



Smart Cardiac Technologies Improve CT Image Quality and Radiology Workflow

One of the world's leading cardiac hospitals is also one of the early adopters worldwide to utilize Smart Cardiac, part of the Smart Technologies suite of intelligent CT tools designed to improve efficiency and expand applications. Beijing Anzhen Hospital, one of the largest cardiac centers in China, performed more than 45,000 cardiac CT studies in 2015—75% of these were coronary CT angiography (CCTA) exams.

In October, 2015, Anzhen Hospital installed its first of two Revolution™ CT systems. According to Lei Xu, MD, Deputy Director of the Radiology Department, Beijing Anzhen Hospital, Capital Medical University, they selected Revolution CT because of its 16 cm wide-area Gemstone™ detector enabling low-dose, whole-heart imaging in a single beat without moving the scanner table. “The scanner is very robust, especially with patients who have arrhythmias. The reduced scan time due to the system’s speed and the one-beat acquisition provides us with very good image quality.”

With the large patient volume at Anzhen Hospital, an efficient workflow is a critical component. So, when GE Healthcare asked the hospital to help evaluate a new automatic, coronary-specific cardiac phase selection reconstruction technique, Dr. Xu was very interested. Dr. Xu believed that this could enhance workflow by decreasing the time radiologists spend manually selecting the best phase.

The accuracy of diagnostic interpretation with CCTA highly depends on good reconstruction image quality since the cardiac motion artifact may compromise the diagnostic image quality. Choosing the wrong phase can lead to a failed or non-diagnostic scan. However, manually selecting the best phase with the least motion in the cardiac cycle for reconstruction is a time-consuming process for radiologists. Smart Cardiac aims to reduce the selection process by using a proprietary algorithm that automatically selects the optimal cardiac phase for CCTA reconstructions.

Dr. Xu led the effort at Anzhen to compare automated selection (AS) of Smart Cardiac technologies with expert manual selection (MS) of the best phase in high heart rate patients who underwent CCTA within single-beat cardiac CT. In the initial evaluation, 46 patients with high heart rates above 75 bpm were included. (Table 1 lists the acquisition parameters.)

Reconstruction intervals for MS were performed at 5%. The acquired AS range is automatically searched in 2% phase intervals during the reconstruction process to determine the optimal phase for coronary assessment based on coronary specific quantitative image quality (IQ) metrics. AS also evaluates all vessels according to the average image quality to get the best phase.

“ Smart Cardiac technology used significantly less time but reconstructed more phases with an average time savings of 60%. As reconstruction increased, review time was reduced. Even with the experienced user we can improve the workflow. ”

Dr. Lei Xu



In a blinded study, two radiologists evaluated the image quality of both reconstructed CCTAs without knowing whether the study utilized MS or AS. Discrepancies were resolved via consensus.

According to Dr. Xu, there was no discernable difference in image quality between AS and MS as subjectively rated by the radiologists/readers. However, there was an important difference in the review time for the automated phase selection.

“Smart Cardiac technology used significantly less time but reconstructed more phases with an average time savings

of 60%,” Dr. Xu explains. “As reconstruction increased, review time was reduced. Even with the experienced user we can improve the workflow.”

Adopting Smart Cardiac technology may also help reduce the frequency of non-diagnostic studies. Dr. Xu explains, “By using Smart Cardiac, we can get the best image quality in an automatic way. Institutions that use the manual selection can improve workflow with Smart Cardiac, while hospitals that have less experienced cardiac CT readers can also use Smart Cardiac to select the most suitable

