Tissue dielectric constant (TDC) measurements at 300 MHz as a method to characterize localized tissue water in arms of women with and without breast cancer related lymphedema

Harvey N Mayrovitz, PhD, 
Professor of Physiology, College of Medical Sciences

Objective: To compare tissue dielectric constant (TDC) values between lymphedematous and non-lymphedematous tissue.

Background: Quantitative measurements to early detect breast cancer (BC) treatment-related lymphedema (BCRL) can aid clinical evaluations. Earliest BCRL changes likely occur in skin and subcutis and might be detected via local skin-tissue water (LTW) changes assessed by TDC measurements at 300 MHz.

Methods: TDC measurements were made in both forearms (2.5 mm depth) of three groups of women (80 subjects per group); 1) healthy women with no BC (NOBC), 2) women with BC but with TDC measurements made prior to their surgery and 3) women with unilateral lymphedema (LE).

Results: Except for affected arms of the LE group, measured TDC values for all other arms were on average close to each other, ranging (mean±SD) between 24.8±3.3 to 26.8±4.9. Contrastingly, TDC values for the LE affected arms were 42.9±8.2 which was significantly greater than all other arm TDC values (p<0.001). Arm TDC ratios, dominant/non-dominant for NOBC, were 1.001±0.050 and at-risk/contralateral for BC were 0.998±0.082 with both significantly less (p<0.001) than LE group affected/control arm ratios (1.663±0.321).

Conclusions: TDC values, used as an index of local tissue water, show that breast cancer per se does not significantly change arm tissue water and also shows that the presence of BCRL does not significantly change local tissue water of non-affected arms. Further, based on the standard deviation of measured arm TDC ratios, an at-risk arm/contralateral arm TDC ratio between 1.165 and 1.200 is suggested as a possible threshold to detect pre-clinical lymphedema.

Research Day ... February 14, 2014