Evaluation of Time Delay Estimation in the Detection of Pleural Effusion in a Phantom Model of the Lungs

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Sound transmission into the respiratory system is one the techniques used to determine the physical properties of the respiratory system. Transmission of sound through a phantom model of the lung was evaluated as a technique for detecting pleural effusion in this study. A phantom model of the lung with acoustical properties similar to the lung parenchyma was developed. Pleural effusion was modeled using two plastic bags filled with 600 ml and 250ml water. A chirp signal with a frequency range of 100 to 250 Hz was transmitted into the model of the lung. The time delay between transmitted sound and received sound from the chest of the model was calculated using cross correlation. The results show that the calculated time delays at points on the model corresponding to the locations where two plastic bags are located (pleural effusion) are significantly less than at other points. This technique may lead to the developmental of an inexpensive, non-invasive and accurate diagnostic tool which can be used in low resource (rural) settings. The next stage of this research is to evaluate this technique in human subjects.