Clinical Applications of Saline Bolus Chasing Techniques with the E-Z-EM Double-Syringe Injection System for Contrast-Enhanced Multidetector-Row CT Angiography: CT Coronary Angiography

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Introduction

Traditional contrast media injection protocols for body applications could be transferred from single-slice CT to the first generation of 4-slice MDCT systems with acceptable, albeit suboptimal results. Now, however, performing non-invasive CT angiography of the coronary arteries with ever-shorter acquisition time requires us to reconsider our strategies for contrast media administration.

Utilizing a saline chasing technique following administration of a contrast media bolus has been shown to reduce the total amount of contrast media needed for optimal vascular opacification. In addition, it results in a more “compact” contrast media bolus which facilitates the derivation of tissue perfusion parameters at CT perfusion measurements. A saline chaser bolus may also help to better utilize the injected contrast media by prolonging the plateau phase of the contrast media bolus, resulting in higher and more consistent, homogenous vascular enhancement.

Saline Chase Application

In CT angiography of the coronary arteries, there is a problem with streak artifacts caused by dense contrast media in the superior vena cava and the right heart chambers. Streak artifacts arising from the right atrium and ventricle of the heart may obscure the right coronary artery or result in artifacts mimicking stenotic disease along the course of the vessel, especially at 2D and 3D image post-processing.

These artifacts may be reduced or avoided entirely, if at the time of image acquisition the contrast material is flushed from the venous system by use of a saline chaser technique with a dual-syringe injection system.

This concept is illustrated in this case of a 42-year-old man with an anomalous origin and course of the left coronary artery (LCA; Figure 1). The left coronary artery has an anomalous origin medial to the origin of the right coronary artery (RCA) and crosses the median line prior to giving off branches supplying the left side of the myocardium. (Figures 1-3).

The scan was performed with our routine CT coronary artery protocol (Table 1) and saline chasing technique, using the E-Z-EM EmpowerCTA® dual-syringe injector system.

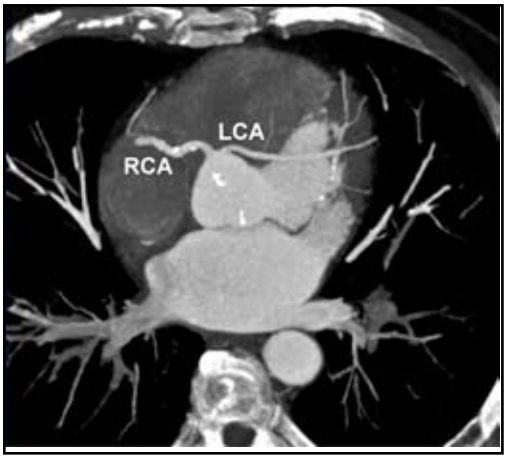
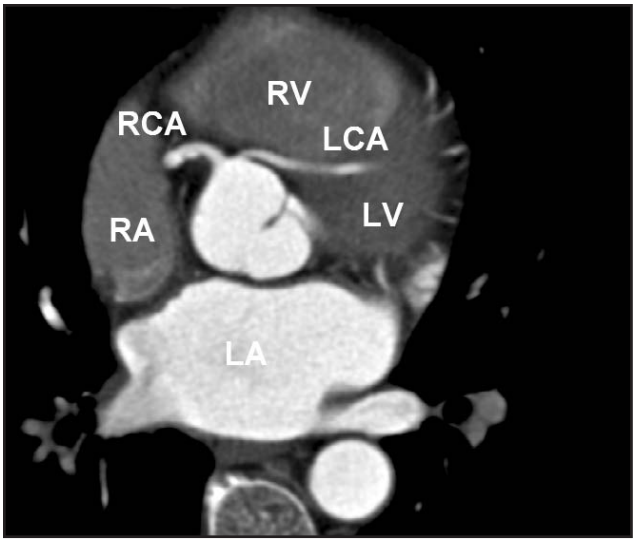


Figure 1. Anomalous origin of the left coronary artery (LCA) medial to the origin of the right coronary artery (RCA).

Table 1. CT Coronary Artery Protocol

Scan parameter	
kV	120
eff. mAs	500
Gantry rotation	420 msec
Collimation	16 x 0.75 mm
Pitch	0.31
Recon thickness/increment	1 mm/0.6 mm
Recon cardiac (ECG) phase	diastole (-400 msec before R)
Scan time	21 sec
Contrast timing	Test bolus (20 cc contrast medium)
Contrast volume	100 cc
Contrast conc.	300 mg Iodine/mL
Injection speed	4 cc/sec
Saline volume	40 cc
Saline inj. speed	4 cc/sec



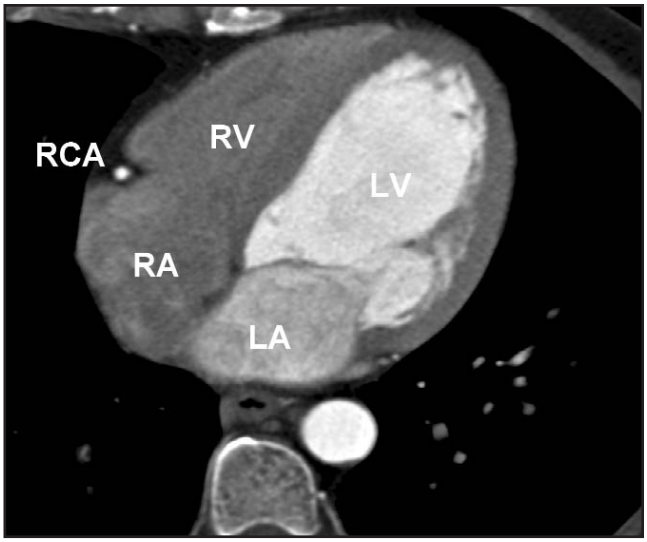


Figure 2. *Saline chasing technique results in contrast enhancement almost exclusively of the arterial side of the cardiac circulation (left ventricle-LV, left atrium-LA) with high and consistent opacification and exquisite delineation of the right coronary artery (RCA) from the significantly less enhanced right ventricle (RV) and right atrium (RA).*

Results

Use of a saline chaser bolus resulted in contrast enhancement almost exclusively of the arterial side of the cardiac circulation (left ventricle-LV, left atrium-LA; Figure 2) with high and consistent opacification and exquisite delineation of the right coronary artery (RCA) from the significantly less enhanced right ventricle (RV) and right atrium (RA; Figure 2). This facilitates threshold-dependent 3D visualization (Figure 3) of this vascular anomaly, since a single, predetermined threshold enables uniform rendering of the entire coronary artery tree.

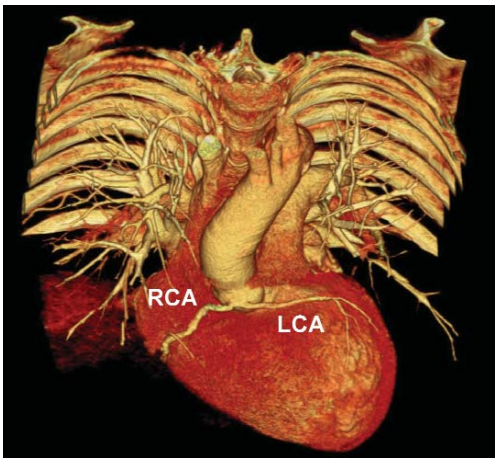


Figure 3. *Threshold dependent 3D visualization of this vascular anomaly is facilitated with use of saline chasing technique, since a single, predetermined threshold enables uniform rendering of the entire coronary artery tree.*

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