

# Dedication

To my family

# Acknowledgements

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## Abstract

Abdominal CT scan have contributed greatly to diagnose abdomen diseases. However the radiation exposure to the patient is significantly higher compared with other radiological examinations. While the benefits of CT exceed the harmful effects of radiation exposure in patients, increasing radiation doses to the population have raised a compelling case for reduction of radiation exposure from CT. In Sudan, there has been a remarkable increase in the number of CT examinations being performed. Therefore, radiation dose optimization is mandatory because of the risks associated with exposure to radiation

The purpose of this study is to optimize the radiation dose, estimate the effective dose and radiation risk during adult computed tomographic CT abdomen.

A total of 83 patients referred to Al-Ribat University Hospital (RUH) in the period of study with abdominal disturbances. Data of the technical parameters used in CT procedures was taken during (May - October, 2009).

The patients were divided in two groups: control group (53patients) were performed with the own department protocol using multislice CT (MSCT) 16 slice (Siemens Sensation); and dosimetry group (30 patients). Optimization was achieved through; the design of dose efficient equipment, the optimization of scan protocol and improvement of referring criteria. Organ and surface dose to

specific radiosensitive organs was carried out using software from National Radiological Protection Board (NRPB).

The mean age was  $45.4 \pm 18.1$  years while the mean weight was  $67 \pm \text{Kg}$ . The DLP was 288.25 mGy.cm and  $\text{CTDI}_{\text{vol}}$  was 9.7 mGy. Patient effective doses were 13.5 mSv before the optimization. Conversely, this was reduced to 4.3 after dose optimization. Estimated radiation risk is 742 per million conversely the risk was reduced to 237 per million. Dose optimized protocol lowered the effective doses to 31.9%. The study has shown a great need referring criteria, continuous training of staff in radiation doses optimization concepts. Further studies are required in order to establish a reference level in Sudan.

## ملخص الأطروحة

تستخدم الأشعة المقطعية بصورة كبيرة في تشخيص أمراض البطن على الرغم من الإزداد الواضح في الجرعة التي يتعرض لها المريض مقارنة بفحوصات الأشعة الأخرى.

ومع زيادة نسبة الفائدة المرجوة من التصوير للبطن تزداد أيضاً نسبة المخاطر مما زاد الحاجة لخفض الجرعة.

هدفت هذه الدراسة لأمثلة الجرعة الأشعة ورصد المخاطر الناتجة في التعرض للأشعة أثناء تصوير البطن بواسطة الأشعة المقطعية.

شملت هذه الدراسة (83) مريض محول لإجراء فحص أشعة مقطعية للبطن في قسم الأشعة المقطعية بجامعة الرباط الوطني في الفترة (مايو 2009م - أكتوبر 2009م).

تم تقسيم المرضى إلى مجموعتين الأولى: مجموعة مقاسات الجرعة دون تدخل أي بواسطة البروتوكول المعمول به في القسم وتشمل (53) مريض. وذلك باستخدام جهاز الأشعة المقطعية الحلزونية (Slices 16).

المجموعة الثانية (30) مريض وهي التي تم تغيير بروتوكول القسم المعمول به ودراسة التغييرات التي تتم عند انخفاض الجرعة للأعضاء وذلك باستخدام الحاسب الآلي المستخدم لدى (البورد العالمي للحماية من الإشعاع). متوسط عمر العينة (45) سنة الإنحراف المعياري + 18 ومتوسط الوزن للعينة 67 كجم DLP من (288.2-826.2) و CTDIvol من (9.7-18.9) والجرعة المؤثرة من (13.5 ملي سيفرت إلى 4.3 ملي سيفرت) وقد قدرت منه الأثر الناتج من التعرض للمجموعة الأولى 742 مريض من كل مليون أي (مريض لكل 1000) وبعد الأمثلة للجرعة إنخفض المعدل إلى 237 مريض من كل مليون أي (مريض لكل 5000).

هذا البرنامج والمعايير التي أتخذت في المجموعة الثانية أحدثت خفض في الجرعة المؤثرة إلى 31.9%.

وقد أظهرت الدراسة الحاجة الماسة إلى المراجعة والتقييم للجرعة وأيضاً الحاجة إلى التدريب المستمر إلى العاملين في هذا الحقل والحاجة إلى دراسة مستقبلية لتحديد المستوى المرجعي للتعرض للأشعة في السودان.

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