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

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A B S T R A C T

Scan quality directly impacts the diagnostic performance of non-invasive imaging modalities as reported in a substudy of the PACIFIC-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...
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), 99mTc-tetrofosmin SPECT (Table 2), and [15O]H2O PET (Table 3) for diagnosing myocardial ischemia as defined by an FFR ≤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 ≤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 99mTc-tetrofosmin SPECT for diagnosing myocardial ischemia (FFR ≤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 (75–97) | 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 [15O]H2O 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, 99mTc-tetrofosmin SPECT, and [15O]H2O 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 RCA 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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