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Diagnostic accuracy of 16- versus 64-slice multidetector computed tomography angiography in the evaluation of coronary artery bypass grafts: a comparative study

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Abstract

OBJECTIVES: Multidetector computed tomography (MDCT) angiography, which is used for native coronary vessels and bypass graft (CABG) imaging is a non-invasive test. Here, we aimed to compare the diagnostic accuracy of 16- and 64-slice MDCT for graft patency and stenosis.

METHODS: A total of 129 consecutive patients with CABG who underwent both MDCT (58 patients with 16-slice, 71 patients with 64-slice) and invasive angiography were included. Median time interval between the two procedures was 12 days (range 3–28 days). Bypass grafts were evaluated concerning patency and presence of stenosis ≥50%. Both 16- and 64-slice MDCT results were compared with invasive angiography.

RESULTS: Overall diagnostic accuracy for the detection of graft patency was 95% for 64-slice vs 92% for 16-slice MDCT. By analyzing the 173 grafts by 64-slice vs 153 grafts by 16-slice MDCT that could be evaluated, sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV) of the MDCT for visualization of graft patency were 90, 98, 90 and 98% vs 87, 97, 94 and 93%, respectively. The accuracy of MDCT for the detection of significant graft stenosis was relatively low (sensitivity, specificity, PPV and NPV were 67, 98.6, 50 and 98.6% with 16-slice vs 80, 98.1, 72.7 and 98.7% with 64-slice).

CONCLUSIONS: This study showed that the 16-slice has a diagnostic accuracy comparable with the 64-slice system for graft patency and can still be used for this purpose if newer systems with improved performance are not available on-site. On the other hand, by the virtue of better image quality, the 64-slice MDCT demonstrates significant graft lesions with higher sensitivity.

Keywords: Coronary artery bypass grafting • Multidetector computed tomography angiography • Stenosis

INTRODUCTION

Coronary artery bypass grafting (CABG) has become the main therapeutic option for symptomatic advanced coronary artery disease (CAD). Graft patency is the most important variable that determines the effectiveness of CABG surgery [1]. However, the natural history of CABG involves patency rates at 10 years of 60% for venous grafts and 90% for arterial grafts [2]. Currently, invasive coronary angiography (ICA) remains the gold standard tool for the assessment of suspected occlusion or restenosis after CABG. The risk of stroke, arrhythmia, injury to graft and haemorrhage, and also technical difficulties in accessing complicated surgical grafts, limit its clinical benefit [3].

Multidetector computed tomography (MDCT) angiography has been proposed as a non-invasive alternative for the evaluation of obstructive CABG lesions. MDCT scanners combine a high spatial resolution with the ability to demonstrate the anatomy through volume-rendered images, thus producing a more sensitive evaluation than does conventional or spiral computed tomography. However, imaging of coronary anatomy using MDCT is not free of complications including contrast agent and radiation exposure. The efficacy of 16-slice and 64-slice MDCT for the detection of CABG occlusion or stenosis has been demonstrated in several studies [2, 4–7]. In a previous study, Stauder *et al.* [8] reported that sensitivity, specificity and positive and negative predictive values for >50% stenosis were 98.5, 93.9, 91.8 and 98.9%, respectively, for venous grafts using 16-slice MDCT. In a previous study including 52 patients, Malagutti *et al.* [5] reported that sensitivity, specificity and positive and negative predictive values for >50% stenosis were 100, 96, 97.5 and 100%, respectively, using 64-slice MDCT. In addition, in a recent study, Weustink *et al.* [9] reported a diagnostic accuracy of 100% for the detection or exclusion of significant stenosis in arterial and venous grafts using dual source MDCT. However, there was no study comparing the 16-slice and 64-slice MDCT for diagnostic accuracy in graft patency and stenosis. Therefore, the aim of this study was to evaluate the diagnostic accuracies of 16- vs 64-slice MDCT in the evaluation of CABG patients.

