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DIJAGNOSTIČKA VREDNOST SVEOBUHVATNE NEINVAZIVNE PROCENE MORFOLOŠKIH I FUNKCIONALNIH KARAKTERISTIKA KORONARNE BOLESTI


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Diagnostic Value of Noninvasive Comprehensive Morphologic and Functional Assessment of Coronary Artery Disease

Dijagnostička vrednost sveobuhvatne neinvazivne procene morfoloških i funkcionalnih karakteristika koronarne bolesti

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Key words: CFR, MSCT, coronary artery disease, noninvasive assessment,
Ključnereči: CFR, MSCT, koronarnabolest, neinvazivnadijagnostika
ABSTRACT:
Background: Recently adopted technique, Transthoracic Doppler Echocardiography (TDE) enables the estimate of functional significance of coronary luminal narrowing. Multi-slice computed coronary angiography (MSCT), as one of the most important noninvasive methods, offers us a quite precise visualization of morphological characteristic of atherosclerotic changes in coronary arteries. We have tried to evaluate the most reliable noninvasive approach aimed at the detection of major stenosis on the left anterior descending artery (LAD) and right coronary artery (RCA).

Methods: This study involved 84 patients, with previously detected atherosclerotic lesions on LAD and/or RCA by MSCT. CFR assessment by TDE with adenosine was obtained in LAD (n=75); RCA (n=61), resulting in 136 vessels subjected to the analysis. Invasive coronary angiography (ICA) was performed in all patients within 24 to 48 hours after CFR as a reference technique.

Results: Cochrans Q test proved a significant statistical difference among these techniques in detection of a significant stenosis on LAD and RCA (p<0.01). Further analyzes have revealed a significant difference between MSCT and CFR (p<0.05), MSCT and ICA (p<0.01), whereas we did not find a significant difference between CFR and ICA (p>0.05). The main discrepancies in results between CFR, ICA and MSCT were noticed concerning intermediate and severe stenosis on MSCT.

MSCT had a diagnostic accuracy for LAD: 66.67%; RCA: 75.00%, CFR had for LAD: 90.00%; RCA: 81.67%, in detection of significant stenosis. Where the consensus was reached between both techniques, diagnostic accuracy was improved to LAD 97.33%; RCA 90.00%.

Conclusions: Comprehensive noninvasive evaluation of both anatomical and functional imaging in coronary diseases makes the optimal approach for precise, noninvasive assessment of coronary artery lesions in coronary arteries.
ABSTRAKT:
Uvod: Nedavno usvojena tehnika, Transtorakalna Doppler Ekokardiografiya (TDE) nam omogućava procenu funkcionalne značajnosti suženja koronarne arterije. Koronarografiya putem "multi-slice" kompjuterizovane tomografije (MSCT) nam pruža informacije o morfološkim karakteristikama koronarne arterijske bolesti. Tokom istraživanja smo pokušali da procenimo najpouzdaniji neinvazivni dijagnostički pristup u cilju detekcije značajnih stenoza na prednjoj descedentnoj arteriji (LAD) i desnoj koronarnoj arteriji (RCA).
Metode: Studija je uključila 84 bolesnika, sa prethodno detektovanim aterosklerotskim lezijama na LAD i ili RCA putem MSCT. CFR procena putem TDE sa adenozinom je sprovedena na LAD (n=75) i RCA (n=61), ukupno 136 koronarnih arterija za analizu. Invazivna koronarografija (ICA) je učinjena kod svih bolesnika 24 do 48 sati posle CFR.
Rezultati: Cochran Q test je dokazao statistički značajnu razliku između tehnika pri detekciji značajnih koronarnih lezija na LAD i RCA (p<0.01). Dalje analize su ukazale na značajnu razliku između MSCT i CFR (p<0.05), MSCT i ICA (p<0.01), dok između CFR i ICA nije uočena statistički značajna razlika (p>0.05). Najveća diskrepanca u rezultatima je uočena između CFR, ICA i MSCT kada su analizirane intermedijan teške stenoze, MSCT je imala dijagnostičku pouzdanost za LAD:66.67%; RCA:75.00%, CFR za LAD:90.00%; RCA:81.67%, pri detekciji značajnih aterosklerotskih lezija. Kada su rezultati obe tehnike bili u saglasnosti dijagnostička pouzdanost je unapređena za LAD 97.33%; RCA 90.00%.
Zaključak: Sveobuhvatna neinvazivna procena, kako morfoloških tako i funkcionalnih karakteristika koronarne bolesti je optimalan pristup za neinvazivnu i preciznu procenu značajnosti aterosklerotskih lezija na koronarnim arterijama.

