ABSTRACT

This study aims to assess low-contrast detectability (LCD) in the American College of Radiology (ACR) performance phantom at various tube voltages and object sizes using the two-alternative forced choice (2-AFC) method. The experiment was conducted using the low-contrast module, which contains objects with diameters of 2 mm, 3 mm, 4 mm, 5 mm, and 6 mm. The phantom was scanned using a Philips CT scanner at three tube voltage settings: 90 kV, 120 kV, and 140 kV. Two-dimensional Regions of Interest (ROIs) were created for both the object and background and displayed through the IndoQCT graphical user interface (GUI), resulting in 300 randomly paired images. These images were independently assessed by seven medical physicists with over two years of clinical experience to identify the presence of low-contrast objects. The IndoQCT application automatically calculated the Percent Correct (PC) for each respondent, and the LCD performance was analyzed based on these PC values. The results showed that larger object sizes corresponded with improved detection performance. The 90 kV setting yielded optimal detection for larger objects (5 mm and 6 mm), while 120 kV was more effective for smaller objects (2–4 mm). Conversely, 140 kV resulted in the lowest detection performance across all object sizes. These findings suggest that lower tube voltages can enhance LCD despite increased image noise. Additionally, the variability among observers was minimal, with a p-value >0,5 indicating no significant differences in their ability to assess LCD.

Keywords: Computed Tomography (CT); Low Contrast Detectability; ACR Phantom; Tube Voltage; 2-AFC; Medical Physicists.