1-19-2016

Initial Evaluation of Coronary CT Angiography Image Quality on the Revolution CT System

Muhammad Latif
Baptist Health Medical Group, MuhammadL@baptisthealth.net

Frank Sanchez
South Miami Hospital, frankws@baptisthealth.net

Karl Sayegh

Emir Veledar
Baptist Health South Florida, emirv@baptisthealth.net

Arthur Agatston
Baptist Health Medical Group, ArthurSAg@baptisthealth.net

See next page for additional authors

Follow this and additional works at: https://scholarlycommons.baptisthealth.net/se-all-publications

Citation
Latif, Muhammad; Sanchez, Frank; Sayegh, Karl; Veledar, Emir; Agatston, Arthur; Batlle, Juan; Janowitz, Warren; Pena, Constantino; Ziffer, Jack; Nasir, Khurram; and Cur, Ricardo, "Initial Evaluation of Coronary CT Angiography Image Quality on the Revolution CT System" (2016). All Publications. 2639.
https://scholarlycommons.baptisthealth.net/se-all-publications/2639

This Conference Poster -- Open Access is brought to you for free and open access by Scholarly Commons @ Baptist Health South Florida. It has been accepted for inclusion in All Publications by an authorized administrator of Scholarly Commons @ Baptist Health South Florida. For more information, please contact Carrie@baptisthealth.net.
Authors
Muhammad Latif, Frank Sanchez, Karl Sayegh, Emir Veledar, Arthur Agatston, Juan Batlle, Warren Janowitz, Constantino Pena, Jack Ziffer, Khurram Nasir, and Ricardo Cury
INITIAL EVALUATION OF CORONARY CT ANGIOGRAPHY IMAGE QUALITY ON THE REVOLUTION CT SYSTEM

Muhammad A Latif, Frank Sanchez, Karl Sayegh, Emir Veledar, Arthur Agatston, Juan C Batlle, Warren Janowitz, Constantino Pena, Jack Zipper, Khurram Nasir, Ricardo C Cury

METHODS

DESIGN AND SETTING

- Study Groups: Prospective evaluation of 24 subjects was performed from May 2013 to November 2013. This study was approved by IRB. All 24 patients provided informed consent. Inclusion criteria were: 18 years or older not requiring acute care, without allergies to iodinated contrast media, and without renal insufficiency. Women less than 60 years of age were confirmed to be pregnant.

- All CT acquisitions with the Volumetric CT scan were axial prospectively triggered CCTA with different acquisition windows dependent heart rate. Motion correction software (Snapshot Freeze, GE Healthcare) was selectively applied only if motion was present.

- Patients were given an injection of 60 cc of contrast in the first phase, followed by 20 cc of contrast and 30 cc of saline in the second phase and completed by 50 cc of saline. Three patients were excluded due to severe motion artefacts.

- Six Region of Interest (ROI) measurements were made across the myocardium in each of the Volumetric CT image sets as well as in the 64-slice CT image sets (Figure 1).

- An ROI of the myocardial wall was obtained, which ranged between 0.1cm² and 0.2cm². These measurements were made in the following regions: base-anterior, base-posterior, mid-anterior, mid-posterior, apex-anterior, apex-posterior. The same technique was used to assess myocardial blood pool.

- All ROI measurements were made in the left ventricular cavity at the base, mid and apex of the heart in each of the Volume CT as well as the 64-slice CT image sets.

- Unlike the smaller ROI in the myocardial wall, a larger maximum ROI ranging between 1cm² and 4cm² was utilized to assess the most possible blood pool. ROI measurements ranging between 1cm² and 2cm² were made in the aorta in each of the Volume CT image sets as well as the 64-slice CT image sets.

- These measurements were obtained in one session by a single radiologist (RR, 3 years of post-fellowship experience) manually placing a circular region of interest at each anatomic site mentioned above. Significant signal-to-noise ratio (SNR) improvement was calculated by dividing the mean CT number within the ROI divided by the standard deviation from the mean value within the ROI.

- The variation in mean values across multiple ROI was quantified by the Coefficient of Variation (CV). This value is calculated by dividing the standard deviation of the mean CT numbers across multiple ROIs by the mean CT number. The CV metric normalizes relative contrast volume and specification differences from patient to patient, which do not reflect the performance of the scanner itself.

RESULTS

- Heart Rate: The median heart rate of patients undergoing the Volume CT was 60 bpm ± 10 SD (range 49-86). The median heart rate for patients undergoing the 64-slice CT was 77 bpm ± 6 SD (range 44-65). A significant difference was found in heart rate between the Volume and 64-slice CCTA (p=0.036). Motion correction methods were applied in the time of the scan acquisition in 11 of 24 subjects. Radiation Dose: Median effective dose for the Volumetric CT studies was 2.06 mSv ± 0.87 (median 2.04 mSv) and for the 64-slice CT images was 3.70 mSv ± 5.76.

- On the 64-slice platform, 8 patients had retrospectively gated scans and 16 had prospectively triggered CCTA. The retrospectively gated scan was 70±24 seconds (median 70 seconds). Of those patients, the median dose for the prospectively triggered CCTA was 4.7±1.26. As expected, there was a significant difference in the radiation dose between those who had retrospectively gated scans from prospectively triggered CCTA (p=0.002).

- Quantitative Analysis: The distributions of the CV in the Volume and 64-slice CCTA were significantly different in each of the myocardium (p=0.007; 0.080; 0.125 vs 0.138, p=0.166; 0.138, p=0.001; 0.016), blood pool (p=0.016: 0.099-0.024 vs 0.058, 0.047-0.075 vs p=0.001) and aorta (p=0.013, 0.008-0.019 vs 0.049, 0.033-0.077 vs p=0.001).

- Measurements of Signal Intensity: Measurements were not statistically significant across the 64-slice CT in the volume and 64-slice CCTA Descending aorta (dLAD), first Obtuse Marginal branch (OM1), distal Circumflex artery (dCx), second Obtuse Marginal branch (OM2), p=0.05). In terms of image quality, 346 of the 432 segments (80.1%) were classified as having good image quality in the Volume CT image set, compared to 299 of the 432 segments (69.2%) for the 64-slice CCTA image set (p=0.001).

CONCLUSIONS

- CT Perfusion allows for the evaluation of myocardium in particular for the detection of ischemia and infarction. Previous studies have, however, described beam hardening artifacts within the myocardium, which may have an effect on identifying true perfusion defects. Larger or voxelsized CT scanners have shown promise in reducing myocardial heterogeneity but have been limited by cone beam artifacts and low rotor rotation speeds. We sought to evaluate the performance of a new volume CT scanner (Revolution CT, GE Healthcare) enabled with novel wide cone reconstruction software (Volume HD reconstruction) and improved temporal resolution with regards to image quality and signal homogeneity.