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Diagnostic value of multislice computed tomography angiography in coronary artery disease: A Meta-analysis

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Abstract

Purpose: To perform a meta-analysis of the diagnostic value of multislice CT (MSCT) angiography in the detection of coronary artery disease (CAD) when compared to conventional coronary angiography.

Materials and Methods: A search of PubMed and MEDLINE databases for English literature was performed. Only studies with at least 10 patients comparing MSCT angiography with conventional coronary angiography in the detection of CAD were included. Diagnostic value of MSCT angiography compared to coronary angiography was compared and analyzed at segment-, vessel- and patient-based assessment.

Results: 47 studies (67 comparisons) met the criteria and were included in our study. Pooled overall sensitivity, specificity and 95% confidence interval for MSCT angiography in the detection of CAD were 83% (79%, 89%), 93% (91%, 96%) at segment-based analysis; 90% (87%, 94%), 87% (80%, 93%) at vessel-based analysis; and 91% (88%, 95%), 86% (81%, 92%) at patient-based analysis, respectively. Diagnostic accuracy of MSCT angiography in evaluating assessable segments was significantly improved with 64-slice scanners when compared to that with 4- and 16-slice scanners ($p<0.05$).

Conclusion: Our meta-analysis showed that MSCT angiography has potential diagnostic accuracy in the detection of CAD. Diagnostic performance of MSCT angiography has been significantly improved with the latest 64-slice CT, with resultant high qualitative and quantitative diagnostic accuracy. 16-slice CT was limited in spatial resolution which makes it difficult to perform quantitative assessment of coronary artery stenoses.

Key words: Coronary artery disease, computed tomography, angiography, diagnostic value, meta-analysis

Introduction

Coronary artery disease (CAD) is the leading cause of death in Western countries (1). The standard of reference for diagnosis of CAD is still conventional coronary angiography, with the advantage of high spatial resolution and temporal resolution. However, it is an invasive and expensive procedure with associated morbidity and mortality (2). Furthermore, coronary angiography usually requires a short hospital stay and causes discomfort for the patients. It is reported that only one-third of all conventional coronary angiography examinations in the United States are performed in conjunction with an interventional procedure, while the rest are performed only for diagnostic purposes, which is only for verification of the presence and degree of CAD (1). Therefore, a non-invasive technique for imaging of the coronary artery disease is highly desirable.

Imaging of the heart has always been technically challenging due to the heart's continuous movement. Over the past decade, non-invasive coronary imaging modalities have undergone rapid developments, such as electron beam computed tomography and magnetic resonance imaging (3, 4). Despite encouraging results, neither of these techniques has been considered suitable for routine clinical use. Imaging of the heart has moved into the diagnostic era with the introduction of multislice CT angiography (MSCT) and development of electrocardiography-synchronized scanning and reconstruction techniques (5, 6).

Currently, MSCT scanner permits acquisition of volume data with up to 64 slices per rotation (330ms to 500ms) in a single breath hold. In recent years, considerable interest has concentrated on the beneficial use of high-spatial resolution of MSCT for non-invasive investigation of the coronary arterial tree (7-10). Studies involving the application of MSCT angiography in CAD were aimed to investigate whether MSCT can replace coronary angiography in the non-invasive detection and diagnosis of CAD (7-12). Although earlier results were promising, MSCT angiography was not found to reach the diagnostic accuracy as that provided by conventional coronary angiography. However, it seems questionable whether it is worthwhile pursuing MSCT angiography in cardiac imaging indefinitely because radiation dose is an important issue resulting from MSCT. Therefore, we aimed in this study to perform a meta-analysis of MSCT angiography in the detection of CAD with regard to the diagnostic value in comparison to conventional coronary angiography, based on the current available results.