METHODS

Study population

In this retrospective analysis, we included a total of 129 patients (104/129 male; mean age: 62.1 ± 9.8) with a history of bypass graft surgery who underwent evaluation with computed tomography and invasive angiography for the evaluation of CAD. Exclusion criteria were previous allergic reaction to iodine contrast medium, pregnancy, arrhythmia and renal dysfunction (creatinine ≥ 1.5mg/dl). Included patients underwent ICA for recurrent chest pain or a prior episode of severe arrhythmia and 16- or 64-slice MDCT examination. Median time interval between MDCT and ICA was 12 days (range: 3–28 days). No cardiac event occurred between ICA and MDCT coronary angiography.

Medical history of angina pectoris, hypertension, stroke, diabetes mellitus (DM), family history of premature CAD (CAD in male first-degree relative <55 years; CAD in female first-degree relative <65 years), current medication, smoking and social status were systematically evaluated. Hypertension was defined as the use of antihypertensive medication, or a systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg. Hypercholesterolemia was defined as total cholesterol >200 mg/dl or use of a cholesterol-lowering agent. DM was defined as fasting plasma glucose level ≥126 mg/dl or current diabetes treatment with dietary modification, oral glucose-lowering agents or insulin [10]. This study was approved by the local ethics committee and informed consent was received from each participant before MDCT imaging.

Venous blood samples were obtained by the venipuncture of the large antecubital veins of the patients. Total cholesterol, triglyceride, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, fasting plasma glucose, glycated haemoglobin, blood urea nitrogen and serum creatinine levels were measured after at least a 12-h fasting period. Results were determined enzymatically with a commercially available assay kit (Hitachi P800, Holliston, MA).

Table 1: The baseline characteristics of the study population

Parameters	16-Slice MDCT group (*n* = 58)	64-Slice MDCT group (*n* = 71)	*P*
Clinical parameters			
Age (years), mean ± SD	61.0 ± 9.1	63.2 ± 8.6	0.77
Gender, male	44 (75.8%)	52 (73.2%)	0.53
BMI, kg/m^2	26.4 ± 2.8	27.5 ± 3.5	0.83
Hypertension	46 (79.3%)	56 (78.9%)	0.45
Diabetes mellitus	16 (27.5%)	22 (31%)	0.24
Current smoking	29 (50%)	35 (49.3%)	0.20
Dyslipidemia	45 (77.5%)	55 (77.5%)	0.98
Family history of premature CAD	4 (6.8%)	6 (8.5%)	0.05
Total cholesterol	211 ± 43.5	199 ± 53.5	0.06
Triglycerides	147 ± 58.5	155 ± 64.5	0.07
HDL cholesterol	49.2 ± 24.1	51.8 ± 21.8	0.89
LDL cholesterol	130 ± 42.7	123 ± 44.7	0.06
ASA	96.1%	97.8%	0.15
Beta-blocker	79.5%	82.7%	0.25
CCB	15.4%	13.1%	0.36
ACE inhibitor	61.7%	66.2%	0.06
ARB	31.3%	30.1%	0.42
Statins	71%	69.6%	0.07
MDCT examination data			
Heart rate during scanning, beats/min	64 ± 8.6	80 ± 4.2	0.02
Scan time, s	20.5 (16–23)	6.2 (5.7–8.4)	0.01
Pitch	0.28	0.2–0.47	0.56
Scan length, cm	18.3 (15.8–21)	17.5 (14–22)	0.45
Contrast volume, ml	120	80	0.03
Radiation exposure	18.1 ± 5.2 (17–25)	17.2 ± 6.5 (15–24)	0.44

Data are means ± SD or *n* (%).
ACE: angiotensin converting enzyme; ARB: angiotensin receptor blocker; ASA: acetylsalicylic acid; BMI: body mass index; CAD: coronary artery disease; CCB: calcium channel blocker; HDL: high-density lipoprotein; LDL: low-density lipoprotein; MDCT: multidetector computed tomography.

Coronary multidetector computed tomography image acquisition

MDCT examination data reviewed for both 16- and dual source 64-slice MDCT are shown in Table 1.

