Photoacoustic Spectroscopy Based Discrimination of Breast Tumor Development in a Xenograft Model

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Breast cancer is a predominant cancer worldwide among women. To address this problem, a considerable scientific effort has already been going on round the globe seeking early detection of the disease. Many optical spectroscopy techniques have also been experimented to detect breast cancer early and with reduced costs. Studies based on photoacoustic spectroscopy have shown steady growth and demonstrated enough capabilities to detect the disease early. With the aim to detect breast cancer early, tumor progression in nude mice as xenograft model was studied using a pulsed laser induced photoacoustic spectroscopy. Tumor tissues were extracted from the nude mice xenografts at different time points (10th, 15th & 20th day) post MCF-7 cells injection and the corresponding photoacoustic spectra were recorded at 281nm pulsed laser excitations. There were 144 time domain photoacoustic spectra recorded from 36 tumor tissues belonging to 36 animals, 12 each to the three time point groups (10th, 15th and 20th day post injection). The spectra were then Fast Fourier transformed using MATLAB algorithms for further analysis. The spectral comparison of the inter-day group of animals have shown a distinct pattern in the intensity of peaks at 5.93 $x10^3$Hz, 15.9 $x10^3$ Hz, 29.69 $x10^3$ Hz and 32.5 $x10^3$ Hz respectively indicating that these frequencies are more sensitive towards tumor development. Further discrimination analysis of the data also indicated a clear variation in the spectral patterns of the samples belonging to different time point groups under study highlighting the sensitivity of the technique in identifying tumor development and growth. The outcomes of the study clearly demonstrated the usefulness of the technique in assessing tumor development and growth which may have clinical implications.