



TESTICULAR DOSES OF PATIENTS UNDERGOING RADIOLOGICAL EXAMINATION OF THE CHEST AT FEDERAL MEDICAL CENTRE MAKURDI, NIGERIA

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ABSTRACT

The testicular dose of eight adult male patients undergoing radiological examination of the chest were investigated at the radiological department of the Federal Medical Center (FMC) Makurdi using thermoluminescent dosimetry technique. The investigation was carried out using LiF TLD discs Reader, TLD model 4500 (Harshaw Radiation measurement product USA), 3-phase diagnostic X-ray machine and single a phase X-ray machine. The Mean testicular dose of the male patients investigated was found to be $0.0662 \pm 0.0034 \text{ mGy}$. There is also a significant correlation between testicular dose and tube potential, in which higher tube potential delivered higher values of testicular doses. Results showed that, testicular doses are within acceptable limits, which is approximately 6.6% of the 1mGy reference dose level.

Keywords: Testicular doses, X-rays, Thermoluminescent dosimeters, Radiation, Exposure, Patients.

1. INTRODUCTION

Medical physicists have become more concerned recently about the somatic and genetic hazard associated with radiation exposure and absorbed dose to patients during chest radiographic examination [1]. Diagnostic radiology requires that measurement be made of the radiation dose received by patients during diagnostic procedures and this has come under scrutiny and monitoring in recent times [2].

In both developed and developing countries, the number of X-rays facilities and X-rays equipment is increasing rapidly [3]. Although alternative modalities for diagnostic of diseases and injuries, such as ultrasound and Magnetic Resonance Imaging (MRI) are becoming increasingly available. Steady improvements in the quality of X-ray images and patients protection have ensured that the use of diagnostic X-rays remain the most used technique for diagnosis [4]. This makes it a major contributor to man's exposure to artificial sources of ionizing radiation. Medical physicists have devoted much attention to the minimization of patients' dose in

diagnostic radiology. Substantial reduction in radiation dose to the patients resulting from radiographic procedures have been achieved in many countries [1].

Radiology personnel cannot quantitatively monitor dose to the patients in every procedure, however, the magnitude of patients exposure resulting from the various radiological examinations performed must be appreciated [5]. The objective of radiological examinations is to obtain information about the internal anatomy of patients in order to provide adequate diagnostic data for clinician [6]. Chest radiography examination is the most frequently performed radiological procedure in Nigeria, which contributes to the most common use of X-rays leading to high population dose of medical irradiation. In chest radiography, testes are outside the exposed field, it would be very useful for clinical radiographers to know how and to what extent the testicular doses vary with tube potential in chest radiography, using both the high tube potential and the tube potential techniques. This knowledge will lead to appropriate exposure selection consistent with acceptable image quality [7].

The objectives of this research is to measure the entry dose to the testes of adult patients during radiological examination of the chest, at the Federal Medical center Makurdi, Nigeria and compare the doses to the reference dose level of 1mGy as recommended by the International Commission on Radiological Protection (ICRP) and to suggest ways of reducing testicular dose during chest X-ray examinations.

2. MATERIALS AND METHOD

This study was carried out at the radiology department of the Federal Medical center Makurdi, Nigeria. 8 adult males were considered and measurement of the scattered X-ray dose to the testes was carried out based on thermoluminescent dosimeter technique (TLD) using TLD 4500 (Harshaw radiation measurement product USA) with disc sharp pallets of 4.5mm diameter and 0.8mm thickness. The TLD discs, which were annealed at the National Institute of Radiation and Research, University of Ibadan, Nigeria were enclosed in plastic covers and positioned at the testes of the male patients. This was removed immediately after examination so that entry testes dose were measured. The radiographic view considered was posteroanterior while chest X-ray for each patient was made at different peak tube voltage (kVp) and source to skin distance (SSD).

The calibration of the TLD discs were done at the National Institute of Radiation and Research, University of Ibadan which enabled the translation of the final corrected counts for the read phase into the appropriate radiation dose in mGy.

3. RESULTS AND DISCUSSION

The result of study has provided useful information about the kVp and the amount of doses received by patients during chest radiological examination (Table 2.0).

Figure 1.0 shows that testicular doses increases with tube potential. This is because the peak voltage across the X-ray tube (kVp) increases the energy of the X-rays in the beam, which produces more absorbed energy in the gonads due to the increased scattering ability of the X-

rays. This in turn means that a greater number of X-rays will be produced at the target, and thus, the intensity of the beam will also be increased as reported by [Graham and Francis \[8\]](#).

High tube potential is not recommended in chest radiography since it delivers significantly higher doses to testes and the produced X-rays will be scattered to greater distances. It also produces a lower contrast film, thus deteriorating the diagnostic value. According to [Fung and Gilboy \[7\]](#), it is important to use a low tube potential technique as this will definitely deliver significantly lower testicular doses.

The study also revealed that testicular doses obtained by TLD measurements decreases with increase in chest thickness (Fig. 2.0). This trend appears to suggest that the amount of X-rays absorbed by the patient is dependent on size of the patients. With increase in the patient chest thickness, more X-rays are absorbed and less X-rays are scattered to the testes.

The mean testicular dose of the male patients investigated was 0.0662mGy obtained at Federal Medical Centre Makurdi, Nigeria approximately 6.6% of the 1mGy.