In 58 patients, MDCT examinations were performed using a 16-slice MDCT scanner (Somatom Sensation 16, Siemens, Erlangen, Germany). After an anteroposterior scout image was obtained (120 kV, 50 mAs) in the supine position, the scanning range was planned individually for each patient ranging from the midclavicle to the apex of the heart (mean distance: 18.3 cm; range: 15.8–21 cm). Image acquisition was performed with an inspiratory breathhold. A total of 120 ml of iodinated contrast agent (Iopamiro 300 mg/ml; Bracco, Milan, Italy) was injected into an antecubital vein via a 20-gauge catheter. Contrast was administrated by a power injector (Medrad envision CT, Pittsburgh, PA) at a flow rate of 4 ml/s. To achieve optimal contrast enhancement, a region of interest was placed on the ascending aorta; and as soon as the density in the region of interest reached a threshold of 100 Hounsfield units, the patient was instructed to maintain an inspiratory breathhold and scanning started. Contrast-enhanced MDCT data were collected with 1-mm slice thickness, 420-ms rotation time (detector collimation: 0.75 mm; table feed: 3.4 mm/rotation) and 0.28 pitch. The tube current was 500 mA at 120 kV. Images were obtained by retrospective ECG and half-scan techniques.

A total of 71 participants underwent MDCT with a dual-source 64-detector scanner (Somatom Definition, Siemens, Erlangen, Germany). Sublingual nitrate (5 mg of isosorbide dinitrate, Fako, Isordil) was given 2–4 min before image acquisition to dilate the coronary arteries. All patients were in sinus rhythm without tachycardia at the time of the MDCT scan. The coronary angiographic scan was obtained with injection of 80 ml of non-ionic contrast medium (350 mg I/ml Iohexol, Amersham Health, Omnipaque) at a flow rate of 6 ml/s followed by 50 ml of saline solution with the same injection rate to wash out the contrast material from the right ventricle. Contrast administration was controlled with bolus tracking. The scan parameters were detector collimation: 32 × 0.6 mm; slice acquisition: 64 × 0.6 mm; gantry rotation time: 330 ms; temporal resolution: 83 ms; pitch: 0.2–0.47 adapted to the heart rate; tube current: 390 mAs/rotation; tube potential: 120 kV. Scanning time was ~5.7–8.4 s, depending on the cardiac dimensions and pitch, in a single breathhold in the craniocaudal direction. Prospective ECG tube-current modulation (ECG pulsing) for radiation dose reduction was used for all patients. The retrospective gating technique was used to synchronize data reconstruction with ECG signal. Best systolic and diastolic reconstructions were made in all patients at a slice thickness of 0.75 mm and a reconstruction increment of 0.5 mm. The reconstruction with fewest motion artefacts was chosen and used for further analysis.

Multidetector computed tomography image evaluation

The MDCT images were evaluated by two radiologists blinded to the ICA results and experienced in the field of MDCT based coronary angiography on an offline workstation (Leonardo, Siemens, Erlangen, Germany). Besides the evaluation of axial images, contrast-enhanced scans were also investigated using multiplanar reconstructions, maximum intensity projections and volume-rendering reconstructions prepared on the offline workstation by using axial images (Figs 1 and 2).

Conventional invasive coronary angiography

Conventional ICA was performed using Siemens Coroscop and Bicor Systems® (Siemens Medical Systems, Munich, Germany). The Seldinger method was used to access via the right femoral artery and selective angiographies of native coronary arteries and bypass grafts were obtained using 6F diagnostic catheters. All of the left internal mammarian artery (LIMA) grafts were selectively catheterized. Aortography in the left oblique position was performed for non-selective visualization of saphenous vein grafts that could not have been shown selectively but were known to be used from the operation records. Grafts that could not be visualized by aortography were accepted as occluded. Coronary angiograms were evaluated by two experienced cardiologists and the decisions were made by consensus.

