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Data Article

Data on the impact of scan quality on the diagnostic performance of CCTA, SPECT, and PET for diagnosing myocardial ischemia defined by fractional flow reserve on a per vessel level

P.A. van Diemen [a], R.S. Driessen [a], W.J. Stuijfzand [a], P.G. Raijmakers [b], S.P. Schumacher [a], M.J. Bom [a], H. Everaars [a], J.K. Min [c], J.A. Leipsic [d], J. Knuuti [e], S.R. Underwood [f], P.M. van de Ven [g], A.C. van Rossum [a], I. Danad [a], P. Knaapen [a, *]

[a] Department of Cardiology, Amsterdam UMC, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands
[b] Department of Radiology, Nuclear Medicine & PET Research, Amsterdam UMC, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands
[c] Institute for Cardiovascular Imaging, Weill-Cornell Medical College, New York-Presbyterian Hospital, New York, United States of America
[d] Department of Medicine and Radiology, University of British Columbia, Vancouver, Canada
[e] Turku PET Centre, Turku University Hospital and University of Turku, Turku, Finland
[f] Department of Nuclear Medicine, Royal Brompton Hospital, London, United Kingdom
[g] Department of Epidemiology & Biostatistics, Amsterdam UMC, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

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ABSTRACT

Scan quality directly impacts the diagnostic performance of non-invasive imaging modalities as reported in a substudy of the PACIFC-trial: "Impact of Scan Quality on the Diagnostic Performance of CCTA, SPECT, and PET for Diagnosing Myocardial Ischemia Defined by Fractional Flow Reserve" [1]. This Data-in-Brief paper supplements the hereinabove mentioned article by presenting the diagnostic performance of CCTA, SPECT, and PET on a per vessel level for the detection of hemodynamic significant

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* Corresponding author.
E-mail address: p.knaapen@amsterdamumc.nl (P. Knaapen).

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tomography
Positron emission tomography

coronary artery disease (CAD) when stratified according to scan quality and vascular territory.

Specifications Table

Subject area	*Clinical Cardiology*
Specific subject area	*Coronary Computed Tomography Angiography; Single-Photon Emission Computed Tomography; Positron Emission Tomography; Fractional Flow Reserve; Coronary Artery Disease.*
Type of data	*Table.*
How data was acquired	*Patients without a history of coronary artery disease (CAD) and suspected of having obstructive CAD underwent coronary computed tomography angiography (CCTA), single-photon emission computed tomography (SPECT), and positron emission tomography (PET) myocardial perfusion imaging prior to invasive coronary angiography in conjunction with fractional flow reserve (FFR) measurements.*
Data format	*Raw and analyzed.*
Parameters for data collection	*All patients included in the related research paper were included in the present Data-in-Brief article. Diagnostic performance measures; sensitivity, specificity, negative predictive value, positive predictive value, and accuracy were stratified by the study parameters; vascular territory; right coronary artery, left anterior descending artery, or circumflex artery and scan quality; good, moderate, or poor.*
Description of data collection	*Data was prospectively collected. All patients underwent CCTA, SPECT, and PET prior to invasive FFR measurements. Scans were analyzed by blinded core laboratories, which assessed images for the presence of obstructive coronary artery disease (CCTA) or myocardial ischemia (SPECT and PET). The reference standard was invasive FFR, were an FFR of $\leq$0.80 or a subtotal/total occlusion in case of missing FFR defined significant CAD. Diagnostic performance is presented as sensitivity, specificity, positive predictive value, negative predictive value, and accuracy and is calculated based on the number of true positive, false positive, true negative, and false negative findings on CCTA, SPECT, and PET.*
Data source location	*Amsterdam, the Netherlands* *Amsterdam UMC*, Vrije Universiteit Amsterdam *De Boelelaan 1117, 1081 HV Amsterdam, The Netherlands*
Data accessibility	*Data is with this article and not in a public repository.*
Related research article	*van Diemen PA, Driessen RS, Stuijfzand WJ, Raijmakers PG, Schumacher SP, Bom MJ, Everaars H, Min JK, Leipsic J, Knuuti J, Underwood RS, van de Ven PM, van Rossum AC, Danad I, Knaapen P. Impact of Scan Quality on the Diagnostic Performance of CCTA, SPECT, and PET for Diagnosing Myocardial Ischemia Defined by Fractional Flow Reserve. J Cardiovasc Comput Tomogr. In press.* https://doi.org/10.1016/j.jcct.2019.06.007.

