SMART HEART AND HEALTH
Preventive Imaging
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CT CORONARY ANGIOGRAPHY WITH MULTIPLANAR REFORMATTED IMAGES

HISTORY AND INDICATIONS
63-year-old male. Family history of heart disease reported.

TECHNIQUE
CT coronary angiography was performed using the Siemens Sensation Multislice CT scanner following the intravenous infusion of 95 cc of Isovue-370 contrast at 5 cc per sec, heart rate 60-76 bpm. Retrospective ECG gating was used for acquisition of multiple phase images over the latter half of the cardiac cycle. He received 30 mg of intravenous esmolol prior to the study.

POST PROCESSING Using CARDIAC PLUS:
Cardiac Plus - In addition to using a TeraRecon Workstation to reconstruct the heart and create specific images of each coronary artery, the raw data was also sent to an ouside post processing lab (Cleerly, Inc.), where the data was analyzed using Artificial Intelligence and a deep learning framework to evaluate the following:

1. Lipid and cholesterol volumes in the coronary artery tree.
2. The degree of stenosis and narrowing in specific coronary artery segments.

CT radiation dosimetry was as follows using 120 kV acquisition:

PHASE	CTDI (mGy)	DLP (mGy*cm)
Topogram	0.15	7.47
Calcium Scoring	3.46	112.05
Pre-monitoring	6.79	6.52
Monitoring	6.70	6.52
Coronary CTA	42.33	935.48
Effective dose	25.6 mSv, using k value of 0.024.	

In order to minimize radiation exposure to the patient while maintaining optimal image quality, this CT scanner uses protocols incorporating automated exposure control, with tube current (mA) and photon energy (kV) tailored to individual patient size. The procedure was performed at Medical Imaging Center of Southern California in Santa Monica, California.

COMPARISON
There are no previous imaging studies of the coronary arteries available for comparison.

FINDINGS
Measurements below are from axial and other oblique sections. These should be regarded as approximate, subject to variation with phase in cardiac cycle, position of section, anatomic lie of the heart, and edge definition based on quality of images.

Right Ventricular Tricuspid Annulus (d): 4.4 cm.
Right Ventricle (d): 4.5 cm. near tricuspid annulus
Left Ventricle (d): 4.6 cm.
LV ED Volume (d): ~110-130 ml.
Ventricular Septum (d): 7-10 mm.
Posterior LV Wall (d): 7-9 mm.

Left Atrium AP (d): 3.0 cm.

Other Linear Measurements:
LV Outflow Tract (s): Approximately 21 x 25 mm.
Aortic Annulus: 26 mm.
Sinuses of Valsalva Aorta: 36 mm. inner diameter
Sinotubular Junction Aorta: 26 mm. inner diameter
Ascending Tubular Aorta: 27 mm. inner diameter at axial level of pulmonary artery.
Main Pulmonary Artery: 20 mm. inner diameter at axial level just below carina.
Descending Thoracic Aorta: 21 mm. inner diameter at axial level of pulmonary artery.
All measurements are approximate, demonstrating positional and temporal variation in the indicated structures.

Aortic Valve: Tricuspid, with central and peripheral calcifications that scored 139 and the calcium scoring study.
Mitral Valve: No definite mitral annular calcifications.
Pericardium: No effusion.
Left Atrial Appendage: Unremarkable.
Hiatal Hernia: None demonstrated.

The left main coronary artery arises from the superior aspect or sinotubular junction of the left sinus of Valsalva and demonstrates minor mural irregularities but no well-defined plaques or significant stenoses.

The left anterior descending coronary artery demonstrates several areas of calcified and noncalcified plaquing distributed over to proximal 4 centimeters. Luminal narrowings appear less than 40% in most of these areas. Just beyond takeoff of a prominent diagonal vessel a zone of noncalcified plaquing is also demonstrated with estimated narrowing of appearing < 30%. There is questionable narrowing at the proximal takeoff of a diagonal, appearing < 25%, WLV.

