Structured Reporting: Coronary CT Angiography

A White Paper from the American College of Radiology and the North American Society for Cardiovascular Imaging

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With the growing use of electronic medical records, the trend of diagnostic imaging reporting is toward a more structured format. Advantages include improved quality and consistency of the reporting and ease of data mining. The essential elements of a structured report are provided and illustrated for coronary artery computed tomographic angiograms.

Key Words: Diagnostic image reporting, coronary artery computed tomographic angiography, radiology imaging reporting, structured reporting

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INTRODUCTION

There is a growing trend in diagnostic imaging to structure reports of imaging procedures [1-3]. Structured reporting is important for several reasons. First, structured reporting can improve quality through consistency. Key report elements are less likely to be omitted if the report is structured and elements are listed systematically within a standard template. The development of lexicons standardizes descriptors. Reports convey similar information regardless of the imager’s background and are similar throughout and across institutions. Referring physicians have access to an end product from which it is easier to extract the pertinent results because they are in an expected location in the report and in standard defined terminology. In addition, data mining may be facilitated through structure with entries serving as data cells in electronic medical records. Finally, structured reporting also ensures that all required elements for billing purposes are contained within the report.

It is understood that although there is the desire to impose more structure in reports, some degree of flexibility must be permitted to accommodate unusual circumstances. However, this should be kept to a minimum. Moreover, the indications for assessing coronary arterial anatomy by coronary computed tomographic angiography (CCTA) are varied. When associated with nonatherosclerotic coronary disease, congenital heart disease, acquired diseases of the myocardium, valves, aorta, and pulmonary arteries, additional relevant findings referable to these diseases should be included in the report.

Probably the most thoroughly developed and used method of standard reporting language is found associated with mammography. The American College of Radiology Breast Imaging Reporting and Data System® has been in use for more than a decade [4]. Other specialty areas in radiology have proposed standardized report language, including lower limb veins [5], lumbar disk disease [6,7], and chest disease [8-10]. RadLex® is being developed by the Radiological Society of North America as a comprehensive lexicon for radiology reporting [11].

Structured reports may be generated using workstation software for some tests, such as single photon emission computed tomography myocardial perfusion imaging and CCTA. Alternatively, dictation templates or macros in transcription software may be used [1].

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The future of structured reporting includes capturing of imaging findings during the imaging process (point-and-click approaches) [12] that may translate directly into text, image-annotated text, and templates with constrained, coded vocabulary. These specific utilities, which can assist with data capture, direct comparison of data, outcomes assessment, and improved patient outcomes, can be facilitated by digital imaging and communication in medicine-structured report mechanisms [13].

**ELEMENTS OF A STRUCTURED REPORT**

**Examination**

The examination briefly describes the specific procedure that was performed. Together with the technical details of the procedure (provided under the heading “Procedure” below), this may be used to assign a Current Procedural Terminology (CPT) code [14] for the study. Generally, the listed examination of the report should be the same as that requested by the referring physician and scheduled in the radiology information system.

**Indication**

The indication should include pertinent clinical history along with signs, symptoms, and relevant results of medical tests. Abbreviations and acronyms should be avoided (eg, SOB = shortness of breath). There should be a corresponding International Classification of Diseases, 9th revision code (ICD-9) [15].

**Comparison Studies**

The date(s) of previous studies used for comparison should be listed. If the examination type differs from the reported study, the examination type should be listed.

**Procedure**

Relevant technical details of the examination that are required to assign a CPT [14] to the study should be stated. All pharmaceutical agents, including contrast media, that were used as part of the imaging procedure should be listed along with the dose administered. Any complication of the procedure, steps taken to treat the complication, and disposition of the patient at discharge should be stated.

**Findings**

A logical division of anatomy should be used in stating findings for each organ system or body part. Descriptive terms should be part of standardized lexicon when possible. Quantitative measures should be used as appropriate. Links to pertinent representative images may be incorporated into the report.

**Impression/Conclusions**

A succinct summary of the important findings should be listed. A numbered list is desirable, presenting the results in order of decreasing importance. Recommendations may be provided concerning additional studies that may be required to answer the clinical question or to work up incidental findings. The use of the phrase “clinical correlation is recommended” should be avoided because it suggests a lack of responsibility on the part of the referring physician.