INTRODUCTION:
Multislice computed tomographic coronary angiography (MSCT) is frequently used as a noninvasive diagnostic procedure for evaluating calcified and non-calcified atherosclerotic lesions and their diameter of coronary artery [1-3]. MSCT has a very high negative
predictive value while it is less reliable in assessing a real physiologic significance of coronary stenosis [4-9]. Consequently, a noninvasive multimodality imaging strategy which could provide to us morphologic and functional information has been appreciated. The purpose of this study was to define the importance of coronary flow reserve (CFR) determined by transthoracic color Doppler Echocardiography (TDE) over MSCT in detection of hemodynamically significant stenosis on left anterior descending artery (LAD) and right coronary artery (RCA). The reference technique was Invasive coronary angiography (ICA)

METHODS:
This prospective study included 84 patients (mean age 61.79±9.21 years). Invasive coronary angiography was recommended due to formerly ambulatory detected atherosclerotic lesions on coronary arteries (LAD or/and RCA) by MSCT angiography. MSCT was performed because of previous inconclusive noninvasive tests. Additional measurements of CFR by transthoracic Doppler echocardiography were performed on 136 coronary arteries 24-48 hours before ICA.

Exclusion criteria for MSCT were pregnancy, renal failure, atrial fibrillation, and frequent extra systolic beats. While exclusion criteria for the CFR test were a high degree atioventricular block, acute myocardial infarction, unstable angina, a significant myocardial hypertrophy, obstructive pulmonary disease or a previous therapy with theophylline preparations. The subjects excluded xanthine-containing food and drinks for at least 24 hours before the test. The study protocol was submitted and certified by hospital’s medical ethical committee, and all patients gave informed consent.

**MSCT coronary angiography:** The 64-slice scanner (Toshiba, Aquilion) with a 0.33 s rotation time was used for all CT scans. A 80 mL Iodixanol (Visipaque 320 mg/mL, Amersham Health, UK) was injected into an antecubital vein with a flow rate 5 ml/s, after that a 50 mL saline bolus. Initial delay was determined by a bolus tracing in the descending aorta after which Scan start was initiated 5 s after getting the threshold [140 HU]. Subsequently, scanning was done from the tracheal bifurcation to the diaphragm using: X-ray tube potential 120 kV, effective tube current 400 mA, slice collimation 64mm2, table feed 9.2mm/rotation, and pitch 0.24. Automated real time anatomy based dose regulation (CARE Dose 4D) was used during all CT scans. The overall scan time was less than 20.
The average total time for the examination was 15 min. We used retrospective electrocardiographic (ECG) gating for optimal heart phase selection and applied adaptive cardio volume approach for data reconstruction. Throughout the examination, axial slices were reconstructed synchronized to the ECG by a single or two sector algorithm (65 b.p.m) using data from consecutive heart beats. Pictures were reconstructed in 10% intervals of cardiac cycle in order to examine coronaries at that cardiac phase with almost minimal motion. Evaluation of coronary arteries were done with 0.5 mm thick slices and with a medium soft-tissue reconstruction kernel (FL03).

Coronary segments were defined pursuant to AHA scheme [10] and examination was undertaken by two independent observers unconscious of the former clinical history. First, both of them independently assessed the quality of visualization of each coronary segment and the presence of hemodynamically significant stenosis, considered as luminal diameter reduction more than 70%. For any difference in data investigation, consensus agreement was reached.

**Two-dimensional echocardiography - CFR measurement:** The acoustic window was around the midclavicular line in the fourth or fifth intercostals space in the left lateral decubital position. In our echocardiographic study we used Vivid 7 (3.5 MHz and 7 MHz probes) and Doppler echocardiography for evaluation of CFR in the distal portion of the LAD or RCA artery. In color Doppler flow mapping, the velocity range was set from 12.0 to 16.0 cm/s to obtain optimal imaging.