Value of the Data

- A large portion of patients referred for invasive coronary angiography do not have significant coronary artery disease, as such non-invasive imaging modalities are pivotal for a more judicious referral pattern to the catheterization laboratory.
- It is important for treating physicians to realize how scan quality can affect the diagnostic performance of different imaging modalities, as this might influence clinical decision making.
- Incorporation of determining scan quality into the assessment of non-invasive imaging techniques might lead to a better interpretation of non-invasive imaging modalities and to a better selection of patients who might benefit from invasive coronary angiography.
- The present Data-in-Brief article extents the findings of the influence of scan quality on the per patient diagnostic performance by presenting the influence of scan quality on the per vessel diagnostic performance, overall, and stratified per vascular territory.

1. Data

The data presented were obtained as part of a sub-study of the PACIFIC-trial in which the impact of scan quality on the diagnostic performance of CCTA, SPECT, and PET for diagnosing myocardial

ischemia defined by FFR on a per patient level was studied [1,2]. This data-in-brief article supplements the original research article by presenting the diagnostic performance on a per vessel level in terms of sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of 256-slice CCTA (Table 1), ^{99m}Tc-tetrofosmin SPECT (Table 2), and [^{15}O]H_2O PET (Table 3) for diagnosing myocardial ischemia as defined by an FFR $\leq$0.80. The diagnostic performance is stratified according to scan quality and vascular territory, namely the right coronary artery, left anterior descending artery, and circumflex artery. Interestingly, the diagnostic accuracy of good quality CCTA, SPECT, and PET scans did not differ ($p = 0.442$, see Tables 1–3). The raw data of the present Data-in-Brief article is available in the supplementary material.

Table 1
Diagnostic performance of 256-slice CCTA for diagnosing myocardial ischemia (FFR $\leq$0.80) on a per vessel level stratified according to scan quality and vascular territory.

CCTA (N)	% (95% CI)				
	Sensitivity	Specificity	PPV	NPV	Accuracy
Good Quality					
Overall (404)	66 (56–76)	88 (84–91)	63 (55–70)	89 (86–92)	83 (79–86)
RCA (132)	59 (36–79)	87 (80–93)	48 (34–63)	91 (87–95)	83 (75–89)
LAD (137)	76 (62–87)	89 (80–94)	79 (68–87)	87 (80–91)	84 (77–90)
Cx (135)	52 (31–73)	88 (81–94)	48 (33–64)	90 (85–93)	82 (75–88)
Moderate Quality					
Overall (133)	75 (57–89)	64 (54–74)	40 (32–48)	89 (81–94)	67 (58–75)
RCA (43)	80 (28–99)	58 (41–74)	20 (12–31)	96 (79–99)	60 (44–75)
LAD (45)	79 (54–94)	65 (44–83)	63 (48–75)	81 (63–91)	71 (56–84)
Cx (45)	63 (24–91)	70 (53–84)	31 (18–49)	90 (78–96)	67 (53–82)
Poor Quality					
Overall (78)	79 (61–91)	44 (30–60)	51 (43–59)	74 (58–86)	59 (47–70)
RCA (26)	100 (72–100)	40 (16–68)	55 (45–65)	100 (–)	65 (44–83)
LAD (26)	71 (42–92)	17 (2–48)	50 (40–60)	33 (10–69)	46 (27–67)
Cx (26)	63 (24–91)	67 (41–87)	45 (26–66)	80 (61–91)	65 (44–83)

Abbreviations: CCTA = coronary computed tomography angiography, FFR: fractional flow reserve, CI: confidence interval, PPV: positive predictive value, NPV: negative predictive value, RCA: right coronary artery, LAD: left anterior descending artery, Cx: circumflex artery.

