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Evaluation of Radiation Dose for Computed Tomography of Kidney Ureter and Bladder Protocol

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Abstract: ***Computed Tomography (CT) is a valuable medical imaging technique for the diagnosis of wide range of diseases. Due to development of powerful CT machines, new clinical applications are continue to emerge in medical fields. Study was performed to evaluate dose for patient undergoing Computed Tomography for kidney, ureter and bladder examination. A total of 65 patients were examined in this study. The data collected from three radiology department in Khartoum state from June 2015 to September 2015. The patients were examined with the own department protocol using multislice Computed Tomography four slice, 16 and 64 CT slice Toshiba . The range of patient dose per Computed Tomography procedure was 401.96 mGy.cm to 924.5 mGy.cm. Patient doses showed wide variation due to patient clinical indication, CT system modality and image acquisition parameters. Also there was direct proportionality between the DLP and the mAs. The findings of this study agreed with the results found in the literature. Conclusion: The study concluded that DLP & mAs in CT kidney, ureter and bladder procedure are directly proportional to each other.***

Keywords: Dose length product, patient dose, CT examination, kidney ureter bladder (KUB)

1. Introduction

The increased use of diagnostic imaging requiring the use of "ionizing radiation" the rapidly expanding use of computed tomography in the emergency setting, the introduction of multi-detector computed tomography (CT) units and newly reported concerns related to the human consequences of low-level radiation exposure have revitalized a long-standing concern over the quantification and management of an individual's cumulative "medical" radiation exposure [1,2,3,4]. Studies have shown that many physicians, including radiologists, have developed a misconception that the shorter imaging acquisition times have resulted in lower doses of radiation, when in fact many times the opposite is true. The multidetector computed tomography units today, even with shorter scan times, expose patients to higher doses of radiation per scan than earlier units. Body parts located in the central part of the body (chest/abdomen and pelvis) generally require higher levels of radiation exposure in order to obtain adequate imaging[4]. While it is possible that with a spiral computed tomography patients can receive a lower dose of ionized radiation compared to a "slice-by-slice" computed tomography, often this is not the case. The technique of the spiral image often exposes the patient to higher doses due to scan volume, milliampere-second (mAs), pitch and slice width [4, 5].Although some estimates have been made of cancer risks to adults attributable to the radiation from Computed Tomography examinations [6, 7, 8], no such estimates have been made for children. This study was intended to evaluate patient dose length product (DLP) during Computed Tomography examination for, kidney, ureter and bladder procedure by using four, sixteen and sixty four slice Computed Tomography machines. The entire hospitals passed successfully the extensive quality control tests performed by Sudan atomic energy commission and met the criteria of this study.

2. Material and Method

The data used in this study were collected from three radiology departments at Khartoum state during four month. Technical specifications of Computed Tomography machines are presented in Table 1. Data of the technical parameters used in computed tomography procedures was collected after informed consents were obtained from all patients prior to the procedure. Ethics and research committee was approved this study according to the Declaration of Helsinki on medical protocol. All computed tomography (CT) machines are regularly inspected by quality control experts from Sudan Atomic Energy Commission (SAEC) and all the measure parameters were within acceptable range.

Patient Data

A total of 65 patients referred for kidney ureter bladder CT imaging procedure were performed during four consecutive months. Patient demographic data (e.g., age, gender, diagnostic purpose of examination, body region, and use of contrast media) and patient dose were collected in terms of dose length product DLP (mGy.cm) and computed tomography Dose Index volume (CTDIvol) mGy. All equipments were subjected to quality control test by experts from Sudan Atomic Energy Commission (SAEC). In addition to that, radiation dose-related factors (exposure factors (Kilovoltage (kVp), tube current milliampere (mA), exposure time (s), slice thickness (mm), table increment (mm/s), number of slices, and start and end positions of scans) were registered for all patients using standard data collection sheet.

Statistical analysis
The data was analyzed using Microsoft office excel 2013.

3. Result Presentation

Table 1: CT systems

No	*Hospital*	*No of patients*	*Manufacture*	*No of detectors*
1	ALZ	21	Toshiba	64
2	YAS	24	Toshiba	16
3	KHA	20	Toshiba	4

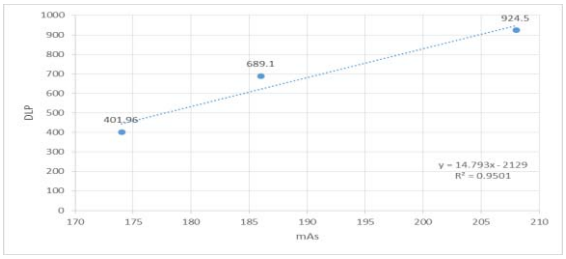

Figure 1: The relation between the DLP for CT KUB procedure in the three hospitals by three machines with the mAs

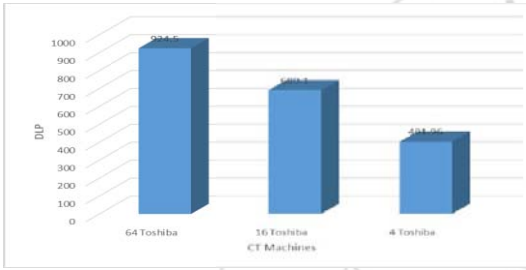

Figure 2: Showed the compression between the DLP for the CT KUB procedure in the three hospitals by three Machines

Discussion

CT scanning has been recognized as a high radiation dose modality, when compared to other diagnostic x-ray techniques. Since launched into clinical practice more than 30 years ago, as scanner technology, it has been developed and advanced largely and its use has become more wide spread. However, concerns over patient radiation dose risk from CT have grown. And the introduction of multi-slice scanners has focused further attention on this issue.

The study showed that there is a direct linear relationship between DLP and mAs as showing in figure (1) where ***y= 4.793x-2129, R^2=0.95*** for mAs.

These results establish that there is a firmly fixed increase in dose length product (DLP) with increase of milliampere-second (mAs) , which typically go with those study done by Islam et al 2015, the study concerned in that the dose length product (DLP) increase with increase of mAs.

The DLP for the CT-KUB procedure were high when 64 Toshiba Aquilion, 16 Toshiba Alexion, 4 Toshiba Asteion are used respectively in the three hospitals by three machines as showing in figure (2).

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