Data analysis

Both the bypass grafts (arterial and venous) and the native vessels distal to the surgical anastomoses were evaluated in the framework of a 16-segment anatomical subdivision of the coronary arteries [11]. Each coronary graft and segment was then classified as assessable or non-assessable on the basis of diagnostic quality. After having evaluated the presence or otherwise of calcifications in each coronary segment, the analysis then regarded the presence of significant stenoses (≥50%), non-significant stenoses (<50%) and total occlusions. Sensitivity, specificity and accuracy of MDCT in quantifying occlusions and significant stenoses in bypass grafts were then calculated. These values were calculated separately for venous grafts and arterial grafts considered. The results of MDCT angiography and ICA were compared regarding graft patency and presence of significant stenotic lesions in patent grafts.

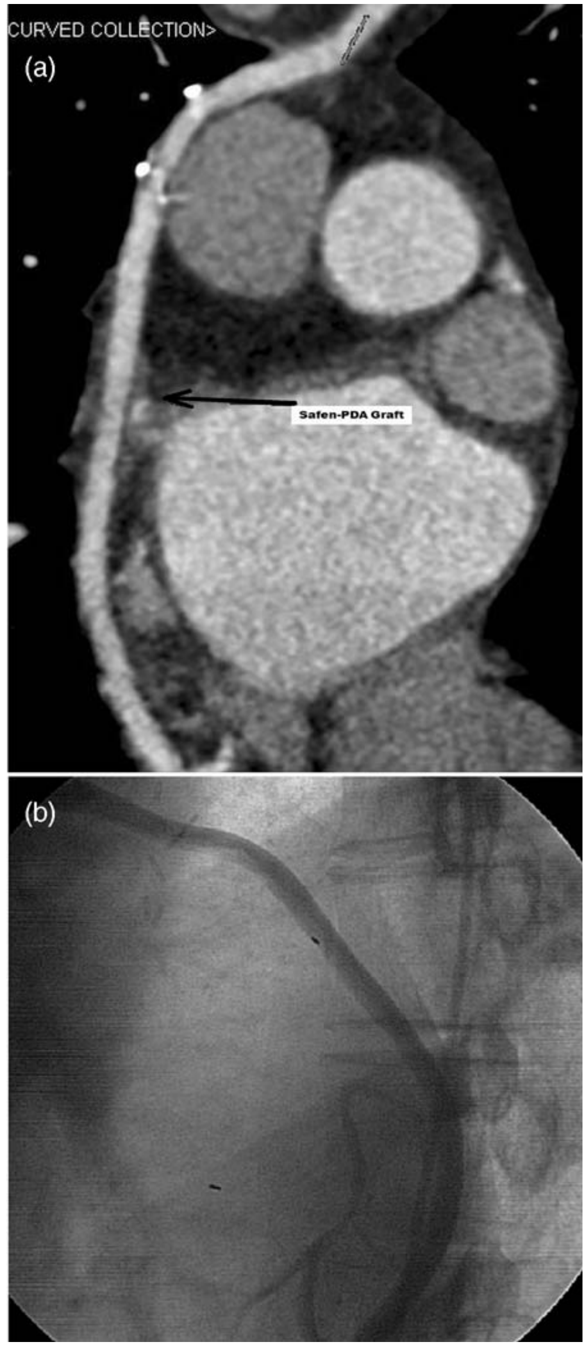

Figure 1: A 48-year old male patient with a history of coronary artery bypass grafting (CABG) 2.5 years ago admitted with atypical chest pain. 16-Slice-computerized tomography (CT) coronary angiography revealed normal safen-posterior descending artery (PDA) graft (**a**). Owing to significant stenosis in left anterior descending artery (LAD) to left internal mammary artery (LIMA) graft, the patient underwent invasive coronary angiography and showed patent safen-PDA graft (**b**).

