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

RSNA Staff
Nancy Obuchowski, PhD
Eric Perlman, MD
Taylor Richards, MD
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 (ơ) {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
  o Use of this model can determine how the hardware affects estimations
  o 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:
  o Object classes (vessels and plaques of varying size, type, and velocities)
  o Deterministic imaging process (resolution (MTF) and noise magnitude)
  o Random imaging process (noise instance and motion direction)
  o 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
  o 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
  o 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](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