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Simulation of X-Ray Tissue Contrast and Dose Optimisation in Radiological Physics to Improve Medical Imaging Students' Skills

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Abstract : Medical Imaging students must understand the roles of Photo-electric Absorption (PE) and Compton Scatter (CS) interactions in patients to enable optimal X-ray imaging in clinical practice. A simulator has been developed that shows relative interaction probabilities, color bars for patient dose from PE, % penetration to the detector, and obscuring CS as Peak Kilovoltage (kVp) changes. Additionally, an anthropomorphic chest X-ray image shows the relative tissue contrasts and overlying CS-fog at that kVp, which determine the detectability of a lesion in the image. A series of interactive exercises with MCQs evaluate the student's understanding; the simulation has improved student perception of the need to acquire "sufficient" rather than maximal contrast to enable patient dose reduction at higher kVp.

Keywords : patient dose optimization, radiological physics, simulation, tissue contrast
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