



ISSN 2815-0481

ANNUAL RESEARCH SYMPOSIUM 2022

**Digital Transformation and Innovative Approaches
to Mitigate Challenges in the Higher Education Sector**

16th November 2022



University of Colombo

<https://cmb.ac.lk/ars>

Noise, Dose and Pitch Relationship in Non-Cardiac Multi-Detector Row Computed Tomography (MDCT) Scanner

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Among diagnostic radiological procedures, a CT study should use relatively higher exposure while still meeting the image quality needs of the exam. Radiation professionals can adjust the patient's dose by manipulating the exposure factors such as kVp, mAs and Pitch. However, the gap in knowledge about dose parameters and equipment's internal software adjustments would not produce the results expected. This study aims to identify the noise, dose, and pitch relationship of multi-detector row CT scanners in both manual and auto mode dose selection criteria. The dependency of noise and dose on tube mAs was investigated by performing the measurements on Polymethyl methacrylate (PMMA) body phantom with tube currents from 10 mA to 260 mA at 25mA intervals. The dependence on the Pitch was investigated by running the same scan with different pitch values of 0.984, 1.375, and 1.531. All above-selected parameters were set manually, and scanned was performed in manual mode. The results prove that the tube mAs should be increased by four times for a particular pitch value to reduce the image noise by half. Also, the absorbed dose increases linearly with mAs. With increasing Pitch, the noise tends to increase, and the dose tends to decrease. However, with an auto preset mode, increasing the Pitch will not reduce the dose as expected, as the equipment automatically increases the tube current proportionately to the Pitch, as modern multi-detector row CT scanners are accompanied by noise and dose optimization algorithms in their software resulting in the pitch variation not affecting image noise and dose. Still, the operators can take control by utilizing the manual tube parameters adjustments, resulting in the desired outcome as in the literature. However, the operator should know the noise and dose behavior of the particular scanner.

Keywords: CT Dose, CT Noise, Pitch relationship, MDCT Scanner, noise index