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Interpreting the Interpretations: The Use of Structured Reporting Improves Referring Clinicians' Comprehension of Coronary Computed Tomography Angiography Reports

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Abstract

Background—Efficiency of coronary computed tomography angiography (CCTA) in clinical practice depends on precise reporting and accurate result interpretation.

Objective—We sought to assess referring clinicians' understanding of patient's coronary artery disease (CAD) severity and to compare satisfactions with free-form impression (FFI) vs. structured impression (SI) section of CCTA reports.

Materials and methods—50 clinical CCTA reports from May 2011 to April 2012 were retrospectively selected (25 FFI and 25 SI), to include cases with the entire spectrum of CAD (6 categories comprised of normal, minimal, mild, moderate, severe stenosis, and occlusion). A survey containing randomized blinded impressions only was distributed to 4 cardiologists and 2 cardiac imaging specialists. Clinician interpretation was examined regarding Q1) worst stenosis severity, Q2) number of vessels with significant stenosis, and Q3) the presence of non-evaluable segments. Agreement proportions and Cohen's kappa were evaluated between FFI vs. SI. Satisfactions were measured with respect to content, clarity, and clinical effectiveness.

Results—Q1 agreement was excellent for both FFI and SI (by six categories: 80% vs. 85%, $p>0.05$; kappa: 0.87 vs. 0.89; by no CAD vs. non-significant vs. significant CAD: 99% vs.97%; $p>0.05$; kappa: 0.99 vs. 0.94). Q2 agreement improved from fair to moderate (53% vs. 68%, $p=0.04$; kappa 0.31 vs. 0.52). Q3 agreement was moderate (90% vs. 87%, $p>0.05$; kappa 0.57 vs. 0.58). Satisfactions with impressions were high and similar with FFI vs. SI for clinicians.

Conclusion—Structured impressions were shown to improve result interpretation agreement from fair to moderate with regard to the number of vessels with significant stenosis.

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Authors report no conflict of interest.

Keywords

structured reporting; coronary computed tomography angiography; referring clinicians

Introduction

The utility of coronary computed tomography angiography (CCTA) relies on precise reporting and accurate result interpretation. Given the rapid development in cardiac imaging and thus evolving terminologies, effective communication between cardiac imaging specialists and referring clinicians is critical to facilitate correct integration of radiological evidence into clinical decision-making. Since a radiology report's effectiveness directly impacts patient care, several studies have investigated the style of radiology reports. Structured reporting is generally favored over free-form formatting with the advantage of better appearance, completeness, consistency, etc (1–6). In our institution, CCTA reports follow a general departmental structured format, including an introduction section (clinical history and exam technique), main body, impression, and if applicable, recommendations (7, 8). While the main body of the report is commonly structured, the impression is traditionally a free-form summary conveying the most clinically relevant items.

In order to improve and standardize the impression section, we implemented an impression template that describes patient's stenosis severity per the six standard categories listed in the SCCT guidelines for the interpretation and reporting of CCTA (normal, minimal stenosis, mild stenosis, moderate stenosis, severe stenosis, and occluded)(7). We hypothesized that a structured impression (SI) would facilitate understanding by referring clinicians and therefore result in more accurate interpretations of patients' CAD severity. We also sought to evaluate satisfactions with respect to the structured impressions in comparison to free-form impressions (FFI).

Materials and Methods

We performed a retrospective analysis of electronic medical records. Our institutional IRB granted a waiver for this retrospective research. HIPAA compliance was maintained throughout the study. No outside funding was received, and the authors maintained full control over the data.

Selection and assignment of reports

50 clinical CCTA reports performed for native coronary artery assessment from May 2011 to April 2012 were retrospectively selected by a research fellow with training in CCTA, to include cases covering the entire spectrum of disease (approximately 8 cases for each of 6 categories of SCCT stenosis grading(7), 25 FFI from May 2011 to October 2011 and 25 SI from November 2011 to April 2012) and representing the style of high-volume cardiac CT attending readers at our institution (3 radiologists and 1 cardiologists, at least 12 reports/ each attending reader, Figure 1). A survey containing only the impression sections from these 50 reports, blinded and ordered in random sequence, was then distributed to our respondents.