Methods

Criteria for data selection

A search of PubMed and MEDLINE databases for English literature was performed by two reviewers (ZS, WJ) for articles describing the diagnostic value of MSCT angiography in CAD when compared to conventional coronary angiography (last search May 2006). The articles must be peer-reviewed and published in English language. We used key words describing MSCT angiography in coronary artery disease; MSCT and coronary artery stenosis or disease; coronary MSCT. We limited our search to reports on human subjects and excluded case reports, conference abstracts, review articles, and articles investigating the coronary stent graft. The search of literature ranged from 1998 to 2006, as MSCT was first introduced into clinical practice in 1998 (13). In addition, the reference lists of identified articles were checked to obtain additional relevant articles. Prospective and retrospective studies were included if they met all of the following criteria: (a) patients undergoing both MSCT angiography and coronary angiography examinations; (b) studies included at least 10 patients; (c) assessment or comparison of MSCT angiography with coronary angiography was focused on the visualization of coronary arteries and detection or exclusion of coronary artery stenosis; (d) diagnostic value of MSCT angiography was addressed when compared to coronary angiography in terms of sensitivity, specificity, either segments-based, vessels-based or patients-based assessment.

Data extraction

Data were extracted repeatedly by two reviewers (ZS, WJ) based on study design and procedure techniques and disagreement was resolved by consensus. We looked for the following characteristics in each study: year of publication; origin of the study performed; number of participants in the study; mean age; mean heart rate; percentage of male patients affected, risk factors of developing CAD (diabetes mellitus-DM, smoking, family history, hypertension, hyperlipoproteinemia), number of patients receiving β–blockage; number of CT detector rows, scanning protocols; assessable segments in each study, occurrence of coronary artery disease (one-vessel, two-vessel, or three-vessel), diagnostic accuracy of MSCT when compared to coronary angiography in terms of the sensitivity, specificity and main factors affecting the visualization of coronary artery tree or lesions. All diagnostic accuracy estimates referred to segment/vessel/patient-based assessment.

Statistical analysis

Data were entered into SPSS (version 12.0) for analysis. Sensitivity and specificity estimates for each study were combined across studies using one sample test. Comparison was performed by Chi Square test using n-1 degree of freedom to test if there is any significant difference regarding the diagnostic accuracy of MSCT angiography in CAD between 4-slice and 16- or 64-slice CT scanners, among segment-based assessment, vessel-based assessment or patient-based assessment. Statistical hypotheses (2-tailed) were tested at the 5% level of significance.

Results

General information

48 studies met criteria and 47 (67 separate comparisons) were included for the analysis (7-12, 14-55) as two studies used similar dataset and one of them was excluded (47). There were 10 studies involved 30 comparisons in different groups, either dealing with different heart rates (12, 19, 42, 45, 50), or variable image visualizations (15, 38), or different criteria of the density of calcification (17, 48-50). According to American Heart Association (56), studies involved all four coronary main branches and coronary artery segments (up to 17 segments) were included for analysis. Table 1 shows the general information in each study that was included in the review. The number of patients enrolled in these studies ranged from 24 to 149. There were only 10 studies which enrolled more than 100 cases, while in four studies patient's number was less than 30. Our review showed that 20 studies were performed on 4-slice CT scanners, while 19 studies were done on 16-slice scanners with seven studies on 64-slice scanners and one study on 8-slice scanner. Four studies carried out on 4-slice scanners were published during 2004 and 2005, while the remaining ones were published prior to 2004. Most of the studies performed on 16-slice CT scanners were carried out during 2004 and 2005, except in two studies for which the publications were between 2002 and 2003 (29, 30). This indicates the changing direction of investigation in cardiac imaging with more efficient and faster CT scanners.

Radiation dose was only addressed in seven studies and it was reported to range from 4.3 to 20 mSv. Comparison among various MSCT detector rows was unavailable due to limited number of studies.