Statistical analysis

Continuous variables were expressed as mean ± SD and categorical variables were expressed as percentages. Differences between continuous variables were analysed by the unpaired Student *t*-test or Mann–Whitney *U*-test, and those between categorical variable by the chi-square test or Fisher's exact test, respectively. Sensitivity, specificity, positive predictive values (PPV)

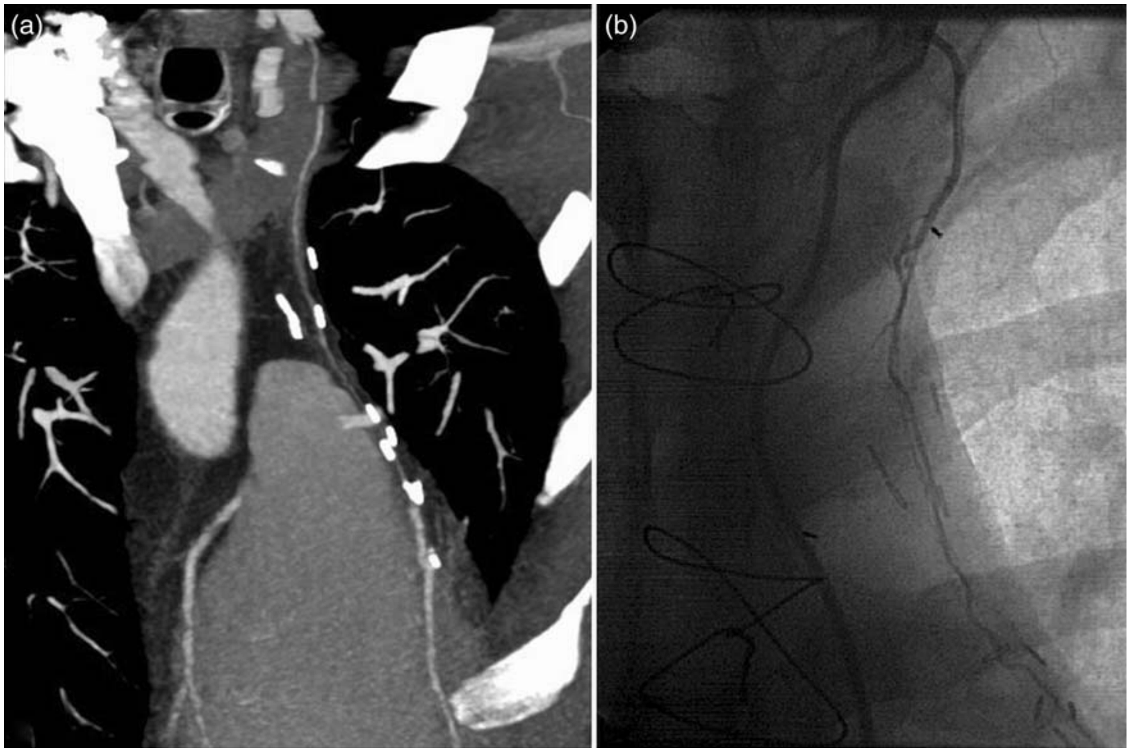

Figure 2: A 58-year old male patient who underwent CABG 14 months ago presented with exertional dyspnoea. 64-Slice CT coronary angiography showed patent LAD-LIMA graft with small calliper (**a**). Invasive coronary angiography also confirmed the diagnosis of patent LIMA graft with small calliper (**b**).

and negative predictive values (NPV) and diagnostic accuracy of MDCT coronary angiography were calculated using ICA results as the reference gold standard. Statistical analyses were performed using SPSS statistical software (version 16.0; SPSS Inc., Chicago, Illinois). A two tailed $P < 0.05$ was considered statistically significant.

RESULTS

The study population was divided into two groups according to scanning protocol as 16- vs 64-slice MDCT scanning. The baseline characteristics and risk factors of both groups were similar, which is shown in Table 1. In accordance with the operation records a total of 153 grafts (56 arterial, 97 saphenous vein grafts) were evaluated in 58 patients with 16-slice MDCT, and 173 grafts (71 arterial, 101 saphenous vein grafts) were evaluated in 71 patients with dual-source 64-slice MDCT scanner. Median time interval between CABG surgery and MDCT angiography was 8 years (range: 6 months to 16 years).