Table 2
Diagnostic performance of ^{99m}Tc-tetrofosmin SPECT for diagnosing myocardial ischemia (FFR $\leq$0.80) on a per vessel level stratified according to scan quality and vascular territory.

SPECT (N)	% (95% CI)				
	Sensitivity	Specificity	PPV	NPV	Accuracy
Good Quality					
Overall (321)	55 (44–65)	96 (93–98)	84 (73–91)	85 (82–88)	85 (81–89)
RCA (105)	68 (47–85)	94 (86–98)	77 (58–89)	90 (84–94)	88 (80–93)
LAD (108)	50 (34–66)	96 (88–99)	87 (68–96)	76 (70–82)	79 (70–86)
Cx (108)	48 (26–70)	99 (94–100)	91 (58–99)	89 (84–92)	89 (81–94)
Moderate Quality					
Overall (231)	28 (17–42)	97 (93–99)	73 (52–87)	80 (78–83)	80 (74–85)
RCA (75)	33 (7–70)	95 (88–99)	50 (19–81)	91 (87–94)	88 (78–94)
LAD (79)	32 (17–51)	96 (85–99)	85 (57–96)	65 (60–70)	68 (57–78)
Cx (77)	14 (2–43)	98 (91–100)	67 (16–95)	84 (81–87)	83 (73–91)
Poor Quality					
Overall (56)	13 (2–38)	98 (87–100)	67 (16–95)	74 (70–77)	73 (60–84)
RCA (18)	33 (1–91)	93 (68–100)	50 (8–92)	88 (76–94)	83 (59–96)
LAD (19)	11 (0–48)	100 (69–100)	100 (–)	56 (50–61)	58 (34–80)
Cx (19)	0 (0–60)	100 (78–100)	–	79 (–)	79 (54–94)

Abbreviations: SPECT: single-photon emission computed tomography, FFR: fractional flow reserve, CI: confidence interval, PPV: positive predictive value, NPV: negative predictive value, RCA: right coronary artery, LAD: left anterior descending artery, Cx: circumflex artery.

Table 3
Diagnostic performance of [^{15}O]H_2O PET for diagnosing myocardial ischemia (FFR ≤0.80) on a per vessel level stratified according to scan quality and vascular territory.

PET (N)	% (95% CI)				
	Sensitivity	Specificity	PPV	NPV	Accuracy
Good Quality					
Overall (516)	79 (71–86)	82 (78–86)	59 (53–64)	92 (90–95)	81 (78–85)
RCA (168)	96 (82–100)	79 (71–85)	47 (39–55)	99 (94–100)	82 (75–87)
LAD (175)	73 (60–83)	84 (76–91)	74 (64–82)	84 (77–88)	80 (73–86)
Cx (173)	78 (60–91)	84 (77–89)	52 (42–62)	94 (90–97)	83 (76–88)
Moderate Quality					
Overall (80)	93 (77–99)	69 (55–81)	62 (52–71)	95 (82–99)	78 (67–86)
RCA (26)	100 (63–100)	67 (41–87)	57 (41–72)	100 (–)	77 (56–91)
LAD (27)	86 (57–98)	69 (39–91)	75 (56–87)	82 (54–94)	78 (58–91)
Cx (27)	100 (54–100)	71 (48–89)	50 (34–66)	100 (–)	78 (58–91)
Poor Quality					
Overall (6)	100 (16–100)	0 (0–60)	33 (–)	–	33 (4–78)
RCA (2)	–	0 (0–84)	–	–	0 (0–84)
LAD (2)	100 (3–100)	0 (0–98)	50 (1–99)	–	50 (1–99)
Cx (2)	100 (3–100)	0 (0–98)	50 (1–99)	–	50 (1–99)

Abbreviations: PET: positron emission tomography, FFR: fractional flow reserve, CI: confidence interval, PPV: positive predictive value, NPV: negative predictive value, RCA: right coronary artery, LAD: left anterior descending artery, Cx: circumflex artery.