Analysis of patients' characteristics

Of all studies analyzed, it was found that the male patients were most commonly affected with CAD, with pooled estimate and 95% confidence interval (CI) being 75% (71%, 78%). The pooled mean prevalence of CAD was 74% (95% CI 64%, 84%). Percentages of one-vessel, two-vessel and three-vessel coronary artery disease were reported in 14 of 47 studies, with pooled estimates and 95% CI being 36% (26%, 45%), 21% (15%, 27%), 18% (12%, 24%), respectively. Five risk factors for developing CAD were reported in 8 studies and pooled estimates and 95% CI were 20% (15%, 26%), 37% (21%, 54%), 31% (15%, 48%), 59% (45%, 75%), 68% (60%, 76%), for DM, smoking, family history, hypertension, hyperlipoproteinemia, respectively. There was statistically significant difference between the two high risk factors (hypertension, hyperlipoproteinemia) and the other three relatively low risk factors ($p<0.05$).

MSCT angiography in the detection of CAD-meta analysis of assessable segments

Pooled estimates of assessable segments and 95% CI for MSCT angiography in the detection of CAD were 74% (69%, 89%), 92% (88% 96%), and 97% (93%, 100%) with 4-slice, 16-slice, and 64-slice scanners, respectively. Assessable segments by MSCT angiography were found to improve with the increase of CT detectors and significant difference was reached when compared 64-slice with 4-slice and 16-slice scanners ($p<0.05$), 16-slice with 4-slice scanners ($p<0.001$). In 23 of 47 studies, 15 or more segments were included for analysis, while in 13 studies, 10 to 14 segments were included, and less than 10 segments were analyzed in four studies. The number of segments analyzed was unavailable in the remaining seven studies. Of 20 studies performed on 4-slice scanners, more than 15 segments were included for analysis in only five studies (25%). In contrast, of 26 studies performed on 16-slice and 64-slice scanners, more than 15 segments were assessed in 18 studies (69%), which indicates the improved diagnostic performance of 16-slice and 64-slice compared to 4-slice CT scanners. Coronary artery segments with a minimal diameter of 1.5 mm or 2.0 mm were included for analysis in more than half of the studies (62%).

MSCT angiography in the detection of CAD-meta analysis of diagnostic accuracy

Table 2 shows pooled estimates of sensitivity and specificity that were available for analysis at the segment-based, vessel-based, patient-based assessment and at each particular coronary segment according to AHA (56). The pooled sensitivity and specificity of MSCT angiography in the diagnosis of CAD was improved with the increase of CT detector rows, as shown in table 2. However, we did not compare the overall diagnostic accuracy between 4-slice and 16-or 64-slice scanners because the sensitivity and specificity were based on variable assessable arterial segments, and therefore there exists a question of judgement. It was noticed that the sensitivity of MSCT angiography in the diagnosis of CAD was the highest in LM and lowest in LCX and side branches, with significant difference being observed between LM and other three main branches ($p<0.05$). However, the specificity of MSCT angiography remains relatively high in the main and proximal branches, which was more than 90% in most of the assessment.

Combined analysis of the sensitivity and specificity of MSCT compared to coronary angiography was performed between proximal and middle, middle and distal, proximal and distal coronary branches. Our meta-analysis showed that significant difference was reached in comparison of proximal LAD with distal LAD, middle

LAD with distal LAD with respect to both sensitivity and specificity ($p<0.05$). Significant difference was found in comparison of proximal LCX with distal LCX regarding the sensitivity ($p<0.05$), but not the specificity ($p>0.05$). Both sensitivity and specificity were not found to be significantly different when comparing proximal and middle with distal right coronary artery ($p>0.05$).

MSCT diagnostic accuracy-influence of heart rate

Our results showed that the diagnostic value of MSCT angiography is restricted to low heart rates, even with the rapid 64-slice CT scanner (49, 50, 54, 55). 26 (55%) studies received β-blockage before or at the time of CT examination with the aim of lowering heart rate for obtaining satisfactory results. In five studies the direct relationship between heart rate and its effect on the visualization of coronary arteries by MSCT angiography in the diagnosis of CAD was investigated (12 comparisons) (12, 19, 42, 45, 50). Combined analysis of these studies showed that the diagnostic value of MSCT angiography in the diagnosis of CAD decreased when the heart rate increases, although this did not reach statistically significant difference ($p>0.05$).