An increase in the peak voltage across the X-ray tube increases the maximum energy of the X-ray in the beam. The results also indicates that testicular doses increases with a decrease in chest thickness and this agrees with the published work of [Fung and Gilboy \[7\]](#) and [Ajayi and Oresegun \[10\]](#).

4. CONCLUSION

These doses are well within acceptance limits [\[10\]](#). From the point of view of stochastic risk of radiation, the individual risk due to these doses is quite low. However, care must be taken for the patients who are repeatedly undergoing radiological examination of the chest.

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Table-1. The specifications of the x-ray machines used.

Name of X-ray machine	Watson	Medtronic
Manufacturer	GEC medical equipment LTD England	GEC medical equipment LTD Wembly Middlesex England
Total Tube filtration (mmAl)	1.5	2.1
SSD (cm)	190	190
Radiographic view Kv range	PA	PA
Kv range	45-120 Max	0-120Max
MAS (variable)	0-500	0-120max

Table-2. The testicular dose and radiographic parameters during posteroanterior chest radiography examinations of the patients using a three-phase x-ray machine.

S/N	Age	kVp	MAS	FSD [CM]	SSD [CM]	Chest [cm]	Thickness	Testicular mGy	Dose
1	43	72	20	159	140	19		0.0620	
2	40	69	20	166	145	21		0.0552	
3	35	78	13	158	142	16		0.0780	
4	22	73	20	138	120	18		0.0640	
5	25	75	13	159	142	17		0.0700	
6	31	70	60	142	122	20		0.0593	
7	35	79	80	140	125	15		0.0823	
8	37	71	80	150	130	20		0.0604	

Fig-1.Variation of testicular dose with tube potential

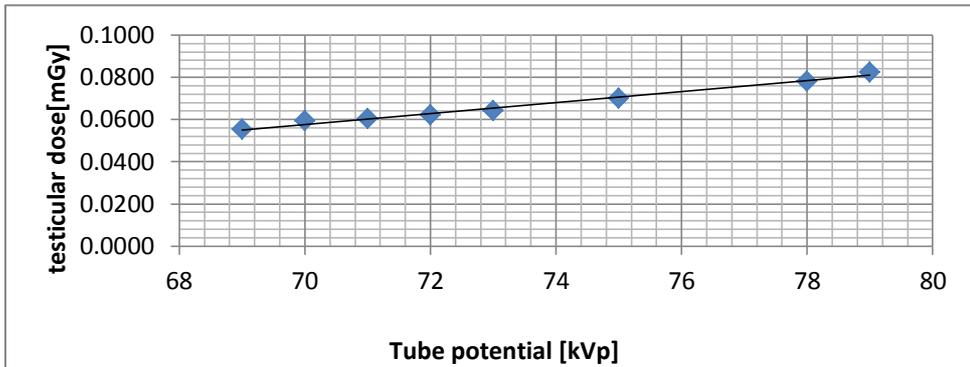
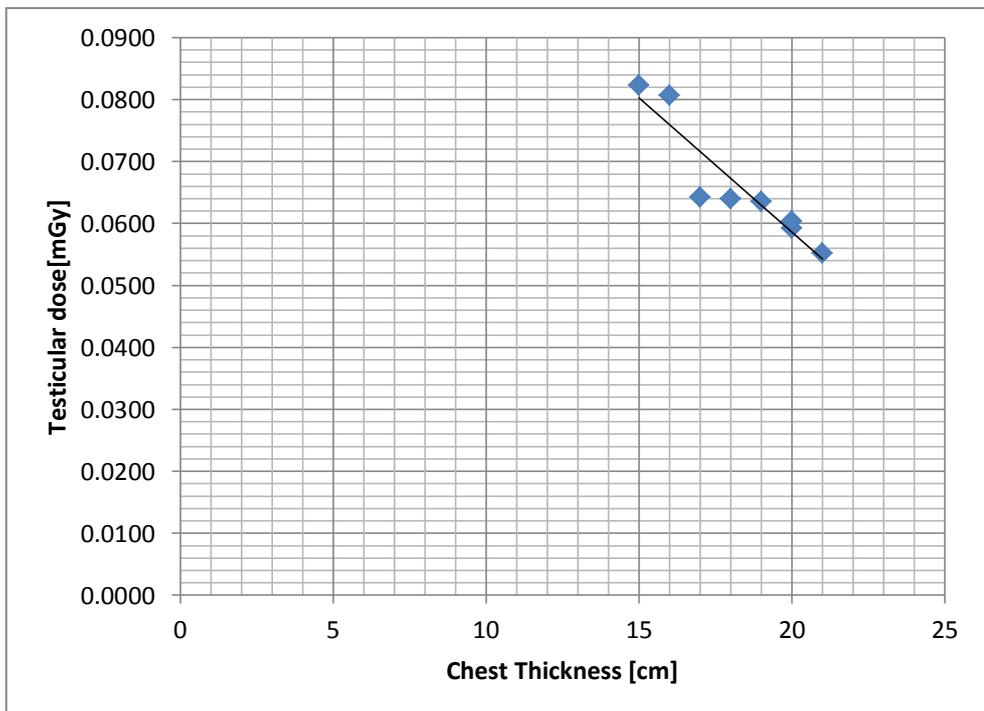


Fig-2.Variation of testicular dose with Chest thickness



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