All of the grafts in the 64-slice group and 150 (98%) of 153 grafts in the 16-slice group were evaluated optimally with MDCT angiography. Only three (2%) arterial grafts: two LIMA to left anterior descending artery and one radial artery to obtuse marginal, could not be evaluated because of the motion and surgical clipping artefacts. All of the saphenous vein grafts were evaluable. Twenty-nine of the 173 grafts in the 64-slice group and fifty of the evaluable 150 grafts were reported as occluded by MDCT angiography. Evaluability was 100% (199/199) for venous grafts and 97.6% (124/127) for arterial grafts.

In the 16-slice group, of 153 venous and arterial grafts, 57 (37%) were occluded and in the 64-slice group, of 173 venous and arterial grafts, 32 (18.4%) were occluded as shown by ICA. Arterial grafts showed a greater performance of patency as compared with venous grafts: 7 (13%) of 56 arterial grafts and 50 (53%) of 97 venous grafts in the 16-slice group and 8 (11.2%) of 71 arterial grafts and 24 (23.5%) of 102 venous grafts were found to be occluded.

Diagnostic accuracy, sensitivity, specificity, PPV and NPV of MDCT angiography were calculated for venous and arterial grafts patency, which showed to be 92, 87, 97, 94 and 93% with 16-slice vs 95, 90, 98, 90 and 98% with 64-slice MDCT, respectively (Tables 2 and 3).

Proximal anastomotic regions of all patent grafts ($n = 244$) were optimally evaluated for the presence of significant stenoses by MDCT angiography. Proximal and distal anastomotic regions of all patent saphenous vein grafts were optimally imaged and evaluated. All proximal and distal anastomoses of evaluable arterial grafts were optimally evaluated except in 4/50 (8%) of patent arterial grafts in the 16-slice group in which the distal anastomotic region could not be evaluated optimally for the presence of significant lesions because of the metallic surgical clip artefacts impairing image quality.

In the 16-slice group, there were significant stenosis in four saphenous vein grafts, and two of them were confirmed by ICA. There were no significant lesions in arterial grafts that were evaluable and patent in 16-slice MDCT angiography. In the 64-slice group, there were significant stenosis in four saphenous vein grafts, and three of them were confirmed by ICA. Also in 2 patients, ICA revealed significant venous graft stenosis, although the 64-slice MDCT showed the patent grafts. For arterial grafts, there were significant stenosis in 7 patients, and 5 of them were confirmed by ICA. Considering these results, sensitivity, specificity, PPV and NPV of 16- vs 64-slice MDCT angiography for detecting significant stenoses were calculated as 67, 98, 50 and 99% vs 80, 98, 73 and 99%, respectively (Tables 4 and 5).

Table 2: The comparison of the results of 16- vs 64-slice MDCT and invasive coronary angiography due to detection of graft patency

Type of graft	Total number	True (+)	True (−)	False (+)	False (−)	Non-evaluable	Diagnostic accuracy
64-slice MDCT							
Saphenous vein graft	102	20	78	2	2	0	98/102 (96%)
Arterial graft	71	6	63	1	1	0	66/71 (97%)
Total	173	26	141	3	3	0	164/173 (95%)
16-slice MDCT							
Saphenous vein graft	97	44	44	3	6		88/97 (91%)
Arterial graft	56	3	49	–	1	3	52/56 (93%)
Total	153	47	93	3	7	3	140/153 (92%)

Table 3: The comparison of the results of 16- vs 64-slice MDCT and invasive coronary angiography due to detection of graft patency (results of the 323 evaluable grafts)