Discussion

The technique of MSCT angiography in cardiac imaging is evolving rapidly. This has been represented by the development of more detector rows of MSCT scanners in clinical practice. Theoretically, emergence of increased MSCT detector rows should be followed by subsequent improvement in image quality in patients with high heart rate or in evaluation of peripheral/distal coronary artery segments. Our analysis confirmed this hypothesis to some extents. Diagnostic accuracy of MSCT acquired with 16-slice and 64-slice scanners showed significant improvement in the assessable segments and inclusion of more distal branches for analysis when compared to earlier 4-slice scanners owing to improved spatial and temporal resolution. Results from the current 64-slice CT were satisfactory and compared favourably with conventional coronary angiography. We have to admit that only seven studies were found performed on 64-slice scanners and data analysis of all coronary segments were available in three of them. We believe that more research findings obtained with 64-slice CT will be available in the medical literature over the next few years as 64-slice CT is being installed in many hospitals or imaging centres.

It must be noted that in practice, MSCT angiography is more likely to be applied to patients who have low to intermediate probability of CAD. While the negative predictive value of MSCT coronary angiography is likely to be high, the positive predictive value will be low in a population with a lower prevalence of CAD. This may lead to unnecessary downstream testing with invasive angiography. The mean prevalence of CAD (74%) in our analysis indicates the high pretest probability of CAD, thus reliable exclusion of significant CAD (high specificity and negative predictive value) would represent the most valuable diagnostic information of MSCT. Our meta-analysis showed that MSCT could be used for screening high risk CAD patients (patients with these five risk factors, especially with hypertension and hyperlipoproteinemia) while avoiding unnecessary invasive angiography examinations. Although with the current technique MSCT cannot replace coronary angiography in the detection of CAD, it is worthwhile identifying the group of patients with high risk CAD in whom MSCT has the most diagnostic value. It is likely that 64-slice scanners could be a promising alternative to coronary angiography in this aspect.

One of the difficulties for cardiac imaging is that image quality highly depends on heart rate. Despite technical improvements in MSCT scanner with subsequent improvement in temporal resolution (83 ms), the assessability and diagnostic accuracy are still higher in patients with a lower heart rate, and deteriorate at a higher heart rate, as observed in our analysis. Motion artefacts have remained the main factor affecting the visualization of coronary tree, even if in the most recent 64-slice CT scanners. Use of beta-blocker in patients with heart rate more than 70 bpm is still required in most of the current studies, which indicates the importance of future development in temporal resolution in MSCT in order to make this technique applicable to more patients, especially those with higher heart rates. Consistent use of beta-blocking agents before the scan to keep patients' heart rates below 60 bpm could produce better results in some studies. Therefore, these results should be explained with caution and this factor needs to be kept in mind while interpreting the results.

Another common factor that affects evaluation of coronary artery lumen is the presence of extensive calcification. Similar to 4-slice and 16-slice CT, extensive artery calcifications are a frequent source for impairing vessel assessment, even with 64-slice CT, although the degree of artifacts due to partial volume effects seem to be less severe. Severe calcification obscures coronary lumen and can lead to overestimation of the severity of the lesions due to blooming artifacts, making quantification of the degree of coronary artery stenosis difficult. Improvements in spatial resolution and dedicated post-processing algorithms may minimize the problem (36, 51).

