ORIGINAL RESEARCH PAPER

Radiology

Volume - 7 | Issue - 2 | February - 2017 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

Radiation Doses for Some Routine X-ray Examinations

KEYWORDS

Nadia Alatta
Ribat National University, Faculty of Radiologic Sciences and Nuclear Medicine Khartoum. Sudan.

Omaima Alraiah
Ribat National University, Faculty of Radiologic Sciences and Nuclear Medicine Khartoum. Sudan

Ikhlas Abdelaziz
Ribat National University, Faculty of Radiologic Sciences and Nuclear Medicine Khartoum. Sudan.

Duha Abdu
College of Medical Radiologic Science, Sudan University of Science and Technology P. O. Box 1908, Khartoum, Sudan

Asma Elamin
College of Medical Radiologic Science, Sudan University of Science and Technology P. O. Box 1908, Khartoum, Sudan

Islam Elsanousi
College of Medical Radiologic Science, Sudan University of Science and Technology P. O. Box 1908, Khartoum, Sudan

ABSTRACT *This study was conducted in 3 hospitals in Khartoum state to estimate values of entrance surface dose (ESD) and effective dose (ED) to sample of 140 adults' patients whose ages ranged between 23 and 60 years underwent routine x-ray examinations.*

The aim of this study was to find the values of ESD and ED and to compare these values with for diagnostic reference level.

Dosecal software was used to calculate these values by entering the exposure factors KV and mAs and the output of the machine and information about the patient like age and weight.

Variation was found in values of ESD and ED from hospital to another, these variations were due to difference in settings of the exposure factors to each patient, also to the differences in machine outputs.

By comparing these values with reference level for diagnostic, it was found that the values of ESD in all hospitals were lower than international reference levels.

1. Introduction: Radiation dose to patients from diagnostic imaging procedures is an important issue. Of the medical uses of radiation, the examination of patients with x-rays for diagnostic purposes is by far the most frequent practice. Doses from diagnostic x-ray examination in general are relatively low. [1] All medical imaging methods deposit some form of energy in the patient's body. Although the quantity of energy is relatively low, it is a factor that should be given attention when conducting diagnostic examination [2]. Patients undergoing x-ray examination are subjected to a wide range of exposure levels. Sources of exposure that must be shielded in diagnostic x-ray room are primary radiation, scattered radiation, and leakage radiation. Scattered and leakage radiations together are called secondary or stray radiation. Primary radiation, also called the useful beam, is the radiation passing through the open area defined by the collimator of the x-ray tube [3], [4]. The amount of primary radiation depends on the output of the x-ray tube per examination; scattered radiation arises from the interaction of the useful beam with the patient, causing a portion of the primary x-ray to be redirected. [5] Dose to tissues and organs from medical radiation exposures are evaluated in terms of absorbed dose, which is defined as the mean energy transferred by radiation to for x-ray examination, the dose without backscattered at the entrance side of the patient is specified by the air kerma. The effect of backscatter is included in specification of entrance surface dose, which is defined as the dose to the first 1 cm of tissue[6] .Doses received by a patient in x-ray examination are function of imaging modality and technique. Measurement of entrance skin dose (ESD) which is defined as the dose to the first 1 cm of tissue is important to assess the effective dose (ED).[7].

2. Materials and methods:
Measurements had been taken in a period of 2 months for about 140 patients, in 3 hospitals in Khartoum state

The dose values were obtained using computer software called DoseCal which is designed for both adults and children data. This software was developed by radiological protection center of Saint Gorge's hospital, London. ESDs were determined from exposure factors recorded at the time of examination. Tube output of all x-ray machines used in this study was measured using calibrated ionization chamber (RAD – Check Plus model 06-526).

3. Results:
Table (1) shows distribution of studied group according to gender and examination

Examination	Female	Male	Total
Chest	20	22	42
Skull	6	10	16
Pelvis	12	10	22
Abdomen	12	10	22
Lumber spine	5	6	11
Cervical spine	3	5	8
Hip joint	6	4	10
Shoulder	4	5	9
Total	68	72	140

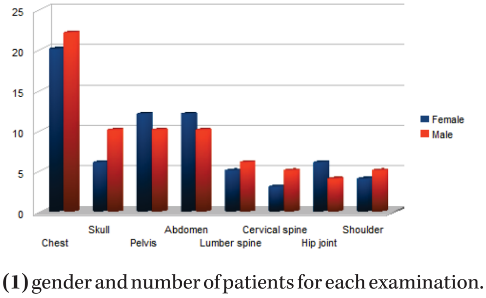

Fig (1) gender and number of patients for each examination.

