

QIBA CT Angiography Biomarker Committee (BC) Call

24 September 2018 at 11 AM CT

Call Summary

On Call

Andrew Buckler, MS (Co-Chair)

Philipp Hoelzer, PhD

Laura Jimenez-Juan, MD

Márton Kolossváry, PhD

Nancy Obuchowski, PhD

Eric Perlman, MD

Taylor Richards, MD

RSNA Staff

Julie Lisiecki

Update from Dr. Taylor Richards:

- Dr. Richards provided an overview of parameters that will be included in the Profile, including those for acquisition, examination, and patient preparation
- The goal is to identify the range of acquisition parameters that enables conformant image analysis tools to fulfill the Profile's precision and bias claims for a given measurand
- Five parameter axes were discussed:
 - Vessel radius {1-3 mm}
 - Vessel displacement {.375 – 4 mm}
 - Image noise (σ) {30 – 70 Hounsfield Units (HU)}
 - Pixel size {.4 – 1.2 mm}
 - Spatial resolution modulation transfer function (MTF_{f50}) {.3 - .6 mm⁻¹}
- Determining how to ascertain that a given combination of parameters would result in acceptable bias and precision measurements may be challenging
 - Net motion during any given acquisition can be as much as 1 mm in terms of displacement
 - Suggestions included the following:
 - Experimentally measure by creating ground-truth phantoms to image and analyze under every possible parameter combination
 - Theoretically predict outcomes as a function of dependent acquisition parameters
- Comments on the parameter values described above were as follows:
 - Values seem reasonable though a smaller value for the lower boundary may be better
 - The HU for the image noise seems too high
 - Voxel size and spatial resolution must also be taken into consideration
 - Determining how to interpret these values must also be discussed with the specifics pertaining to what is being measured
 - Reformatting must be taken into consideration
 - Different software packages approach this differently
 - In radiomic and other analyses, calculations are typically done on an original unreformatted image
 - The approach a software method takes will affect the accuracy
- The measurands for the Profile focus on cross-sectional measurements
 - Consensus on the measurands is important, as the Profile needs to be very specific regarding measurements and methodology
 - Approximation of volumes is also generally required, but validation strategies for volume are more difficult in determining truth so we focus on cross sectional areas for the profile
 - But we will want to address issues in best-practice methods for volume determination in the text since this is also important
- Precision must be grounded in validation and functionalized in terms of dependent parameters

- How the hardware performs will always be measured with a physical phantom; however, numbers have been incorporated into a model to estimate the performance of the parameters without actually having to do the imaging itself
 - Use of this model can determine how the hardware affects estimations
 - If vessel radius is increased or decreased in the model, numbers self-adjust accordingly
 - Mr. Buckler would like to have this model available for others to test either on the wiki or via e-distribution
 - Dr. Richards to consider setting up a standalone executable program for BC members to try
- The simulation framework includes a full description of the following:
 - Object classes (vessels and plaques of varying size, type, and velocities)
 - Deterministic imaging process (resolution {MTF} and noise magnitude)
 - Random imaging process (noise instance and motion direction)
 - Ideal estimator (matched template maximum-likelihood-estimator {MLE} with full knowledge of object and imaging process)
- Results from the model have not yet been validated with the physical phantom; however, they correlate well with existing literature
 - Scaling factors and margins are needed to validate the model results before incorporating them into the Profile, and some groundwork will be needed to validate the methodology
- Various software tools exist and testing them may help to determine what information may be missing as well as to determine how effective the methods are
- Technical specifications regarding image acquisition are needed to complete the Profile
 - Dr. Hoelzer volunteered to perform some testing on Siemens equipment; Mr. Buckler to follow up with him offline to discuss

Next steps:

- Dr. Taylor Richards to review which CT lung densitometry procedures may be applicable to the CT Angiography Profile on the October 8th BC call
- Mr. Buckler to follow up with Dr. Hoelzer offline regarding testing of parameters
- Dr. Richards to follow up on making a standalone executable program for the model or providing some content for the QIBA wiki
- Dr. Saba volunteered to update the Protocol Specifications Unique to Carotid Arteries table

QIBA wiki: Latest version of the Atherosclerosis Biomarkers Profile, as well as other useful documents can be found on the CT Angiography BC page at: http://qibawiki.rsna.org/index.php/CT_Angiography_Biomarker_Ctte

Next call: Monday, October 8th at 11 am CT

QIBA Working Meeting and Meet-the-Experts Sessions at RSNA 2018:

- All are encouraged to RSVP for the [QIBA Working Meeting](#) on Wednesday, November 28th.
- All are invited to volunteer for [Meet-the-Expert](#) session times