In addition to non-invasive assessment of the coronary artery lumen, wall and calcified plaque, MSCT angiography has been found to be able to provide excellent information concerning myocardial morphology, having the potential to investigate the morphological and hemodynamic significance of a coronary lesion, e.g. the relationship between the status of a coronary artery and its dependent myocardial region (57-60). Magnetic resonance imaging is well established for the assessment of myocardial viability. However, the clinical application of CT in the diagnosis of myocardial infarctions has not become popular until the introduction of MSCT systems. At present, although there is little data available on the use of MSCT in myocardial perfusion imaging, the preliminary results are promising. Nikolaou et al (57) reported a 90% diagnostic accuracy of MSCT angiography for detection of previous myocardial infarction, suggesting that it might provide information on coronary arteries status, and at the same time, on myocardial morphology. Hoffman et al (58) in their recent study showed that MSCT has the potential to depict accurately not only the infarct localization, but also to quantify infarct size on a porcine model of complete coronary occlusion. Francone et al (59) in their most recent study systematically investigated the feasibility of MSCT angiography in detecting myocardial infarction, and to correlate the localization of necrosis with MSCT findings. Their results showed the high diagnostic accuracy of MSCT in detection of myocardial infarction and infarcted segments in comparison with the non-infarcted myocardium. We believe that better results will be obtained with 64-slice scanners in the investigation of myocardial infarction and perfusion due to advancement in spatial and temporal resolution, since most of the current studies in this area are based on 4-slice and 16-slice scanners.

There are some limitations in our analysis which should be addressed. Firstly, publication bias may have affected our results as we excluded non-English references and unpublished results. However, we do endeavour to include studies published in non-English journals with English correlation to their original research (37, 38). Although we are aware that more studies are being performed on 64-slice scanners, it is difficult to include all of the potential studies in the review, especially those studies currently being undertaken or under review. Secondly, lack of uniform criteria of assessment is another limitation inherent in most of the studies analysed. Inclusion of variable number of coronary segments makes the comparison of MSCT results difficult. When interpreting sensitivity and specificity values of MSCT angiography, one needs to consider the specific restrictions that are used in each study analysis. It becomes complicated to compare findings between studies as results are reported according to segment-based, vessel-based, patient-based and lesion-based analyses. Consequently, we did not perform this comparison as we are aware that findings could be invalid. Instead, we analyzed and compared the individual segments acquired with different MSCT scanners. Our analysis showed that image quality was compromised in distal coronary segments when compared to proximal or middle ones. Finally, assessment of all coronary branches was carried out in less than half of the studies (45%), which indicate further studies of MSCT angiography deserves to be investigated in a large cohort with inclusion of more coronary segments.

In conclusion, our meta-analysis has shown that MSCT angiography has potential diagnostic value in the diagnosis of CAD. The diagnostic performance of MSCT angiography has been significantly improved with the recent development of 64-slice scanners. Apparently, 4-slice CT does not meet clinical requirements for diagnosis of CAD, while 16-slice CT has relatively high diagnostic accuracy, but its limited spatial resolution only allows qualitative assessment of coronary artery stenoses. Thus, 16-slice CT may have difficulty in accurately measuring the very small diameters at the site of maximum stenosis less than 1 mm. Diagnostic accuracy has been significantly improved with current 64-slice CT, with resultant high qualitative and quantitative diagnostic accuracy.

Clinical application of 16-and 64-slice scanners is recommended in the following areas which will provide clinicians with guidance in the judicious use of MSCT in cardiac diseases:

- Due to high specificity, MSCT angiography could be the preferred initial imaging test in patients with an intermediate likelihood of CAD. If an entire coronary MSCT angiography is normal, without significant coronary calcification, no further testing would be required;
- Despite improved temporal resolution in 64 slice scanners, beta-blockers are still required in patients with a heart rate more than 70 bpm in order to obtain acceptable image quality;
- If coronary artery stenoses defined by MSCT angiography are of uncertain significance, myocardial perfusion SPECT should be performed for purposes of risk stratification and guiding patient management;
- Clinical application of MSCT angiography should be combined assessment of coronary arteries with visualisation of the myocardium and myocardial chambers in patients with severe coronary artery disease or previous procedures of revascularisation. This aims to provide valuable information on myocardial viability and perfusion without an increase in volume of contrast agent or radiation dose administered to the patient.