**Attestation**

In academic institutions where residents or fellows may be reporting, it is important that the interpreting staff physician state that he or she was present for the entirety of the procedure (if an interventional procedure was performed) or that all images were personally reviewed. This is a requirement of Medicare.

Structured reporting is increasingly used by other medical specialties. It is widely incorporated in reporting systems for assessing echocardiograms, for example CCTA, in particular, lends itself to structured reporting because there are limited anatomic elements and pathologic variations. Workstations are now providing structured reports that are generated in the course of image analysis. However, many radiology information systems cannot accept these reports at the present time. Dictation systems are more commonly used. Quantitative measures for data (eg, ejection fraction) may be provided. At the same time, semiquantitative descriptors may be needed, for example, coronary stenoses are generally graded as normal (0% stenosis), mild (<50% stenosis), moderate (50%-70% stenosis), severe (>70% stenosis), or occluded because the spatial resolution is inadequate to be precise.

Templates that may be used with electronic reporting mechanisms and that use many of the described reporting elements are provided below. Local preferences may add to or modify these templates, but the essential elements of the report are provided [16]. Other variations in reporting may be necessary in the presence of coronary anomalies or bypass grafts and to describe findings outside of the coronary arterial tree. The template for reporting the results of coronary artery bypass grafts, for example, may require considerable editing depending on the number, type, and location of bypass grafts present.

The type (left internal mammary artery [LIMA], right internal mammary artery [RIMA], saphenous vein graft, and radial artery), artery of distal anastomosis, and proximity of the graft to the sternum should be noted. In

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1 Templates may be downloaded from www.acr.org and www.nasci.org
addition, the position of the graft in relationship to the sternal notch should be reported if the graft abuts the sternum. Proximity of the grafts and cardiac chambers to the sternum is of concern to avoid damage during a redo sternotomy. The sternal notch is selected as a surface landmark that is readily identifiable by the surgeon. Minimally invasive surgery may require a modification of the template to localize the proximal graft anastomosis with the distance of the graft origin from the anterior surface of the brachiocephalic artery origin or the aortic annulus. These landmarks are integral to the ascending aorta and as such are not apt to change the relationship relevant to the graft origins with changes in the mediastinum position relative to the sternum, such as from a pericardial effusion.

**TEMPLATE FOR CCTA**

**CCTA with Coronary Artery Calcium Score**

**Indication:** A [<>]-year-old [<>]-man [<>]-woman] with [<>]-chronic chest pain > atypical chest pain > abnormal single photon emission computed tomography study > exertional angina > prevalve replacement [<>].

**Comparison**

[<>] [<>] [<>] [<>]

**Procedure**

Computed tomography (CT) of the heart was obtained using prospective electrocardiography (ECG) triggering initially without the use of contrast media. A [<>]-slice multidetector CT coronary angiogram was subsequently obtained using retrospective ECG gating. [<>] mL of [<>] contrast was administered intravenously. In preparation for the examination, the patient received [<>] mg [<>]-intravenous [<>]-oral] [<>]-metoprolol, [<>]-calcium channel blocker] for heart rate/rhythm control and [<>] mg sublingual nitroglycerin [<>]-spray [<>]-tablet] for coronary vasodilation. Before medication administration, the heart rate was [<>] beats per minute and blood pressure was [<>] mm Hg. At the time of CT, the heart rate was [<>] beats per minute and blood pressure was [<>] mm Hg. [<>] There were no complications [<>]. [<>]-ECG tube modulation was used to reduce the radiation exposure [<>]-ECG tube modulation was not used because of arrhythmia [<>]-ECG tube modulation was not used because of the need for systolic and diastolic imaging]. The CT dose index-volume was [<>] mGy, and dose length product of the examination was [<>] mGy-cm.

**Extracardiac Findings**

The visualized lungs [<>] and mediastinum [<>]. Images of the upper abdomen demonstrate [<>]. The pulmonary arteries are [<>]. The visualized thoracic aorta is [<>]. (If the aorta is enlarged or dissected, description and size should be provided.)

**Agatston Score**

Total coronary artery calcium score is [<>], distributed as left main (LM) coronary artery [<>], left anterior descending (LAD) [<>], left circumflex coronary artery (LCx) [<>], right coronary artery (RCA) [<>]; [<>]% of similar patients have less coronary artery calcium.

