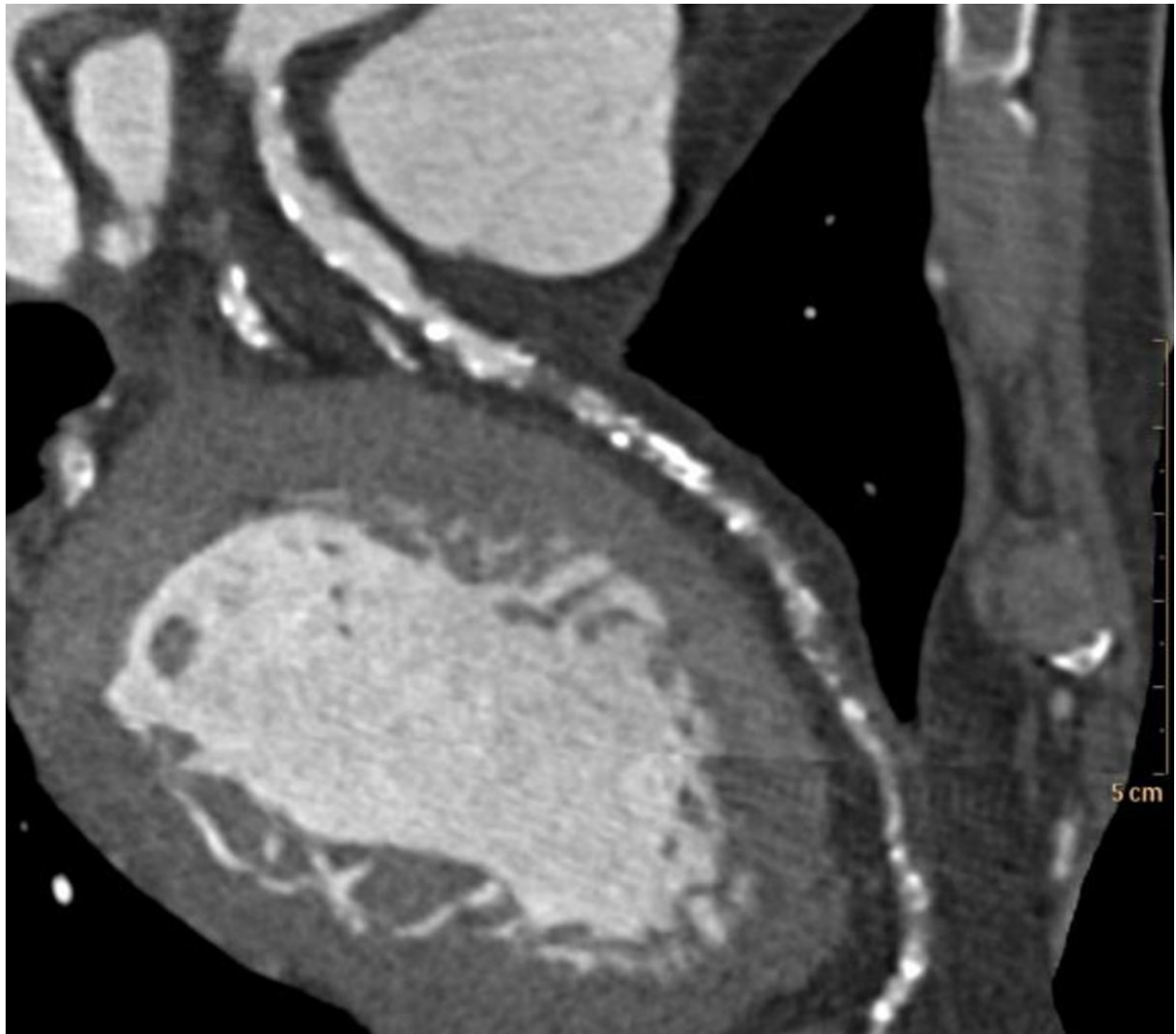


Fig. 5: cMPR of the left anterior descending artery of a 67 year old diabetic male, with multiple significant stenosis.

Conclusion

We confirmed the association between traditional cardiovascular risk factors and significant CAD. Our data suggests that diabetes and BMI have a smaller effect on the development of CAD among women, as these risk factors were not associated with the presence of significant coronary atherosclerosis.

Our results suggest that CCTA provides little or no additional diagnostic information regarding the presence of obstructive CAD among patients with chest pain and contemporary history of CAD, as the majority of these scans yielded as positive result. In this population other diagnostic tests might be more favorable (e.g.: myocardial perfusion imaging).

In the sub-study of patients with no history of CAD age, diabetes and male sex were associated independently with obstructive CAD. Our results indicate the need of a simple scoring system based on contemporary data to predict obstructive CAD in patients with stable chest pain.

Images for this section:

Conclusions

- **We confirmed the association between traditional cardiovascular risk factors and significant CAD**
- **Data suggest that diabetes and BMI have a smaller effect on the development of CAD among women**
- **CCTA provides little or no additional diagnostic information regarding the presence of obstructive CAD among patients with chest pain and contemporary history of CAD**
- **Patients with no history of CAD only age, diabetes and male sex were associated independently with obstructive CAD**

Fig. 7: Conclusions

References

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Personal Information