Impression format

Reporting software templates for both FFI and SI are shown in Figures 2a and 2b, respectively. An optional recommendation section followed the impression section in both templates. The structured template included a description of CAD stenosis severity per one of six categories of SCCT guidelines (menu selection), and the location of stenosis (free-text field) if significant stenosis was detected. Both templates were set to automatically populate as part of the default reports associated with the relevant exam codes in the Radiology Information System (RIS), but imaging readers had the flexibility to modify the template as appropriate. Use of the standard reporting software is mandatory at our institution. Reports were all entered initially in the reporting software (RadWhere, Nuance Healthcare Solutions, USA) by cardiac imaging fellows (board-certified or eligible radiologists and cardiologists) and later edited by the attending CT readers before final signature.

Respondents

Respondents were physicians at our institution whom agreed to participate in this study. The group of non-imaging clinicians included 2 general cardiology fellows and 2 interventional cardiology fellows. All fellows had undergone the requisite advanced cardiac imaging rotations as required by our ACGME-accredited Cardiovascular Medicine fellowship; none had undergone additional or elective training in cardiac CT. All invited participants agreed to take part in the study. All respondents were surveyed regarding the number of radiology reports reviewed each day (answer choices: < 10 reports/day, 10 to 30 reports/day, and > 30 reports/day).

The cardiac imaging specialists (1 attending radiologist and 1 cardiologist in training each with COCATS level 3 equivalent training) had extensive cardiac imaging experiences (greater than 5 years of experience) and routinely performed and interpreted CCTA studies.

Report interpretation and satisfaction

Understanding of patient's CAD as represented in the report impression was assessed with three questions. Each question and its answer choices were considered to reflect clinical significance in guiding patient management. Questions and answer choices are shown in Table 1. Clinician's satisfaction with the report impressions were assessed on three previously established grading systems (9). Content (whether a critical information is present), clarity (how clear the information is expressed), and clinical effectiveness of impressions in each report were rated. Content and clarity were rated on a scale of 1–10 with 1 being the least satisfied and 10 being the most satisfied. Clinical effectiveness was measured in the helpfulness in advancing patient's position on a clinical spectrum (POCS), consisting stages of 1) signs and symptoms, 2) differential diagnosis, 3) diagnosis, 4) change in status, as previously published(10). POCS grading is listed in Table 2.

Radiology report grading scale

The POCS grades were assigned values for calculations as follows: grade I, 1; grade IIA, 2; grade IIB, 3; grade III, 4; and grade IV, 5.

Statistical analysis

Two cardiac imaging specialists independently reviewed all 50 CCTA impressions and completed the survey. Differences in survey results regarding CAD interpretation were adjudicated by consensus. Interpretation results from imaging specialists and clinicians were tabulated in agreement tables for FFI and SI. Regarding the coronary stenosis severity, proportions of agreement were evaluated by six SCCT guideline categories as stated in the survey, and by a threshold method (no CAD [normal] vs. non-significant CAD [minimal, mild, and moderate stenosis] vs. significant CAD [severe stenosis and occlusion]). For each question, Cohen's weighted kappa coefficient and proportions of agreement between cardiac imaging specialists and clinicians were calculated for FFI and SI. Inter-observer reliability was considered as excellent if kappa >0.81, substantial if kappa >0.61, moderate if kappa >0.41, fair if kappa >0.21, and poor if kappa >0(11). Proportions of agreement with FFI vs. SI were compared with Fisher's exact test. Satisfactions with impression's content, clarity, and clinical effectiveness on the POCS scale were expressed in average ± standard deviation by specialty. Differences in satisfaction were compared with student t-tests between specialties and between FFI vs. SI. A *P*- value less than 0.05 was considered statistically significant.

Results

Respondents

The number of reports viewed per day was as follows: both general cardiology fellows (<10 reports/day), interventional fellows (10–30 reports/day and < 10 reports/day), imaging specialists (radiologist by training > 30 reports/day, cardiologist by training <10 reports/day).

Impression interpretation

Overall, inter-observer reliability on the worst CAD stenosis severity of each patient (6 categories) was excellent with FFI (kappa=0.87) and with SI (kappa=0.89). The overall agreement was 82.5% (165/200) with 80% agreement with FFI (80/100) and 85% agreement with SI (85/100). No difference in agreement proportion was seen with FFI vs. SI ($p > 0.05$, Table 4). By the threshold method (no CAD vs. non-significant CAD vs. significant CAD), the inter-observer reliability was excellent for both FFI (kappa=0.99) and SI (kappa=0.94). Overall agreement was 98% with 99% agreement (99/100) with FFI and 97% agreement (97/100) with SI ($p>0.05$, Table 4).