**Cardiac Morphology**

The right atrium is [<>]. The right ventricle is [<>]. The left atrium is [<>]. The left ventricle is [<>]. Valves [<>]. The pericardium is normal > The pericardium is thickened > There is a small pericardial effusion > There is a moderate pericardial effusion > There is a large pericardial effusion >

**Function**

The calculated left ventricular ejection fraction is [<>]% left ventricular end-diastolic volume is [<>] mL, and left ventricular end-systolic volume is [<>] mL. There [<>] are no regional wall motion abnormalities > is hypokinesia/akinesia/dyskinesia of the anterior/anterolateral/inferolateral/inferior wall/Septum of the left ventricle >.

**Coronary CT Angiogram**

The overall quality of the CT angiographic examination is [<>] and is limited by [<>] patient motion >. The coronary artery system is [<>] dominant with [<>] origins.

The LM [<>] has no stenosis > has mild stenosis > has moderate stenosis > has severe stenosis > is occluded > is nonevaluable > with [<>] plaques >.

The proximal LAD and first diagonal branch (D1) [<>] has no stenosis > has mild stenosis > has moderate stenosis > has severe stenosis > are occluded > are nonevaluable > with [<>] plaques >.

The mid-distal LAD, D2 and D3 branches [<>] has no stenosis > has mild stenosis > has moderate stenosis >
There was no complications.

At the time of CT, the heart rate was [><] beats per minute and blood pressure was [><] mm Hg. The patient received [><] mg of metoprolol [oral] for heart rate/rhythm control and [><] mg sublingual nitroglycerin [spray] for coronary vasodilation. Before medication administration, the heart rate was [><] beats per minute and blood pressure was [><] mm Hg.

The RCA and acute marginal [left posterior descending artery (RPDA)/left posterolateral (LPL)/left circumflex (LCx)/left marginal (LM)] branches [><] with [><] plaque. (If left or codominant: RPDA and LPL branches need to be addressed.)

The LCx and its obtuse marginal (OM) [and left posterior descending artery (LPDA)/left posterolateral (LPL)] branches [><] with [><] plaque. (If left or codominant: LPDA and LPL branches need to be addressed.)

Impression
[><]
evaluable] with [\(\text{mild} \text{stenosis}\) \(\text{mixed}\) \(\text{calcified}\) ] plaque.

[There is a ramus intermedius branch that has no stenosis \(\text{mixed}\) \(\text{calcified}\) ] plaque. The LCx and its OM [and \(\text{LPDA/LPL}\) ] branches have no stenosis \(\text{mixed}\) \(\text{calcified}\) ] plaque. (If left or codominant: LPDA and LPL branches need to be addressed.)

The RCA and acute marginal [and \(\text{RPDA/RPL}\) ] branches have no stenosis \(\text{mixed}\) \(\text{calcified}\) ] plaque. (If right or codominant: RPDA and/or RPL branches need to be addressed.)

**Bypass Grafts**

A \([\text{LIMA} \text{RIMA} \text{saphenous vein} \text{radial artery} \text{gastroepiploic artery}]\) graft to the \([\text{LAD} \text{diagonal} \text{OM} \text{RCA} \text{PDA}]\) \([\text{is well separated from} \text{abuts}]\) the sternum \([\text{cm} \text{below} \text{the} \text{sternal} \text{notch}]\). The graft \([\text{has} \text{no} \text{stenosis} \text{mild} \text{stenosis} \text{moderate} \text{stenosis} \text{severe} \text{stenosis} \text{is} \text{occluded} \text{non-evaluable}]\].

A \([\text{LIMA} \text{RIMA} \text{saphenous vein} \text{radial artery} \text{gastroepiploic artery}]\) graft to the \([\text{LAD} \text{diagonal} \text{OM} \text{RCA} \text{PDA}]\) \([\text{is well separated from} \text{abuts}]\) the sternum \([\text{cm} \text{below} \text{the} \text{sternal} \text{notch}]\). The graft \([\text{has} \text{no} \text{stenosis} \text{mild} \text{stenosis} \text{moderate} \text{stenosis} \text{severe} \text{stenosis} \text{is} \text{occluded} \text{non-evaluable}]\].

**Impression**

\([\text{mild} \text{stenosis}\) \(\text{mixed}\) \(\text{calcified}\) ]

**REFERENCES**


