

Diagnostic Reference Range (DRR) in Computed Tomography (CT) Imaging Based on Clinical Indications Related to Thorax, Abdomen and Pelvic Regions

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Abstract

The concept of diagnostic reference range (DRR) is introduced to address the balance between a patient's risk (radiation dose) and benefit (image quality necessary for an accurate diagnosis). R provides a minimum estimated dose that covers 25–75% range of dose distribution. The International Commission on Radiological Protection, ICRP (2017) recommended the 75th percentile as the upper and 25th percentile as the lower limit of DRR ^[1]. Dose below the lower range should compromise accurate interpretation of the image and dose above the upper range may be in excess and need to be reviewed. Meanwhile, Diagnostic Reference Levels (DRLs) are set at the 75th percentile of dose distribution and recommended by ICRP as a guidance to identify any unusual computed tomography (CT) procedures that consistently exceed the established DRLs.

The aim of this study was to establish the local DRR for CT scanning based on clinical indications associated to thorax, abdomen, and pelvic regions in adult patients at Department of Radiology, Hospital Universiti Sains Malaysia (HUSM), Kelantan. This study involved a retrospective survey on data of adult patients underwent CT scanning based on 5 most common clinical indications related to thorax, abdomen, and pelvic regions at two departments, Radiology and Trauma Department, HUSM. This study obtained human ethical approval from the university ethical committee (Protocol code: USM/JEPeM/22010025). The CT dose metrics (dose length product, DLP and total DLP) and associated technical factors were collected.

Results showed that the five most common clinical indications were cancer staging, coronary artery disease, pulmonary embolism, stones (CTU protocol) and stones (KUB protocol). The DLP values were varied based on their clinical indications and CT scanner types. Figure 1 shows boxplots representing the DRRs of DLP based on five most common clinical indications associated to CT scans of thorax, abdomen, and pelvic regions for Toshiba and Siemens CT scanners. The highest total DLP values was 4722 mGy.cm observed from CT scanning of cancer staging using Siemens scanner. While the lowest DLP value is 40 mGy.cm for stones scanning using the KUB protocol also using Siemens scanner. The main factor that contributes to higher DLP is the longer scanning length.

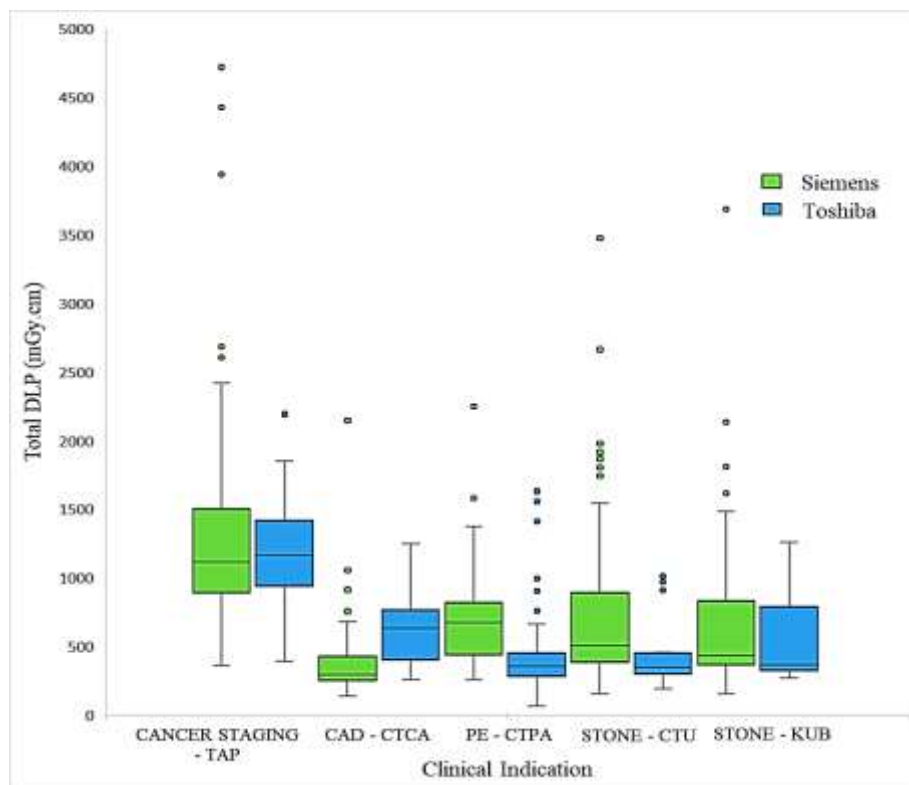


Figure 1: The boxplot of DRRs for total DLP based on five most common clinical indications associated to CT scans of thorax, abdomen, and pelvic regions for Toshiba and Siemens CT scanners.

This study demonstrates that the dose descriptor values, DLP and total DLP were varied for similar anatomical region based on different image quality requirement for each clinical indication. Thus, utilisation of both DRR and DRL are crucial to minimise the unnecessary dose to patient and ensure the optimum image quality is produced by each CT scanning.

Keywords

Clinical indications, Computed tomography, Diagnostic reference range

Reference

1. ICRP, 2017. Diagnostic reference levels in medical imaging. ICRP Publication 135. *Ann. ICRP* 46(1).