2. Experimental design, materials, and methods

The prospective comparison of Cardiac PET/CT, SPECT/CT perfusion imaging and CT coronary angiography with invasive coronary angiography (PACIFIC) trial, is a prospective head-to-head comparative trial investigating the diagnostic performance of CCTA, SPECT, and PET for the detection of myocardial ischemia against a background of FFR (NCT01521468) [2]. A total of 208 patients were enrolled from January the 23, 2012, to October 25, 2014, in the VU University Medical Center, Amsterdam, the Netherlands. Important inclusion criteria entailed: patients were suspected of having CAD, had no prior documentation of CAD, had an intermediate pre-test likelihood for CAD, were referred for a clinically indicated invasive coronary angiography (ICA). Patients were excluded if they; had a history of asthma or chronic obstructive pulmonary disease, had renal failure (eGFR ≤45 ml/min), were suspected of having a myocardial infarction. A more elaborate description of all in and exclusion criteria has been published previously [2].

Patients underwent 256-slice CCTA, ^{99m}Tc-tetrofosmin SPECT, and [^{15}O]H_2O PET prior to ICA. All scan protocols have previously been described in detail [1,2]. Core laboratories, blinded to ICA results, assessed CCTA (Dalio Institute of Cardiovascular Imaging, New York-Presbyterian Hospital, New York, and St Paul's Hospital, Vancouver, British Columbia, Canada), SPECT (Royal Brompton Hospital, London, England), and PET (Turku University Hospital, Turku, Finland) for the presence of significant CAD and graded scan quality [1,2]. A ≥50% stenosis on CCTA was deemed obstructive, while a summed difference score of ≥2 for SPECT, and the presence of a hyperaemic myocardial blood flow of ≤2.3 ml/min/g in at least 2 adjacent segments for PET, respectively, were considered indicative of myocardial ischemia [1,2]. ICA in conjunction with FFR measurements served as reference standard, significant CAD was defined as an FFR ≤0.80 or a subtotal/total lesion in which FFR measurements could not be obtained [1].

A total of 208 patients underwent CCTA, while SPECT and PET failed in 2 and 4 patients, respectively [1]. Of the 624 coronary arteries, 7 RCAs were deemed a right ventricle branch and 2 Cx arteries were considered an anomaly and therefore excluded. Leaving a total of 615 arteries included in the present analysis, of which 160 suffered from significant CAD [1].

The number of false negatives, true positives, false positives, and true negatives were used to calculate the sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of CCTA, SPECT, and PET. 95% confidence intervals (CI) for sensitivity, specificity, and accuracy are Clopper-Pearson CIs, while predictive values are the standard logit confidence given by Mercaldo et al. [3]. In addition, the diagnostic accuracy of good quality CCTA, SPECT, and PET scans was compared

using generalized estimating equations applying a Bonferroni correction to account for multiple testing.

Conflict of Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Dr. James K. Min receives funding from the Dalio Foundation, National Institutes of Health, and GE Healthcare, serves on the scientific advisory board of Arineta and GE Healthcare, and has an equity interest in Cleerly. Dr. Leipsic has received research grants from GE Healthcare; and serves as a consultant for Edwards Lifesciences and HeartFlow. Dr Knuuti reported receiving support from the Academy of Finland Centre of Excellence in Molecular Imaging in Cardiovascular and Metabolic Research, Helsinki, Finland, and receiving grant support from Gilead Inc and serving as a consultant to Lantheus Inc. Dr. Knaapen has received research grants from HeartFlow. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104584.

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