Volume - 7 | Issue - 2 | February - 2017 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

Table (2): The most common exposure factors used for each examination

Examination	position	Distance in cm	Field size	Kv	mAs
Chest	PA	180	50*50	70	14
Skull	AP	100	50*50	75	18
Pelvis	AP	100	50*50	70	16
Abdomen	AP	100	50*50	70	20
Lumber spine	AP	100	50*50	75	22
Cervical spine	AP	100	50*50	65	20
Hip joint	AP	100	50*50	72	22
Shoulder	AP	100	50*50	66	14

Table (3) gives a summary of minimum, maximum and average dose in (mGy) for each examination comparing with world reference levels for diagnostic.

Examination	maximum	minimum	average	reference
Chest	0.155	0.063	0.110	0.200
Skull	0.740	0.064	0.450	0..500
Pelvis	0.988	0.347	0.740	0.400
Abdomen	1.288	0.326	0.810	0.500
Lumber spine	1.962	0.429	0.960	0.600
Cervical spine	0.706	0.024	0.420	0.400
Hip joint	0.905	0.086	0.540	0.500
Shoulder	0.662	0.084	0.300	0.300

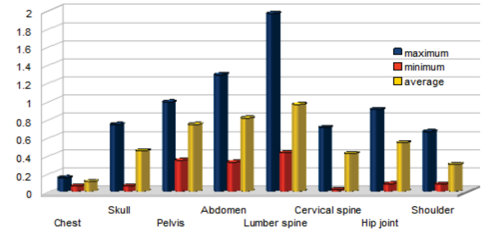

Fig. (2):-minimum, maximum and average dose in (mGy) for each examination

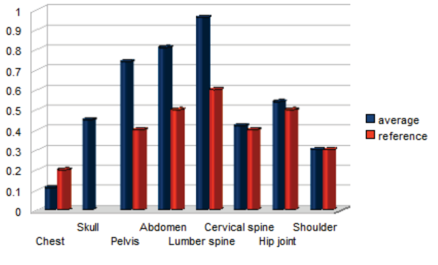

Fig. (3): average dose in (mGy) for each examination comparing with world diagnostic reference levels

Table (4): effective dose in (mSv)

Examination	ED (mSv)
Chest	0.009
Skull	0.003
Pelvis	0.103
Abdomen	0.090
Lumbar spine	0.089
Cervical spine	0.018
Hip joint	0.026
Shoulder	0.002

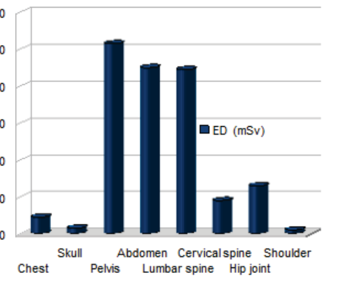

Fig.:- (4) effective dose in (mSv)

Discussion: From the above results variations in values of entrance surface dose (ESD) and effective dose (ED) from one hospital to another were observed. To justify these variations, in different setting and exposure factors were used from one hospital to another for the same examination and also patient size was be considered. Also it was found that values of entrance surface dose (ESD) were less than world diagnostic reference levels.

Conclusions:

The study concluded that:

1. Observed variations in values of entrance surface dose (ESD) and effective dose (ED) from one hospital to another should be analyzed and discussed.
2. Reasons of variations could be: - performance of equipments and processors, radiographic techniques used in each hospital, film-screen combination, use of grids and or training and skills of the staff.
3. A lot of work should be done to narrow the gap between values of ESD and ED to the same examination in each hospital.

References:

1. United Nation Scientific Committee On the Effect of Atomic Radiation. UNSCEAR 1993 Report to the General assembly, with scientific Annexes. Sources and Effects Of Ionizing Radiation. V- 93- 86295- October 1993.
2. Perry Sparwls, Jr. Physical Principles of Medical Imaging. Second edition 1995.
3. Jerrold T. Bushberg, et al The Essential Physics Of Medical Imaging. Second edition 2002.
4. G. Leib Radiobiology Of Human and Animals. 1989.
5. Herman Cember. Introduction To Health Physics. Second edition 1985.
6. Walter Huda PhD. Patient <Dose in Radiology. August 2001.
7. University of Leeds. Leeds x-ray Imaging Research 2006.
8. NRPB 1999- 2000.
9. IAEA BSS 115 2000 (11).