

QIBA COPD/Asthma Committee

Tuesday, February 16, 2010

11 AM CST

Call Summary

In attendance

Philip Judy, PhD (co-chair)
David Lynch, MD (co-chair)
Andrew Buckler, MS
James Crapo, MD
David Gierada, MD
Zachary Levine, PhD
Michael McNitt-Gray, PhD

RSNA

Fiona Miller
Susan Anderson, MLS
Joe Koudelik

Status of COPDGene CT Number Accuracy Conference

- Dr Crapo has postponed planning for large mtg with vendors; instead will convene smaller group meeting of COPDGene investigators, ctte members and others to move towards consensus before involving vendors
- Concrete proposal for phantom design and request from vendors needed before bringing manufacturers together
- COPDGene phantom not stressing algorithms enough; may have difficulty identifying major issues
- Reproducible CT numbers for scanners and algorithms needed in the lung area of -950 to -1000 HU
- COPD/Asthma ancillary study document prepared by Mr Buckler and Dr Judy may have already defined the process
- Drs Judy and Hoffman to review Dr Crapo's proposal

Phantom Modification

- COPDGene, new phantom design, or a combination approach; set of phantoms may be needed
 - New phantom to calibrate algorithms and equipment
 - COPDGene phantom to calibrate scanner consistency over time
- Dr Judy examining COPDGene phantom modification (acrylic annulus), provided by Mr Levy of Phantom Laboratory
- Main focus is lung density across entire "lung density range"; airway wall thickness to be addressed later in development of profile
 - Cross-scanner variability of airway wall thickness exists due to reconstruction kernel issues associated with lung density measurements
 - Airway size measures to be included in proposal; pseudo-airways already exist in COPDGene and ECLIPSE phantoms

COPDGene Phantom Foam

- Medical CT of foam samples have been done by Drew Torigian at UPenn on a clinical scanner
 - The foam samples have now been scanned on micro, mini, and medical CT.
- CT numbers foams appear not to depend on slice thickness while the median CT number of lung does depend on slice thickness.
- Exploring possibility of recovering thicker sections by averaging thinner section

- Histogram of foam (Siemens) compared to recovered thick sections, i.e. a Siemens reconstruction of 5mm sections done; close comparison observed
- Histogram of COPDGene phantom foam does not mimic what happens with imaging of the lung; foam is not comparable to the lung parenchyma
- Slice thickness is an important issue
- Dr Ross work compared 0.75mm vs. 4.75mm lung medians in pilot study
- Adding -950 HU foam material suggested for the proposal
- Putting two foams in a phantom was proposed
 - For example -850 and -950 HU foams to determine homogeneity cross-scanners;
 - Dr Judy indicated that lung tissue is more complex, so two foams alone may not stress scanner performance far enough

Additions Metrics Proposed

- Median lung
- 15th percentile
- Trachea median
- Fraction below -950 HU (changes dramatically as function of slice thickness)
- Modification needed to test beam hardening with COPDGene phantom proposed
- COPDGene phantom may not scan properly with certain scanner, e.g. Siemens Sensation 64
- Beam hardening artifacts may be larger issue than foam; need to test algorithms on beam hardening correction
- New annulus to mimic air in trachea and help determine whether beam hardening effects lead to an increase in CT numbers
- Internal scanner calibration of air trachea to -1000 HU a possibility

(Beam Hardening: If I suggested that modification to the COPDGene phantom would demonstrate a beam hardening effect, my expectation was that any shift in air CT numbers inside annulus would NOT be explained by beam hardening. Phil Judy 2/26/2010)

Additional Issue to Address

- Effect of body mass index on CT numbers; patient size may modify noise and artifacts
- 0.625 – 0.900 mm slice thicknesses may show non-linear effects; correction issues possible with thin slices, but vendors caution using slices below 1mm; 1.0-1.5mm expect to be reproducible and quantifiable; need addition vendor reaction to perceived instability of thin (<1.0mm) sections
- Dr Judy currently planning to compare thin slice with thick slice data on BWH COPDGene cases.

Next Steps:

- Dr Judy to scan the COPDGene phantom with the new annulus
- RSNA staff to forward annulus diagram to group members for reference
- Drs Lynch, Crapo, Levine, Judy, Hoffman to work on proposal draft for meeting; Drs Judy and Hoffman to perform first critique of Dr Crapo's proposal
- Next call scheduled for March 2 at 11 AM CST