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Table 1 Characteristics of MSCT scanning protocols used in the evaluation of CAD

First author Country of origin	Year of Publication	No. of Patients	Mean age	Mean HR	No. of cases β blocker %	No. of detectors	ST (mm)	Pitch	RI (mm)	GRT (ms)	Assessable Segments (%)
Nieman et al Netherlands (7)	2001	35	59	NS	NS	4x1	1.25	1.5-2.0	0.8	500	73
Kopp et al (8) Germany	2002	102	62	63	None	4x1	1.25	1.5-2.0	0.6	500	NA
Achenbach et al Germany (9)	2001	64	79	NS	None	4x1	1.2-1.4	0.375	1.0	500	68
Nieman et al Netherlands (10)	2002	53	56	68	None	4x1	1.25	1.5/2.0	0.5/0.8	500	70
Gerber et al USA (11)	2003	126	58	NS	60	4x1	1.25	0.375	0.6	500	72
Giesler et al Germany (12)	2002	100	63	NS	36	4x1	1.25	0.375	1.2-1.4	500	71
Mahnken et al Germany (14)	2003	35	62	69	NS	4x1	1.25	0.375	0.6	500	67
Vogl et al Germany (15)	2002	64	56	64	NS	4x1	1.25	0.375	0.5	500	75
Beck et al Germany (16)	2002	28	64	58	100	4x1	1.25	0.75	0.6	500	95
Herzog et al Germany (17)	2004	38	62	71	71	4x1	1.25	0.375	0.5	500	68
Knez et al Germany (18)	2001	44	60	64	50	4x1	1.25	0.75	0.5	500	94
Nieman et al Netherlands (19)	2002	78	57	68	None	4x1	1.25	0.375	0.5	500	68
Leber et al Germany (20)	2003	91	62	64	29	4x1	1.25	0.75	0.5	500	82
Morgan-Hughes et al UK (21)	2003	30	56	64	None	4x1	1.3	0.375	NS	500	68
Nieman et al Netherlands (22)	2003	24	64	64	None	4x1	1.25	1.5	0.5	500	69

Herzog et al Germany (23)	2003	36	60	63	NS	4x1	1.25	0.375	0.5	500	80
Martuscelli et al (24) Italy	2004	47	60	59	100	4x1.25	1.25	NS	0.6	500	77
Haberl et al Germany (25)	2005	133	67	66	95	4x1	1.3	0.375	0.7	500	74
Kuettner et al (26) Germany	2004	66	61	67	None	4x1.0	1.2	0.375	0.8	500	57
Gerber et al (27) Belgium	2005	26	66	60	15	4x1.0	1.2	0.94	0.6	500	85
Matsuo et al Japan (28)	2004	25	65	60	100	8x1	NS	0.2	NS	500	94
Ropers et al Germany (29)	2003	77	82	69	84	12x0.75	1	0.31	0.5	420	88
Nieman et al Nether lands (30)	2002	59	58	56	63	12x0.75	NS	0.74	N/A	420	92
Mollet et al Netherlands (31)	2004	128	59	58	60	16x0.75	N/A	0.25	NS	420	93
Kuettner et al Germany (32)	2004	60	58	64	93	12x0.75	1.5	0.42	NS	500	79
Martuscelli et al Italy (33)	2004	64	58	59	100	16x0.625	0.625	0.29	0.4	500	84
Hoffmann et al USA (34)	2004	33	60	57	52	16x0.75	1	0.23-0.32	0.5	420	83
Kuettner et al Germany (35)	2005	72	64	64	60	16x0.75	1.0	0.32	0.5	375	93
Mollet et al Netherlands (36)	2005	51	59	57	25	16x0.75	NS	0.25	NS	375	NA
Cademartiri et al Italy (37)	2005	40	59	55	45	16x0.75	0.75	0.25	0.4	375	98
Cademartiri et al Italy (38)	2005	60	58	56	NS	16x0.75	1.0	0.25	0.5	375	98
Fine et al USA (39)	2004	50	58	NS	NS	12x0.75	1.0	0.31	0.5	420	NA