The coronary blood flow in the distal portion of the LAD was visualized by color Doppler, in the long axis cross section of left ventricle and in the anterior interventricular groove. The coronary flow velocity in the distal RCA, was obtained from the posterior descending coronary artery (PD), in modified apical two-chamber view including posterior interventricular groove.

Pulsed wave Doppler was used for Coronary flow velocity measurements. Angle correction was needed in each examination because of the incident Doppler angle (mean angle 28°, range 15-44°). Stop frames and clips were digitally documented. The coronary blood flow velocity profiles at the distal part of coronary arteries were biphasic, and it was estimated separately for the distal part of LAD or PD at baseline and after administration of adenosine (140 mcg/kg/min, lasting for 2 min). CFR was calculated dividing the maximum hyperemic and resting peak diastolic flow velocity, so it is non dimensional parameter.
Average value of three cardiac cycles was used for CFR measurement at basal and hyperemic conditions. A value of CFR less than 2 was used to categorize significant stenosis. All patients had uninterrupted heart rate, blood pressure and ECG monitoring.

**Invasive coronary angiography (ICA):** ICA was considered as the reference diagnostic technique. It was completed according to the standardized protocols, and images were recorded for additional analysis. Two experts, familiar with the patient's clinical history, but unaware of the results MSCT, independently assessed all angiograms according to the same AHA scheme[3]. Significant coronary artery stenosis was defined as ≥70% diameter reduction. In case of any dispute over data analysis, consensus agreement was appended.

**Statistical analyses:** Data analysis was performed by renowned statistical analysis software (SPSS 11.5, Chicago, Illinois). Statistically significant was a p value <0.05. Cochran’s Q test and McNemar’s test were used to assess differences concerning findings of MSCT coronary angiography, CFR and ICA. Sensitivity, specificity, positive and negative predictive values of MSCT and CFR were counted in the standard method. Pearson’s correlation coefficient was used to evaluate relation between MSCT, invasive angiographic and echocardiographic parameters.

**RESULTS:**
This prospective study analyzed 84 patients. Their main clinical characteristics are listed in Table 1. We also included patients who were previously revascularised with percutaneous coronary interventions 15/84 (17.86%) and coronary surgery 3/84 (3.6%).

CFR measurements were successfully obtained in LAD (n=75) and RCA (n=61), resulting in 136 vessels for analysis. Feasibility for LAD was (75/77) 97.40% and for RCA (61/70) 87.14%, due to poor acoustic window.

We have presented findings of all diagnostic procedures including invasive coronary angiography as a reference diagnostic technique in Table 2.

**Difference between diagnostic techniques in evaluation of atherosclerotic lesions** Significant statistical difference, by Cochran’s Q test was found between these three techniques in detection of a significant lesion on LAD (Q=27.55, p<0.01) and RCA (Q=8.96, p<0.01). Additionally, further analyzes revealed a significant difference between the results of MSCT and CFR (LAD: p<0.01; RCA: p<0.05), MSCT and ICA
Diagnostic techniques in detection of atherosclerotic lesions on LAD:

Significant atherosclerotic coronary artery stenosis (≥70%) on LAD by ICA as reference method were detected in 25 of 75 (33.33%) arteries, lesions of intermediate diameter (50-70%) were present in 7 of 75 (9.33%) and in 43 of 75 (57.33%) ICA detected lesions less than 50% of diameter reduction.

