**Volumetry in Dynamic Contrast-Enhanced Liver CT**

Clinically accurate and precise liver lesion sizing depends on local anatomical complexity, underlying disease, patient physiology, contrast injection, and CT technical acquisition.

**Aims:**
- To create a phantom simulating clinical conditions for evaluating sizing of low contrast hepatocellular lesions and to use it to investigate hepatic lesion size error as a function of CTDIvol (mGy).
- To develop methods to improve the accuracy of lesion size measurement.

**Methods:**
- Phantom: Dynamic contrast-enhanced liver phantom with 100 liver lesion inserts.
- CT: GE Lightspeed 16 slice CT. 0.5 sec rotation, 16 sec per phase, 1 mm slice thickness, 30 cm FOV. 3.87 mGy for arterial, 3.90 mGy for portal, 4.05 mGy for venous.

**Results:**
- For lesions ≥10 mm, IR (ASiR) had lower variability but showed improvement in detection similarly for lesions ≥10 mm; IR (ASiR) behave statistically IR (ASiR) behave similarly for lesions ≥10 mm.

**Conclusion:**
- The Technically Complete version of the CTVAD Profile is expected to be published in the next few months.
- The following stage is Claim Confirmed, which involves field testing the profile again with a focus on confirming it is possible to achieve the performance stated in the Claim by conforming to the Profile requirements and procedures.

Please see below for opportunities to get involved in the effort.

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**Volumetry of Pulmonary Lesions in Thoracic CT**

**Aims:**
- To quantitatively benchmark volume estimation performance of image analysis tools.
- To provide a qualitative understanding of differences between approaches.

**Methods:**
- Image-based segmentation on datasets generated using
  - (1) an anthropomorphic phantom with synthetic and virtually inserted nodules
  - (2) clinical images containing real lung lesions and virtually inserted lesion models.

**Nodules virtually inserted using three methods:**
- Technique A is a projection-domain insertion method
- Techniques B and C are image-domain insertion methods.

**Results:**
- Data from 21 national and international participants were analyzed for bias and precision of estimated volumes. Aggregate data will be published and used as a gauge of quantitative variability across segmentation methods.

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**Defining Standard for CT Tumor Volume Change for Advanced Disease (CTVAD) Profile**

**Aims:**
- To define a robust and standardized approach to measure tumor volume change.

**Study 1: impact of acquisition and lesion characteristics**
- 53 lesions; 21 scanner/protocol combinations.
- Findings:
  - CT technology is a significant contributor to variability in tumor volume estimation.
  - Additional image acquisition improves variability in tumor volume estimation.

**Study 2: impact of recon algorithm**
- 51 lesions; 21 scanner/protocol combinations.
- Findings:
  - IR (ASiR) had lower variability but showed improvement in detection similarly for lesions ≥10 mm.

**Conclusion:**
- Creation of a set of blended CT scans that "look and feel" like actual clinical scans of patients with tumors. Will allow testing of algorithms for measurement of tumors in known volumes.

1. Use projection and image-domain lesion insertion tools to virtually insert lung and liver lesions of known shape, volume, and texture into clinical CT images.
2. Develop datasets of clinical CT scans with virtually inserted lesions and disseminate lesion insertion software.

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**Hybrid Data for CT Volumetry Testing**

**Aims:**
- To compare and evaluate the performance of different hybrid data sets for CT volumetry.

**Methods:**
- Nodules virtually inserted using three methods:
  - Technique A is a projection-domain insertion method
  - Techniques B and C are image-domain insertion methods.

**Results:**
- No statistical difference in bias of virtual insertion methods.

**Conclusion:**
- Hybrid data sets can be used to evaluate the performance of different hybrid data sets for CT volumetry.

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**CT Quantification Beyond Volume: Texture, Morphology**

**Aims:**
- To develop a framework to analyze scanner-specific shape deformation.

**Methods:**
- Create a dynamic hybrid dataset.
- Use projection and image-domain lesion insertion tools to virtually insert lung and liver lesions of known shape, volume, and texture into clinical CT images.

**Results:**
- 4. Assessing variation across imaging system & morphology.

**Conclusion:**
- Hybrid data sets can be used to evaluate the performance of different hybrid data sets for CT volumetry.

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**QIBA 2017 CT Volumetry Biomarker Committee: Overview and Status Update**

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