AbstractID: 9570 Title: Potential Sources of Variation in Quantitative Ultrasound Quality Control Measurements

Purpose:

The AAPM Ultrasound Task Group No. 1 has recommended various quality control (QC) tests for ultrasound systems, including quantitative measures of spatial resolution (via full width half maximum, or FWHM) and depth of penetration (DOP) of the ultrasound beam. In our department, FWHM and DOP are measured using spatial measurement tools built into the ultrasound system software. However, the measurements are subjective, compounding variations in how each physicist makes the measurements with variations in the performance of the ultrasound system. Here, we seek to determine the role of these user-based measurement variations.

Method and Materials:

To remove user subjectivity, a Matlab program was written to automate the measurement of FWHM and DOP, requiring the user only to draw a cross-section through the filament target in the phantom (for FWHM) and define the edges of the images (for DOP).

The automated software was used to analyze QC images for L12-5 ultrasound transducers (n=11) used with Philips iU22 scanners; analysis was performed by three physics technologists, all of whom have been trained to routinely perform ultrasound QC. Results were compared with historical measurements made by visual inspection.

Results:

The two measurement techniques yielded axial and lateral FWHM values that differed by an average of 18% and 15%, respectively. The manual measurements had a range of 0.56mm and 0.47mm, respectively, while the automated measurements had an average range of 0.28mm and 0.13mm. The automated DOP measurements differed from the manual measurements by an average of 3.9mm±5.9mm; there was little difference in the range of DOP values.

Conclusion:

While little improvement was seen in the measurement of DOP, images that did not meet the criteria set forth by TG1 for FWHM when measured manually passed using the automated technique. This highlights the importance of distinguishing between user- and equipment-dependent variations in QC measurements.