**Patient Dose Optimization for Critical Organs**

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Interventional Radiology (IR) is an invasive diagnostic subspecialty which comprises a wide range of image guided therapeutic procedures. X-ray exposures resulted from radiology procedures are usually higher than other type of radiations and the rate of patients exposed in these procedures is increasing over the years due to less cost in compare with surgeries. IR may lead to two major type of negative effects: deterministic effect (skin injuries) and stochastic effect (cancer induction). Patients are not aware of the extend of the radiation risks nor are followed up when radiation doses from sophisticated procedures may lead to injury. According to American Cancer Society, breast cancer in the United States is the second most common cancer among women. Radiation for teenager female patients has a higher risk leading to breast cancer. Thus, it is important to compute dose for critical tissues, but more important is to avoid high exposure to the patient. A few studies use Monte Carlo simulation to calculate organ dose for each organ after each exam is completed. On the other hand, there is no methodology to specify how the c-arm angulations, table and patient position matters in calculation of tissue dose. After an injury occurs, the recovery procedure is costly and may not be successful. Therefore, it is useful to estimate dose for breast tissue and compute geometry and physics setup with image requirement.

In this study, we construct an optimization model which minimizes the absorbed dose in critical organs (e.g. patient breasts) while providing an acceptable level of the image quality for diagnosis. In this model, we will determine the angulations of the c-arm and table positions. We divide patient body into small voxels and calculate dose for each voxel. Coordinates of each voxel, corresponding organ and attenuation coefficients are known, which are available from CT data of the patient prior to the IR procedure. The image quality is described by signal-to-noise ratio and considered as a constraint. A lower bound for the required energy at the detector is set. Physics of the procedure is corresponding to number of the photons and energy of each photon absorbed at the detector. We calculate dose for each voxel of the body based on the absorbed energy required at the detector for an acceptable image quality.

The major contribution of this study is to have a tool for the physicians which will suggest them a setup for the geometry and energy in order to expose less amount of dose to the patient breast tissue while keeping image in a reasonable level of the quality for the diagnosis.

Keywords: Optimization Model, Image Quality, Interventional Radiology Procedure, Absorbed Dose, Voxel, Breast Tissue