Type of graft	*N*	Sensitivity	Specificity	PPV	NPV
64-slice MDCT					
Saphenous vein graft	102	91% (20/22)	96% (78/80)	91% (20/22)	98% (78/80)
Arterial graft	71	86% (6/7)	99% (63/64)	86% (6/7)	98% (63/64)
Total	173	90% (26/29)	98% (141/144)	90% (26/29)	98% (141/144)
16-slice MDCT					
Saphenous vein graft	97	88% (44/50)	94% (44/47)	94% (44/47)	88% (44/50)
Arterial graft	53	75% (3/4)	100% (49/49)	100% (3/3)	98% (49/50)
Total	150	87% (47/54)	97% (93/96)	94% (47/50)	93% (93/100)

Table 4: The comparison of the results of 16- vs 64-slice MDCT and invasive coronary angiography due to detection of critical lesions

Type of graft	Total number	True (+)	True (−)	False (+)	False (−)	Non-evaluable	Diagnostic accuracy
64-slice MDCT							
Saphenous vein graft	102	3	96	1	2	0	99/102 (97%)
Arterial graft	71	5	64	2	0	0	69/71 (97%)
Total	173	8	160	3	2	0	168/173 (97%)
16-slice MDCT							
Saphenous vein graft	97	2	92	2	1	0	94/97 (97%)
Arterial graft	56	0	52	0	1	3	52/53 (98%)
Total	150	2	145	2	2	3	146/150 (97%)

Table 5: The comparison of the results of 16- vs 64-slice MDCT and invasive coronary angiography due to detection of critical lesions (results of the 323 evaluable grafts)

Type of graft	*N*	Sensitivity	Specificity	PPV	NPV
64-slice MDCT					
Saphenous vein graft	102	60% (3/5)	99% (96/97)	75% (3/4)	98% (96/98)
Arterial graft	71	100% (5/5)	97% (64/66)	71% (5/7)	100% (64/64)
Total	173	80% (8/10)	98% (160/163)	73% (8/11)	98% (160/162)
16-slice MDCT					
Saphenous vein graft	97	67% (2/3)	98% (92/94)	50% (2/4)	99% (92/93)
Arterial graft	53	–	100% (52/52)	–	98% (52/53)
Total	150	50% (2/4)	99% (145/147)	50% (2/4)	99% (145/147)

ORIGINAL ARTICLE

DISCUSSION

In this study, we compared the diagnostic accuracy of 16- vs 64-slice MDCT angiography for the assessment of CABG patency and the presence of significant stenosis in the patent grafts. Furthermore, performance of MDCT in the evaluation of proximal and distal anastomotic regions of the grafts is also analysed. This study has some important messages: (i) 16-slice MDCT showed a comparable diagnostic accuracy with 64-slice MDCT for the evaluation of arterial and venous bypass graft patency; (ii) all proximal and distal anastomoses of arterial and venous grafts could be assessed with both scanners, but only 8% of distal arterial bypass anastomoses could not be adequately assessed with 16-slice MDCT; (iii) the 16-detector MDCT can reliably detect and classify bypass stenoses with diagnostic accuracies similar to that of the 64-slice MDCT. However, despite the promising results of diagnostic accuracy for the detection of both graft patency and critical stenosis, lower sensitivity and positive predictive values in the detection of significant stenosis indicated limited accuracy for both the 16- and 64-slice MDCT.

CABGs seem well suited for evaluation by MDCT angiography. Compared with native coronary arteries, grafts are characterized by less cardiac motion, a larger luminal diameter and lesser calcifications. All these factors contribute to the reliable evaluation of the bypass grafts by MDCT [12]. Thus, there were several studies evaluating the patency of grafts MDCT coronary angiography [7]. Also, chronic bypass graft vasculopathy is generally attributable to vessel stenosis and occlusion secondary to intimal hyperplasia. The efficacy of both 16- and 64-slice MDCT in examining vein and arterial graft stenosis (>50% luminal narrowing) has been evaluated previously [5, 13–15].