Inter-observer reliability on the number of coronary arteries with significant stenosis was fair with FFI (kappa= 0.31) and moderate with SI (kappa= 0.52). The overall agreement was 60.5% (121/200). Proportions of agreement were significantly higher with SI vs. FFI (68% vs. 53% respectively, $p=0.043$, Table 4).

Inter-observer reliability on the presence of non-evaluable segments was moderate for both FFI and SI (kappa: 0.57 vs. 0.58, respectively). The overall agreement was 88.5% (177/200, Table 4) with 90% (90/100) with FFI and 87% (87/100) with SI ($p>0.05$, Table 4).

Report satisfaction

Satisfactions with content and clarity of impressions were rated high by both imaging specialists and clinicians (Table 3). Regarding both content and clarity, specialists expressed a higher satisfaction than clinicians for both FFI and SI ($p<0.05$ for all). For imaging specialists, satisfactions decreased in SI vs. FFI for both content and clarity ($p<0.05$ both). For clinicians, satisfaction remained similar for content and clarity for SI and FFI.

Radiology report grading

A higher POCS rating was judged by imaging specialists vs. clinicians with both FFI (4.92 vs. 4.14, $p< 0.05$) and SI (4.96 vs. 4.27, $p< 0.05$). For both imaging specialists and clinicians, PCOS remained similar between SI and FFI ($p>0.05$ for both). Overall, imaging specialists considered impressions to be approximately grade IV while clinicians considered these impressions to be approximately grade III (Table 3).

Discussion

Our study investigated clinician's perspectives on CCTA reports in terms of accuracy of result interpretation and general satisfaction with the impression. In our study, we found that SI (using a simple template) improved result interpretation agreement from fair to moderate with regard to the number of vessels with significant stenosis.

Quality improvement initiatives

Given the time-sensitive nature of CCTA results and the complexity of information provided in the body of the report, clinicians place great emphasis on the impression for a concise summary statement to guide clinical management. Per practice guidelines for the communication of diagnostic imaging findings by the American College of Radiology (ACR), the body of the report should contain imaging findings, and the impression section should contain a specific diagnosis(2). Therefore, imaging specialists at our institution strive to provide concise and decisive summary statement in the impression that can be used alone to guide patient management.

Clinical use of CCTA

The three most important questions to be answered by CCTA include the severity of stenosis, the number of vessels with significant stenosis, and the presence of non-evaluable segments (7). We found that while agreement between clinicians and cardiac imaging specialists was excellent along the 6 established categories of stenosis (7), agreement was even better when using the most clinically important criteria (no CAD vs. non-significant CAD vs. significant CAD, 98% agreement). In the recently published 2012 Appropriate Use Criteria for Diagnostic Catheterization by American College of Cardiology (ACC), invasive coronary angiography is deemed appropriate after CCTA demonstrating a greater than 50% stenosis(12), thus highlighting the importance of clear distinction of precise lesion severity in official CCTA reports.

The severity of CAD as determined by CCTA is predictive of future cardiovascular events and all-cause mortality (13–16)(17–20). By using a modified Duke coronary artery jeopardy

score, studies have shown that survival was highest in patients with less than 50% stenosis and decreased as the number of vessels with significant stenosis increased, with significant stenosis of the left main coronary artery carrying the worst prognosis. It is interesting to note that only fair (FFI) and moderate (SI) agreement (53% and 68%) was reached on the number of vessels with significant stenosis between our imaging specialists and clinicians, and disagreement mostly arose from over-estimation by clinicians. Such over-estimation may result in a lower specificity and could potentially cause unnecessary downstream testing(21). This is also concerning because there is a known tendency for CCTA to result in "over-call" of stenosis (22); if the interpretations are over-interpreted, this effect compounds the high sensitivity of CCTA at the expense of specificity.