Smart Cardiac: atrial fibrillation

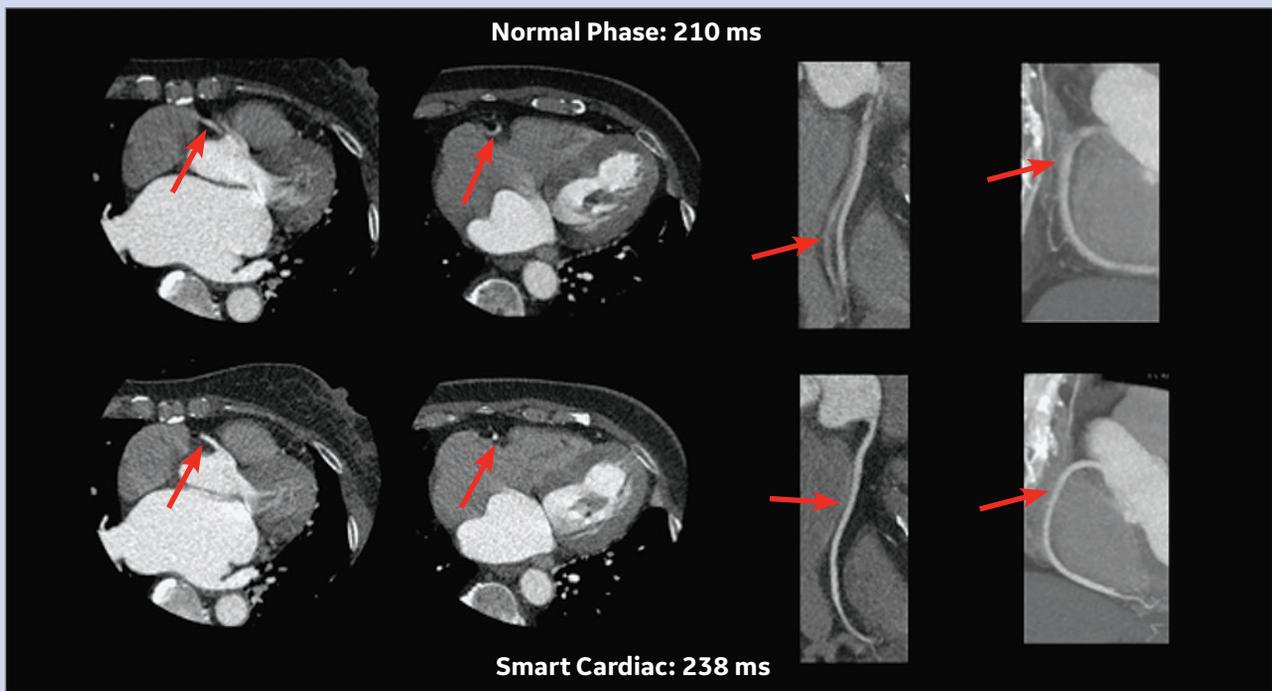


Figure 1. Right coronary artery motion observed at normal phase (top row). Smart Cardiac technology automatically selected the phase with no motion in the right coronary artery (lower row).

Parameters	
<i>1-beat axial</i>	
<i>0.28 sec/rot</i>	
<i>kV</i>	100 kV
<i>mA</i>	Smart mA
<i>CTDI_{vol}</i>	6.56 mGy
<i>DLP</i>	91.85 mGy-cm
<i>Eff. Dose</i>	1.29 mSv

reconstruction phase. This will improve the image quality, which can lead to a better diagnostic-quality exam. Either way, the technique benefits patient care.”

There is also the potential to utilize GE’s SnapShot™ Freeze with Smart Cardiac—Dr. Xu believes combining both techniques would continue to improve workflow and enhance image quality. “With one click, we could auto select the phase and apply motion correction, which could improve the image quality within the single-beat cardiac angiogram.” ■

Table 1

Parameters	
<i>Slice thickness and interval</i>	0.625 mm
<i>ASiR-V</i>	50%
<i>Recon matrix</i>	512 x 512
<i>Noise index</i>	25 HU
<i>Rotation speed</i>	0.28 sec
<i>RR interval</i>	30-80% for 75-85 bpm; 40-60 for >85 bpm

Smart Cardiac + SSF: high heart rate

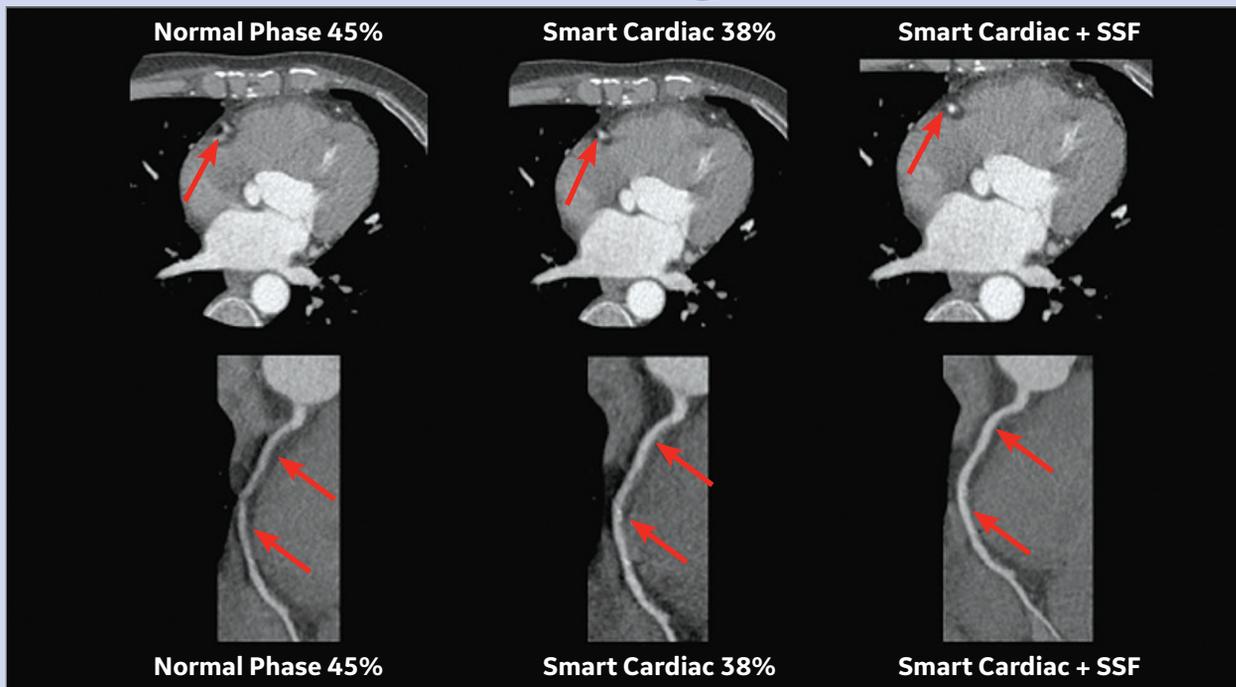


Figure 2. Right coronary artery motion observed at 45% phase (first column). Smart Cardiac technology automatically selected a better phase to reduce right coronary artery motion (second column). Smart Cardiac with SnapShot Freeze eliminates motion in the right coronary artery (third column).

Parameters	
<i>1-beat axial</i>	
<i>0.28 sec/rot</i>	
<i>kV</i>	100 kV
<i>mA</i>	Smart mA
<i>CTDI_{vol}</i>	6.56 mGy
<i>DLP</i>	91.81 mGy-cm
<i>Eff. Dose</i>	1.29 mSv