Achenbach et al (40) Germany	2005	50	62	58	86	16x0.75	1.0	0.25	0.5	375	96
Hoffmann et al (41) Germany	2005	103	62	69	NS	16x0.75	0.2-0.3	NS	NS	420	94
Kaiser et al (42) Switzerland	2005	149	64	NS	69	16x0.75	1.0	0.23	0.5	NS	77
Kuettner et al (43) Germany	2005	120	64	64	51	16x0.75	1.0	0.32	0.5	370	93
Kefer et al (44) Belgium	2005	52	65	66	NS	16x0.75	0.8	0.20-0.24	0.8	420	99
Cademartiri et al (45) Italy	2005	120	58/59*	52/63*	None	16x0.75	1.0	0.25	0.5	420	100
Morgan-Hughes et al (46) UK	2005	57	61	64	NS	16x0.63	0.625	0.27-0.29	0.625	500	100
Cademartiri et al (48) Italy	2005	120	57/58*	57/58*	NS	16x0.75	1.0	0.25	0.5	420	100
Mollet et al (49) Netherlands	2005	51	60	58	73	64x0.6	0.6	0.20	0.4	330	100
Raff et al USA (50)	2005	70	59	70-80	None	64x0.6	0.6	0.2	NS	330	88
Leber et al Germany (51)	2005	59	64	62	36	64x0.6	0.6	NS	NS	330	100
Leschka et al (52) Switzerland	2005	67	60	66	60	64x0.6	0.75	0.24	0.5	370	100
Pugliese et al (53) Netherlands	2005	35	61	NS	NS	64x0.6	0.75	0.2	0.4	330	100
Ropers et al (54) Germany	2005	84	58	59	74	64x0.6	0.75	0.2	0.4	330	96
Fine et al (55) USA	2005	66	62	NS	NS	64x0.6	0.75	0.2	0.4	330	94

HR-heart rate, ST-sectional thickness, RI-reconstruction interval, GRT-gantry rotation time. * indicates that different groups are included in the study.

Table 2. Summary of diagnostic accuracy of MSCT angiography in comparison to coronary angiography in the diagnosis of CAD

Analysis	Studies	Pooled Sensitivity (95% CI)	Pooled Specificity (95% CI)
Segment-based	34	83% (79%, 89%)	93% (91%, 96%)
LM	16	98% (94%, 100%)	99% (99%, 100%)
LAD	19	89% (84%, 93%)	92% (88%, 96%)
LCX	19	73% (61%, 84%)	95% (92%, 98%)
RCA	19	89% (83%, 95%)	94% (91%, 98%)
Vessel-based	16	90% (87%, 94%)	87% (80%, 93%)
Patient-based	21	91% (88%, 95%)	86% (81%, 92%)
4-slice CT	20	76% (70%, 82%	93% (90%, 96%)
16-slice CT	19	82% (74%, 90%)	95% (92%, 98%)
64-slice CT	7	92% (83%, 100%)	94% (91%, 97%)
Proximal RCA	12	84% (74%, 95%)	96% (93%, 99%)
Middle RCA	12	86% (75%, 96%)	94% (89%, 98%)
Distal RCA	12	83% (67%, 98%)	96% (93%, 98%)
RPDA	11	67% (41%, 92%)	90% (70%, 99%)
Proximal LAD	12	87% (79%, 96%)	90% (84%, 97%)
Middle LAD	12	89% (79%, 99%)	90% (84%, 96%)
Distal LAD	12	69% (49%, 89%)	96% (92%, 99%)
Proximal LCX	12	83% (70%, 96%)	94% (90%, 99%)
Distal LCX	10	66% (35%, 96%)	91% (80%, 99%)
LPDA	9	49% (17%, 81%)	86% (61%, 99%)
DIA1	9	75% (53%, 97%)	92% (86%, 98%)
DIA2	6	55% (14%, 96%)	84% (49%, 99%)
OM	8	78% (51%, 99%)	93% (84%, 99%)
PLA	5	NA	77% (24%, 99%)

LM-left main branch, LAD-left anterior descending, LCX-left circumflex, RCA-right coronary artery, RPDA-right posterior descending artery, LPDA-left posterior descending artery, DIA1-first diagonal, DIA2-second diagonal, OM-obtuse marginal, PLA-posterior lateral artery
NA-not available