Finally, clinicians should understand the limitations of CCTA to fully appreciate its clinical effectiveness. In patients with a large body habitus, high heart rate, or significant calcium burden, CCTA may suffer from artifacts causing non-evaluable segments. This information should be applied within the individual patient's clinical context. Clinicians may plan the next step of management differently depending on an intention-to-treat or intention-to-diagnose paradigm, or simply use only a specific portion of the results (ie. exclusion of balanced ischemia caused by 3-vessel or left main disease in the setting of a normal nuclear perfusion test (23)). Our clinicians correctly interpreted and detected the presence of all non-evaluable segments denoted by our imaging specialists. This demonstrated that no non-evaluable segment was overlooked. All of the disagreements (10% and 13%, FFI and SI, respectively) were over-estimations by the clinician, i.e., clinicians inferred that this non-evaluable segment could be a significantly stenotic vessel segment while imagers did not believe that this was the case. Our clinicians were also blinded to the clinical histories and images of the patients; therefore they were more likely to apply an "intention-to-diagnose" paradigm and assume the worst.

We note that clinicians had a tendency to over-estimate the severity of CAD with respect to the number of vessels with significant stenosis as well as the presence of non-evaluable segments. This can be explained by several factors. First, clinicians may be very cautious so as to not under-diagnose. While over-diagnosis can lead to unnecessary testing, under-diagnosis can potentially result in missed diagnoses or death of a patient, especially when the suspicion for CAD is moderate or high. Thus, for the safety of patients, CCTA readers are willing to induce some proportion of "unnecessary" followup tests such as invasive angiography rather than to miss a critical stenosis. Second, "hedging" in the report phrasing may have caused confusion to clinicians.

Agreement on the number of vessels with hemodynamically significant stenosis improved significantly after the template implementation. Our impression template now prompts readers to precisely name the vessels with moderate stenosis, severe stenosis or occlusions. Although imaging specialists have the option to not follow the template, it nonetheless serves as a reminder to include this critical information in impression. Our template did not improve the agreement on the severity of stenosis. This could be because that our imaging specialists were already well versed in these terminologies before the template implementation. We are considering further changes to the template to discriminate the overall degree of plaque burden from the description of the most severe stenoses; while each

of these findings have clinical implications, only likely hemodynamically significant stenoses are likely to warrant confirmation by invasive coronary angiography.

Agreement on the presence of non-evaluable segments did not change after the template implementation. This could be because no information was included in the template. We believe that improvement can be achieved if the number and location of non-evaluable segments are specifically prompted in the impression template.

Satisfactions with impression section

Referring clinicians expressed a lesser satisfaction overall in comparison to imaging specialists. This could be due to personal preference differences, since we only had 2 imaging specialist participants and 4 clinician participants. With respect to FFI vs. SI, clinicians showed no difference in satisfaction in content, clarity, or POCS effectiveness. It is interesting to note that imaging specialist's satisfaction in content and clarity decreased after the template implementation. It is possible that imaging specialists preferred FFI because FFI are more commonly used than SI in general radiology.

Study limitations

We acknowledge several limitations of this study. First, a potential bias in favor of SI could be perceived at our institution, where structured reporting is required by the Department of Radiology (although report impressions are not required to be structured). Our radiologists advocated the change to a structured impression format as a quality improvement initiative in response to feedback during multispecialty peer reviews. Second, our study was conducted using only the impression section of CCTA reports, instead of the entire report. The impression section, by definition, should have included all critical information that quickly guides patient management. In addition, most clinicians focus on the Impression when reading a report. Third, our sample was limited in size. We only included 50 reports in this study due to the practical nature of this research. However, reports were selected to reflect a whole spectrum of CAD stenosis severity. Although the agreement on stenosis severity was less than perfect between imaging specialists and clinicians, the proportion of agreement on our service would have been higher in actual clinical situations given that most of patients referred to CTA had no significant CAD, and in the setting of clinical knowledge of the patient histories by the referring clinicians. However, it should be noted that most of the disagreement occurred in patients with non-significant stenosis, and imaging specialists should pay special attention to wording when describing non-significant stenosis. Lastly, our respondents only included cardiologists. We plan to include Emergency Department physicians as well in future studies, as emergency physicians represent an increasing source of CCTA referrals(24).

Conclusion

Critical information in CCTA reports is adequately communicated by the impression section of the report and is interpreted appropriately by clinicians. Structured impressions were shown to improve result interpretation agreement from fair to moderate with regard to the number of vessels with significant stenosis. Room for improvement exists at our institution

to optimize the wording and communication of CCTA reports, especially regarding the summary statement in report impressions.