MSCT verified 47 obstructive lesions in 75 observed LAD arteries (62.70%), 22 of 47 (46.81%) significant lesions on MSCT were in agreement with ICA, while 25 of 47 (53.11%) of obstructive lesions on MSCT were overestimated comparing with ICA (5 of them were intermediate lesions and 20 non-significant lesions on ICA). MSCT find out 12 of 75 (16.00%) stenosis of intermediate diameter (50-70%), but 10 of 12 (83.33%) on ICA were non-significant lesions. MSCT detected 16 of 75 (21.33%) vessels with non-significant lesions (<50%), there was agreement with ICA in 13 of 16 (81.25%) segments, while only 3 of 16 (18.75%) were underestimated. (Table 2, Figure 1.a)

Comparing measurements of coronary flow reserve and MSCT angiography on LAD there was a significant difference (p<0.01) (Table 3). We found that CFR results agreed in detection of significant lesions with MSCT in 24 of 47 vessels (51.06%), while in 23 of 47 (48.94%) arteries coronary flow reserve was preserved and excluded their functional significance. Concerning intermediate lesions detected by MSCT, CFR found preserved coronary flow reserve in 11 of 12 arteries (91.67%) with intermediate stenosis what excluded their functional significance. Regarding normal vessels on MSCT there was agreement with CFR in 13 of 16 (81.25%) vessels, while 3 of them were underestimated with CFR. (Table 2, Figure 1.c)

CFR measurements detected in 28 of 75 (37.33%) LAD arteries hemodynamically significant (CFR<2) stenosis, and it was in concordance with ICA in 23 of 28 (82.14%) vessels, while 5 of them (17.86%) had no significant atherosclerotic lesions on ICA (2 were intermediate and 3 non-significant lesions on ICA) and they were overestimated by CFR. CFR graded 47 of 75 (62.67%) LAD arteries as normal, and it was in concordance with ICA in 40 of 47 (85.11%) arteries, but 7 of 47 (14.89%) were underestimated (5 of them were intermediate lesions and 2 vessels had obstructive lesions on ICA). (Table 2, Figure 1.b)

Diagnostic techniques in detection of atherosclerotic lesions on RCA:
ICA detected 26 of 61 (42.62%) significant stenosis on RCA, 6 of 61 (9.83%) were intermediate lesions and 29 of 61 (47.54%) were non-significant lesions.

MSCT found 40 obstructive atherosclerotic lesions of 61 RCA arteries (65.57%) and correctly identified 23 of 40 (57.50%) significant lesions, while 17 of 40 (42.50%) were overestimated comparing with ICA (2 were intermediate lesions and 15 were non-significant on ICA). Regarding lesions of intermediate range MSCT verified 7 of 61 (11.48%), but 3 of 7 (42.86%) were overestimated comparing with ICA, 3 of 7 (42.86%) were correctly classified as intermediate stenosis, and 1 of 7 (14.29%) was underestimated. MSCT detected 14 of 61 (22.95%) stenosis less than 50% diameter and it was in agreement with ICA in 11 of 14 (78.57%) cases while 3 of 14 (21.43%) were underestimated by MSCT. (Table 2, Figure 2.a)

Comparing measurements of CFR and MSCT on RCA there was a significant difference (p<0.05) (Table 3). CFR was in agreement with MSCT in detection of significant lesions in 20 of 40 (50.00%) vessels which were graded on MSCT as stenosis over 70% diameter, while 20 of them (50.00%) had preserved coronary flow reserve. Concerning intermediate lesions on MSCT, CFR detected preserved coronary flow reserve in 5 of 7 (71.43%) RCA arteries and excluded their real hemodynamic significance. Regarding lesion up to 50% on MSCT there was agreement between these techniques in 10 of 14 (71.43%), while 4 of them were hemodynamically significant lesions by CFR. (Table 2, Figure 2.c)

CFR measurements by TDE verified in 26 of 61 (42.62%) flow limiting stenosis on RCA and there were agreement with ICA in 20 of 26 vessels 76.92%, while 6 of them were overestimated comparing with ICA (2 were intermediate lesion and 4 non-significant). CFR detected a normal coronary flow in 35 of 61 (57.38%) vessels and correctly identified 25 of 35 (71.43%) non-significant lesions. Although 10 of 35 (28.57%) were underestimated (4 of them were lesions of intermediate diameter and 6 were obstructive lesions). (Table 2, Figure 2.b)

**Diagnostic significance of findings MSCT coronary angiography and CFR measurements by transthoracal Doppler echocardiography:** The results of sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of MSCT coronary angiography and CFR are presented in Table 4. MSCT had a high sensitivity, negative predictive value, while CFR measurements presented better values of specificity and positive predictive value. When the results of both methods were in concordance regarding importance of atherosclerotic lesions on LAD or on RCA, it
increased a diagnostic accuracy of noninvasive detection of obstructive lesions, what indirectly imply on importance of both morphological and functional assessment of atherosclerotic lesions.