The introduction of 16-slice MDCT increased the number of grafts that could be assessed, leading to increased diagnostic accuracy of significant stenosis. With the use of the 16-slice MDCT, sensitivity and specificity were between 95 and 100% in the evaluation of bypass graft patency. For the evaluation of significant graft stenosis, sensitivities and specificities varied between 80–96% and 85–95%, respectively. Optimum performance was observed in patients with heart rates below 70 beats/min. Assessment of the distal anastomosis site, in particular, remained challenging with 16-slice MDCT [2, 6, 16–23]. Recently, the development of 64-slice MDCT scanners increased spatial and temporal resolution compared with previous scanners, which improved visualization of grafts and distal anastomoses, but coronary calcifications and surgical clip artefacts remain challenging problems [14, 24]. The most recently evolved dual-source MDCT scanner provides high diagnostic accuracy for the evaluation of coronary arteries without heart rate control. However, there is limited data regarding the role of dual-source MDCT angiography in the evaluation of bypass grafts [9].

In our study, we demonstrated that the 16-slice MDCT has similar diagnostic accuracies regarding both graft patency and detection of critical stenosis compared with dual source 64-slice MDCT (92 vs 94.8% for graft patency and 97.3 vs 97.1% for graft stenosis, respectively). Those findings were similar to previous reports as described in an earlier meta-analysis [7]. However, the evaluability of bypass grafts and distal run off arteries as well as native vessels were better with newer-generation scanners [25]. However, despite higher diagnostic accuracy rates, 16-slice MDCT had lower sensitivity and PPV ratios compared with dual-source 64-slice MDCT, which were probably due to the small number of patients with significant graft stenosis.

Our study has several limitations. First, this was a retrospective analysis including a small group of patients and comparing 16- and dual source 64-slice MDCT in the assessment of bypass grafts. However, our study was not a direct comparison of 16-slice vs dual source 64-slice CT. Second, different contrast agent protocols for 16-slice vs 64-slice CT were used. Finally, there was no analysis of inter- and intra-observer variability for the evaluation of graft patency and critical stenosis.

In conclusion, 16- and dual source 64-slice scanners had similar diagnostic accuracy regarding graft patency and stenosis. In addition, the diagnostic performances of both scanners were mainly due to the exclusion of critical stenosis. On the other hand, dual source 64-slice MDCT demonstrates significant graft lesions with higher accuracy as well as evaluable grafts. Those findings emphasize the complementary role of computed tomography to ICA. Further studies with newer-generation scanners may provide more accurate data relevant to the diagnostic role of MDCT in the evaluation of bypass grafts.

Conflict of interest: none declared.

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eComment. Cardiac computed tomography angiography for evaluation of coronary artery bypass grafts

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Sahiner and colleagues [1] demonstrate the comparative efficacy of 16- vs 64-slice cardiac computed tomography (CT) angiography when assessing coronary artery bypass grafts. One of the major concerns regarding the increased use of cardiac CT angiography is the effective radiation dose received by patients. The widening indications and applications of cardiac CT angiography may mean patients undergo multiple studies during their lifetime. The improved spatial and temporal resolution achieved by 64-slice cardiac CT over 16-slice cardiac CT comes at the expense of an increased effective radiation dose. In a study comparing 16- and 64-slice cardiac CT angiography, despite strategies to reduce radiation dose including reduction in tube voltage and changing gating strategies, the effective dose for cardiac CT was 6.4±1.9 and 11.0±4.1 mSv with 16- and 64-slice CT, respectively [2]. The Society of Cardiovascular Computed Tomography promotes the "ALARA principle", which states that the radiation dose to a patient should be "As Low As Reasonably Achievable". In other words, we should use the lowest optimal radiation dose possible to achieve a diagnostic image [3]. In this study there was a similar diagnostic accuracy for graft patency between 16- and 64-slice cardiac CT although the 16 slice was less accurate for detecting graft stenosis. All proximal anastomosis could be visualized using both techniques. Therefore in certain clinical scenarios, where the question to be answered depends on identifying the origin of grafts or patency of grafts, the use of 16-slice cardiac CT will provide diagnostic information at a lower radiation dose.

Conflict of interest: none declared

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ORIGINAL ARTICLE