References

1. Johnson AJ. Radiology report quality: a cohort study of point-and-click structured reporting versus conventional dictation. Acad Radiol. 2002 Sep; 9(9):1056–61. [PubMed: 12238549]
2. Lucey LL, Kushner DC. The ACR guideline on communication: to be or not to be, that is the question. J Am Coll Radiol. 2010; 7(2):109–14. [PubMed: 20142084]
3. Naik SS, Hanbidge A, Wilson SR. Radiology reports: examining radiologist and clinician preferences regarding style and content. AJR Am J Roentgenol. 2001 Mar; 176(3):591–8. [PubMed: 11222186]
4. Reiner BI, Knight N, Siegel EL. Radiology reporting, past, present, and future: the radiologist's perspective. J Am Coll Radiol. 2007 May; 4(5):313–9. [PubMed: 17467614]
5. Schwartz LH, Panicek DM, Berk AR, Li Y, Hricak H. Improving communication of diagnostic radiology findings through structured reporting. Radiology. 2011 Jul; 260(1):174–81. [PubMed: 21518775]
6. Weiss DL, Langlotz CP. Structured reporting: patient care enhancement or productivity nightmare? Radiology. 2008 Dec; 249(3):739–47. [PubMed: 19011178]
7. Raff GL, Abidov A, Achenbach S, Berman DS, Boxt LM, Budoff MJ, et al. SCCT guidelines for the interpretation and reporting of coronary computed tomographic angiography. Journal of cardiovascular computed tomography. 2009 Mar-Apr;3(2):122–36. [PubMed: 19272853]
8. Sistrom CL, Dreyer KJ, Dang PP, Weilburg JB, Boland GW, Rosenthal DI, et al. Recommendations for additional imaging in radiology reports: multifactorial analysis of 5.9 million examinations. Radiology. 2009 Nov; 253(2):453–61. [PubMed: 19710005]
9. Plumb AA, Grieve FM, Khan SH. Survey of hospital clinicians' preferences regarding the format of radiology reports. Clin Radiol. 2009 Apr; 64(4):386–94. 95–6. [PubMed: 19264183]
10. Lee R, Cohen MD, Jennings GS. A new method of evaluating the quality of radiology reports. Acad Radiol. 2006 Feb; 13(2):241–8. [PubMed: 16428061]
11. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics. 1977 Mar; 33(1):159–74. Research Support, U.S. Gov't, Non-P.H.S.Research Support, U.S. Gov't, P.H.S. [PubMed: 843571]
12. Patel MR, Bailey SR, Bonow RO, Chambers CE, Chan PS, Dehmer GJ, et al. ACCF/SCAI/AATS/AHA/ASE/ASNC/HFSA/HRS/SCCM/SCCT/SCMR/STS 2012 Appropriate Use Criteria for Diagnostic Catheterization: A Report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, Society for Cardiovascular Angiography and Interventions, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Failure Society of America, Heart Rhythm Society, Society of Critical Care Medicine, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons. J Am Coll Cardiol. 2012 May 29; 59(22):1995–2027. [PubMed: 22578925]
13. Chow BJ, Small G, Yam Y, Chen L, Achenbach S, Al-Mallah M, et al. Incremental prognostic value of cardiac computed tomography in coronary artery disease using CONFIRM: COroNary computed tomography angiography evaluation for clinical outcomes: an InteRnational Multicenter registry. Circ Cardiovasc Imaging. 2011 Sep; 4(5):463–72. Comparative Study Multicenter Study Research Support, Non-U.S. Gov't. [PubMed: 21730027]
14. Ahmadi N, Nabavi V, Hajsadeghi F, Flores F, French WJ, Mao SS, et al. Mortality incidence of patients with non-obstructive coronary artery disease diagnosed by computed tomography angiography. The American journal of cardiology. 2011 Jan; 107(1):10–6. [PubMed: 21146679]
15. Bamberg F, Sommer WH, Hoffmann V, Achenbach S, Nikolaou K, Conen D, et al. Meta-analysis and systematic review of the long-term predictive value of assessment of coronary atherosclerosis by contrast-enhanced coronary computed tomography angiography. J Am Coll Cardiol. 2011 Jun 14; 57(24):2426–36. Meta-Analysis Review. [PubMed: 21658564]

16. Motoyama S, Sarai M, Harigaya H, Anno H, Inoue K, Hara T, et al. Computed tomographic angiography characteristics of atherosclerotic plaques subsequently resulting in acute coronary syndrome. J Am Coll Cardiol. 2009 Jun 30; 54(1):49–57. [PubMed: 19555840]