**DISCUSSION:**

Invasive coronary angiography still remains the “gold standard” for detection of significant obstructive coronary disease, using the percentage of diameter stenosis with cutoff values of 50% or 70%. In recent years, MSCT coronary angiography has been increasingly used as a noninvasive imaging technique capable to detect non-significant and obstructive atherosclerosis and exclude it with a high diagnostic certainty like its greatest attributes. [1-3,11].

Some previous comparative studies between MSCT and functional tests (nuclear perfusion imagining) have reported a good concordance between these modalities in the case of normal MSCT. These observations are in line with the high negative predictive value observed comparing MSCT with ICA, and indicate that patients with a normal MSCT do not need further evaluation[11,3]. Significantly lower agreement was found between the anatomical and functional approaches in patients with intermediate and significant atherosclerotic lesions on MSCT. Usually, in case of significant lesions on MSCT, patients had almost normal perfusion scans[12-14]. Motion artifacts due to ventricular ectopic beats and blooming effects of calcifications decrease precise lumen visualization, what predispose to overestimation of severity of coronary atherosclerotic lesions by MSCT and result with low positive predictive value [14]. Regarding a coronary arteries with non-significant atherosclerotic lesions, the results of our study revealed a high agreement between results of invasive and multislice coronary angiography (LAD: 81.25%, RCA: 78.57%), also between results of MSCT and functional assessment of atherosclerotic lesions by CFR (LAD: 81.25%, RCA: 71.43%). We could notice to some extent inferior concordance of results between techniques regarding RCA, due to its worse visualization because of high mobility and smaller diameter of RCA comparing with LAD. These results are in line with previous reports and point out that a normal coronary anatomy by MSCT could accurately exclude the presence hemodynamically significant CAD[15,16, 27].

Accordingly, patients with minimal or non-obstructive atherosclerosis on MSCT do not need any further evaluation and could be safely advised for medical treatment and reduction of risk factors for cardiovascular disease.
Several studies reported that further functional evaluation following MSCT is particularly needed in patients with intermediate, diffuse lesions on MSCT, due to problems with defining real reference vessel diameters and low spatial resolution. In these group of patients, hemodynamic characteristics of atherosclerotic lesion would determine whether additional invasive diagnostic is indicated [15, 16, 19, 20]. Analyzing intermediate stenosis detected by MSCT, our investigation revealed a high proportion of overestimated lesions in comparison with ICA (LAD: 83.33%, RCA: 42.86%). In addition, normal values of CFR also excluded their real significance (LAD: 91.67%; RCA: 71.43%).

In case of significant stenosis our findings have shown that MSCT had to some extent better agreement with ICA (LAD: 46.81%; RCA: 57.50%), while still a high proportion of significant stenosis on MSCT were overestimated. As well a high proportion of these significant atherosclerotic lesions on MSCT did not resulted in functional abnormalities on CFR (agreement between MSCT and CFR for LAD: 51.06%; RCA: 50.00%) what indirectly implicates that normal values of coronary flow reserve could be used quite correctly to exclude overestimated lesions on MSCT coronary angiography.

Recent studies that compared MSCT to FFR [15, 16, 17] and investigations that assessed MSCT to CFR [18, 27] in prediction of significant stenosis reported that significant lesions on MSCT were not usually associated with hemodynamically significant reduction of coronary flow reserve, what indicated that MSCT has a tendency to overestimate the degree of stenosis.

Previous studies that evaluated results of MSCT and perfusion imaging [12, 13, 14] found a quite moderate relation between MSCT and myocardial perfusion imaging. Indeed, the percentage stenosis was the only a moderate predictor of perfusion defects. In evaluation of severity of coronary stenosis they didn’t included also other factors that may modify myocardial perfusion, such as plaque morphology and endothelial function. Furthermore, diagnosis and therapy for patients with suspected CAD [13, 21] will be a significantly improved if we take in account at the same time the results of perfusion imaging and MSCT.

