

AbstractID: 10435 Title: Sequential volume change estimation of breast tumor from whole breast automated ultrasound by reader study

Purpose: To evaluate use of image based registration in volume change estimation of breast tumor by expert reader study of three-dimensional (3D) ultrasound (US) whole breast image volumes.

Methods: 3D US volumes of tumors in nearly whole breast sweeps using mammography-style compression were acquired using the Logiq-9 10L transducer (GE Healthcare, Waukesha, WI). Nearly whole breast scanning was performed before, during and after 115 ± 14 days of chemotherapy on 7 patients. Three breast radiologists marked a 3D ellipsoid around the tumor on pairs of pre-chemotherapy with mid- or post-chemotherapy US image volumes, spatially unregistered or registered in a pseudo-random order. Additional information including pre-chemotherapy US hand scan(s), mammograms and a clinical findings report without tumor dimensions was provided.

Results: Preliminary results on the first 3 of 7 cases showed that registration provided a nearly significant reduction in the statistical uncertainty in reader estimates of normalized fractional tumor volume change due to chemotherapy (p-value<0.08). The time taken to mark the tumor boundary decreased significantly from 10 min (9.8-10.3) without registration to 5.5 min (3.6-6.6) with registration (p-value<0.02). Mean intersection-to-union volume ratio also improved with registration, by 33% from 0.15 ± 0.1 (p-value<0.05). A negligible improvement in confidence in identifying tumor margin in the automated US image volumes was seen with registration. The normalized, between-reader, mean separation of the centers of identified tumors decreased insignificantly with registration by 47% (p-value<0.3).

Conclusion: Successful spatial registration appears to aid ultrasound measurement of tumor changes in response to neoadjuvant chemotherapy. Visual segmentation speed and volume overlap between readers were increased with the help of registration. Larger studies would be appropriate with focus on treatment response, breast cancer screening and diagnostic applications.