17. Hulten EA, Carbonaro S, Petrillo SP, Mitchell JD, Villines TC. Prognostic value of cardiac computed tomography angiography: a systematic review and meta-analysis. J Am Coll Cardiol. 2011 Mar 8; 57(10):1237–47. Meta-AnalysisReview. [PubMed: 21145688]

18. Pundziute G, Schuijf JD, Jukema JW, Boersma E, de Roos A, van der Wall EE, et al. Prognostic value of multislice computed tomography coronary angiography in patients with known or suspected coronary artery disease. J Am Coll Cardiol. 2007 Jan 2; 49(1):62–70. Research Support, Non-U.S. Gov't. [PubMed: 17207724]

19. Schlett CL, Banerji D, Siegel E, Bamberg F, Lehman SJ, Ferencik M, et al. Prognostic value of CT angiography for major adverse cardiac events in patients with acute chest pain from the emergency department: 2-year outcomes of the ROMICAT trial. JACC Cardiovascular imaging. 2011 May; 4(5):481–91. Clinical Trial. [PubMed: 21565735]

20. Min JK, Shaw LJ, Devereux RB, Okin PM, Weinsaft JW, Russo DJ, et al. Prognostic value of multidetector coronary computed tomographic angiography for prediction of all-cause mortality. J Am Coll Cardiol. 2007 Sep 18; 50(12):1161–70. [PubMed: 17868808]

21. Min JK, Shaw LJ. Noninvasive diagnostic and prognostic assessment of individuals with suspected coronary artery disease: coronary computed tomographic angiography perspective. Circ Cardiovasc Imaging. 2008 Nov; 1(3):270–81. discussion 81. [PubMed: 19808551]

22. Mark DB, Berman DS, Budoff MJ, Carr JJ, Gerber TC, Hecht HS, et al. ACCF/ACR/AHA/NASCI/SAIP/SCAI/SCCT 2010 expert consensus document on coronary computed tomographic angiography: a report of the American College of Cardiology Foundation Task Force on Expert Consensus Documents. Catheter Cardiovasc Interv. 2010 Aug 1; 76(2):E1–42. [PubMed: 20687247]

23. Songco AV, Brener SJ. Initial strategy of revascularization versus optimal medical therapy for improving outcomes in ischemic heart disease: a review of the literature. Curr Cardiol Rep. 2012 Aug; 14(4):397–407. [PubMed: 22555943]

24. Hoffmann U, Truong QA, Schoenfeld DA, Chou ET, Woodard PK, Nagurney JT, et al. Coronary CT angiography versus standard evaluation in acute chest pain. N Engl J Med. 2012 Jul 26; 367(4):299–308. [PubMed: 22830462]

Summary

Structured impressions were shown to improve result interpretation of coronary computed tomography angiography by referring clinicians.

Take-home points

- Critical information in CCTA reports is adequately communicated in the impression of the report and is interpreted appropriately by clinicians.
- Structured impressions were shown to improve result interpretation agreement from fair to moderate with regard to the number of vessels with significant stenosis, by decreasing the tendency toward overestimation of non-significant stenosis by clinicians.
- Future steps for improvement exists at our institution to optimize the wording and communication of CCTA reports, especially regarding the summary statement in report impression.