In our study we have also analyzed diagnostic accuracy of MSCT coronary angiography, furthermore we have found a significant additive diagnostic role of non-invasive measurement of coronary flow reserve by TDE, which significantly increased its diagnostic accuracy in recognition of significant stenosis on coronary arteries LAD and RCA (Table 4). This is the first study which have analyzed additive diagnostic value of CFR over
MSCT results in assessment of atherosclerotic lesions on both arteries LAD and RCA. Previously one study[18] presented similar results, which for a difference of our investigation compared diagnostic value of MSCT 40 slice scanner and CFR in estimation of atherosclerotic lesion on LAD, also there is a comparable report of one small study preformed with same technology but concerning only lesions on LAD[27]. The additive diagnostic value of CFR over MSCT regarding lesions on RCA is not as good as with lesions on LAD, because of inferior feasibility, more complicated visualization due to high mobility and very often small diameter of coronary artery.

Transthoracic Doppler echocardiography with possibility to assess the Coronary Flow Reserve has been recognized as reliable additive diagnostic tool in assessment of functional significance of coronary artery stenosis, but with limitations concerning microcirculatory dysfunction due to longstanding arterial hypertension, hyperlipidemia and diabetes mellitus, what resulted in small percent of abnormal CFR even in absence of coronary stenosis[22]. The measurements of TDE-CFR, in the LAD as in the PDA arteries, are closely correlated with invasive measurements using a Doppler flow wire[23,24,25,26].

MSCT coronary angiography is reliable to exclude the presence of significant coronary stenoses in patients with suspected coronary artery disease, and this group of patients does not require any further invasive coronary angiography.

Nevertheless anatomical evaluation of coronary artery disease with MSCT has its own limitations and additional functional assessment is necessary, especially regarding range of intermediate and diffuse atherosclerotic lesions or obstructive stenosis. In everyday clinical work CFR could be useful additive diagnostic tool for functional assessment of these atherosclerotic lesions, before final decision whether invasive evaluation is really necessary. Consequently, it would lessen a number of unnecessary invasive coronary angiographies and exposure to radiation.

Even though progress in noninvasive evaluation of coronary artery disease is obvious, we should always think also about its limitations, especially in patients with significant left main stenosis or multivessel disease on MSCT. It seems reasonable to immediately refer these patients to the catheterization laboratory for additional invasive assessment in order to prevent any uncertainty.
CONCLUSION: Comprehensive noninvasive anatomical and functional imaging would be the optimal way for noninvasive assessment of coronary artery lesions. This approach could most appropriately identify patients who should be safely referred for medical treatment and those who require immediate invasive coronary angiography with further revascularization.

Study limitations: Initially important lack of our study was a relatively small number of patients. Quantification of coronary artery stenosis with MSCT is still difficult in the presence of extensive and diffuse calcifications, so Ca score should be included in final assessment of diagnostic value of MSCT in order to improve its diagnostic parameters. TDE-CFR measurements of ACX are unreliable for clinical practice. We have used invasive coronary angiography as a reference method but FFR would be more appropriate.

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Disclosures The Authors declare that there is no conflict of interest.

REFERENCES:


Table 1. Clinical characteristics of the patients
Table 2. Results of MSCT an CFR in relation to ICA findings
Table 3. MSCT versus CFR results on LAD/RCA
Table 4. Diagnostic value of MSCT coronary angiography and CFR detected by TDE

Figure 1.
Scatterplots of MSCT values in observed LAD arteries with up to 50%, 50 to 70%, and over 70% diameter narrowing on ICA (a), CFR values in observed LAD arteries with up to 50%, 50 to 70%, and over 70% diameter narrowing on ICA (b) and MSCT (c). Regarding detection of significant stenosis (>70%) on LAD there were a significant difference between MSCT and CFR (p<0.01), MSCT and ICA (p<0.01), while between CFR and ICA we didn’t find a significant difference (p=0.45).