The left circumflex coronary artery demonstrates an area of mixed calcified and noncalcified plaquing approximately 3.8 cm into the vessel at site of takeoff of a second marginal, but with estimated narrowing appearing less than 30% within limits of visualization. The circumflex supplies two obtuse marginals, but no definite obstructive lesions are demonstrated in the marginals although minor irregular plaquing is present in the vessels. The second marginal and distal left circumflex extend to the inferior wall of the left ventricle.

The codominant right coronary arises from the right sinus of Valsalva and demonstrates numerous band and slice artifacts likely related to variation in heart rate during image acquisition, as above, that obscure visualization of portions of the lumen of the right coronary artery. Nevertheless, areas of mural irregularity and plaquing are demonstrated in the second vertical descending portion, within limits of visualization, but with narrowings appearing less than 20% within limits of visualization. The distal inferior aspect of the right coronary artery supplies a small posterior descending. Nevertheless, blood supply to the inferior wall of the left ventricle is supplied minimally from the right coronary as well as from the left circumflex coronary artery in a codominant pattern.

Summary of Findings of Analysis by Cardiac Plus postprocessing from Cleerly, Inc.

Analysis of Plaque Volume (mm^3)
131.3 mm3 (6.2% PAV) of atherosclerotic plaque:
40.2 mm3 (1.9% PAV) Calcified Plaque,
91 mm3 (4.3% PAV) Non-Calcified Plaque, and
0.1 mm3 (< 0.1% PAV) Low-Density-Non-Calcified Plaque.

Analysis of stenoses:
LM: Minimal stenosis < 25%
LAD: Mild proximal stenosis 25-49%
Minimal stenosis < 25% mid LAD
D1: Minimal stenosis < 25%
LCx: Minimal stenosis < 25%
RCA: No stenosis

Abbreviations:
LM=Left main coronary artery
LAD=left anterior descending coronary artery
RI=Ramus intermedius coronary artery
LCx and Cx=Left Circumflex coronaty artery
OM=Obtuse marginal coronary artery
RCA=right coronary artery
PDA=Posterior descending coronary artery
PLB=Posterolateral branch (of RCA)
D=Diagonal branch (of LAD), D1=first diagonal, D2=second diagonal
Prefixes: p=proximal, m=mid, d=distal, L=left, R=right

Reference:
Min JK et al., Coronary CTA plaque volume severity stages according to invasive coronary angiography and FFR. Journal of Cardiovascular Computed Tomography.

Abbreviations: NA=Not available, WLV=within limits of visualization, ~ means approximately, (d)=diastole, (s)=systole, WNL=within normal limits

It should be recognized that all estimates of luminal narrowings or their absence are only approximations, with the apparent degrees of luminal narrowing or patency demonstrating considerable variation among images acquired from different phases of the cardiac cycle.

If not already established and/or recently completed, consultation with a physician or other qualified health professional for review of the diagnostic, prognostic, and therapeutic significance of these results is recommended.

IMPRESSION

1. Multiple areas of calcified and noncalcified plaquing are demonstrated in the left anterior descending coronary artery, as above. Estimated luminal narrowings appear less than 40-50% however within limits of visualization. Minimal narrowing also suggested at takeof of first daigonal from the left anteriro descending.

2. An area of mixed plaquing is demonstrated in the left circumflex coronary artery as above, but with luminal narrowing appearing less than 30%.

3. The left main coronary artery demonstrates mural irregularities but no well-defined plaques or stenoses.

4. The codominant right coronary artery demonstrates areas of mixed minor mural plaquing, but without well-defined stenoses, within limits of visualization. Numerous artifacts affect the images of the right coronary artery however.

5. The great vessels and cardiac chambers demonstrate normal overall dimensions.

6. See also separate report of quantification of atheromatous burden and stenoses from Cleerly Inc.

summary pages

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