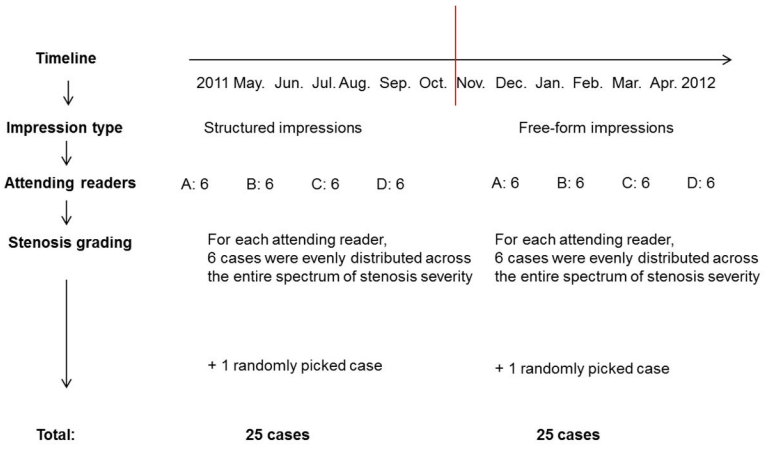

Figure 1.
Flow chart illustrating the report selection process

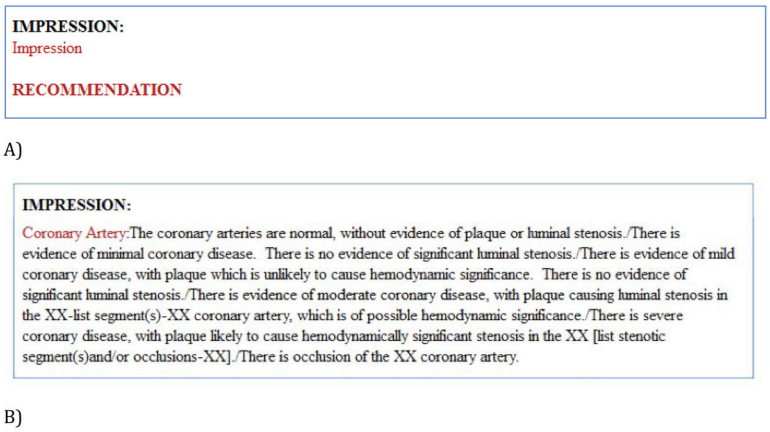

Figure 2.
Impression template section for free-form impressions (A) and structured impressions (B).

Table 1

Survey questions regarding understanding of patient's CAD

1. What is the CAD stenosis severity of this patient? **a.** Normal: Absence of plaque and no luminal stenosis **b.** Minimal: Plaque with negligible impact on lumen **c.** Mild: Plaque with no flow-limiting stenosis **d.** Moderate: Plaque with possible flow-limiting stenosis **e.** Severe: Plaque with probable flow-limiting disease **f.** Occluded
2. If a significant stenosis is present, which vessels have significant stenosis? **a.** 0 vessel **b.** 1 vessel **c.** 2 vessel **d.** 3 vessel **e.** Left main
3. Are there any non-evaluable segments? **a.** Yes **b.** No

Table 2

POCS grading scale(10)

Grade I	Does not take clinical picture at least one step forward on the POCS algorithm; Does not include pertinent information in the description or impression of the report.
Grade IIA	Does not take clinical picture at least one step forward on the POCS algorithm; But includes pertinent information in description but not in impression of the report.
Grade IIB	Does not take clinical picture at least one step forward on the POCS algorithm; Includes pertinent information in the description and the impression of the report.
Grade III	Takes clinical picture at least one step forward on the POCS algorithm; The findings are in the description but not in impression of the report.
Grade IV	Takes clinical picture at least one step forward on the POCS algorithm; The findings are in the description and summarized in impression of the report.

Table 3

Satisfaction with content, clarity, and POCS effectiveness

Satisfaction	Imaging specialists			Clinicians		
	Free-form	Structured	*p*-value	Free-form	Structured	*p*-value
Content (1–10)	9.58 ± 1.04	9.20 ± 1.56	0.044*	7.07 ± 1.21	7.04 ± 0.94	0.856
Clarity (1–10)	9.64 ± 0.75	9.08 ± 1.47	0.002*	6.99 ± 1.47	6.98 ± 1.15	0.954
POCS effectiveness (1–5)	4.92 ± 0.40	4.96 ± 0.20	0.343	4.14 ± 1.09	4.27 ± 0.81	0.243

Table 4

Agreement table summary

		Free-form (n=100)	Structured (n=100)	*p*-value
Coronary stenosis severity (6 categories per SCCT guidelines)	Agreement	80	85	
	Over- estimation by clinicians	4	6	
	Under- estimation by clinicians	16	9	
	Kappa	0.87	0.89	
Coronary stenosis severity by threshold (no CAD vs. non- significant CAD vs. significant CAD)	Agreement	99	97	
	Over- estimation by clinicians	1	1	
	Under- estimation by clinicians	0	2	
	Kappa	0.99	0.94	
Number of vessels with significant stenosis	Agreement	53	68	**0.043***
	Over- estimation by clinicians	46	32	
	Under- estimation by clinicians	1	0	
	Kappa	0.31	0.52	
Presence of non- evaluable segments	Agreement	90	87	
	Over- estimation by clinicians	10	13	
	Under- estimation by clinicians	0	0	
	Kappa	0.57	0.58	

* Only p-value <0.05 is shown in this column.