Figure 2.
Scatterplots of MSCT values in observed RCA arteries with up to 50%, 50 to 70%, and over 70% diameter narrowing on ICA (a), CFR values in observed LAD arteries with up to 50%, 50 to 70%, and over 70% diameter narrowing on ICA (b) and MSCT (c). Regarding detection of significant stenosis (>70%) on RCA there were a significant difference between MSCT and CFR (p<0.05), MSCT and ICA (p<0.01), while between CFR and ICA we didn’t find a significant difference (p=1.00).
Table 1. Clinical characteristics of the patients

Clinical characteristics of the patients (n = 84)

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<tr>
<td>Age (years)</td>
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<tr>
<td>Hypertension</td>
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<td>Family history for CAD</td>
<td>49 (58.3%)</td>
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<td>Hyperlipidemia</td>
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<td>Stress</td>
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<tr>
<td>Ejection fraction (%)</td>
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<td>Wall motion score index</td>
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<td>Number of coronary arteries with obstructive lesions</td>
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Table 2. Results of MSCT an CFR in relation to ICA findings

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Table 3. MSCT versus CFR results on LAD / RCA

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<th></th>
<th>RCA (n=61)</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>percent of stenosis</td>
<td>CFR&gt;2</td>
<td>CFR&lt;2</td>
<td>Total</td>
<td>percent of stenosis</td>
<td>CFR&gt;2</td>
<td>CFR&lt;2</td>
<td>Total</td>
</tr>
<tr>
<td>MSCT &lt;50%</td>
<td></td>
<td>13</td>
<td>3</td>
<td>16</td>
<td></td>
<td>10</td>
<td>4</td>
<td>14</td>
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<tr>
<td>MSCT 50-70%</td>
<td></td>
<td>11</td>
<td>1</td>
<td>12</td>
<td></td>
<td>5</td>
<td>2</td>
<td>7</td>
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<tr>
<td>MSCT ≥70%</td>
<td></td>
<td>23</td>
<td>24</td>
<td>47</td>
<td></td>
<td>20</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>47</td>
<td>28</td>
<td>75</td>
<td></td>
<td>35</td>
<td>26</td>
<td>61</td>
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Table 4. Diagnostic value of MSCT coronary angiography and CFR detected by TDE

<table>
<thead>
<tr>
<th>Coronary artery</th>
<th>LAD (n=75)</th>
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<th>RCA (n=61)</th>
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<tbody>
<tr>
<td></td>
<td>Diagnostic technique(%)</td>
<td>MSCT &amp; CFR</td>
<td>MSCT &amp; CFR</td>
<td>MSCT</td>
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<tr>
<td></td>
<td>sensitivity</td>
<td>88,00%</td>
<td>92,00%</td>
<td>92,00%</td>
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<td></td>
<td>specificity</td>
<td>57,63%</td>
<td>90,00%</td>
<td>100,00%</td>
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<td></td>
<td>positive predictive value</td>
<td>46,81%</td>
<td>82,14%</td>
<td>100,00%</td>
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<tr>
<td></td>
<td>negative predictive value</td>
<td>91,19%</td>
<td>95,74%</td>
<td>96,15%</td>
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<td>diagnostic accuracy</td>
<td>66,67%</td>
<td>90,00%</td>
<td>97,33%</td>
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Figure 1.
Scatterplots of MSCT values in observed LAD arteries with up to 50%, 50 to 70%, and over 70% diameter narrowing on ICA (a), CFR values in observed LAD arteries with up to 50%, 50 to 70%, and over 70% diameter narrowing on ICA (b) and MSCT (c). Regarding detection of significant stenosis (>70%) on LAD there were a significant difference between MSCT and CFR (p<0.01), MSCT and ICA (p<0.01), while between CFR and ICA we didn’t find a significant difference (p=0.45).

Figure 2.
Scatterplots of MSCT values in observed RCA arteries with up to 50%, 50 to 70%, and over 70% diameter narrowing on ICA (a), CFR values in observed LAD arteries with up to 50%, 50 to 70%, and over 70% diameter narrowing on ICA (b) and MSCT (c). Regarding detection of significant stenosis (>70%) on RCA there were a significant difference between MSCT and CFR (p<0.05), MSCT and ICA (p<0.01), while between CFR and ICA we didn’t find a significant difference (p=1.00).