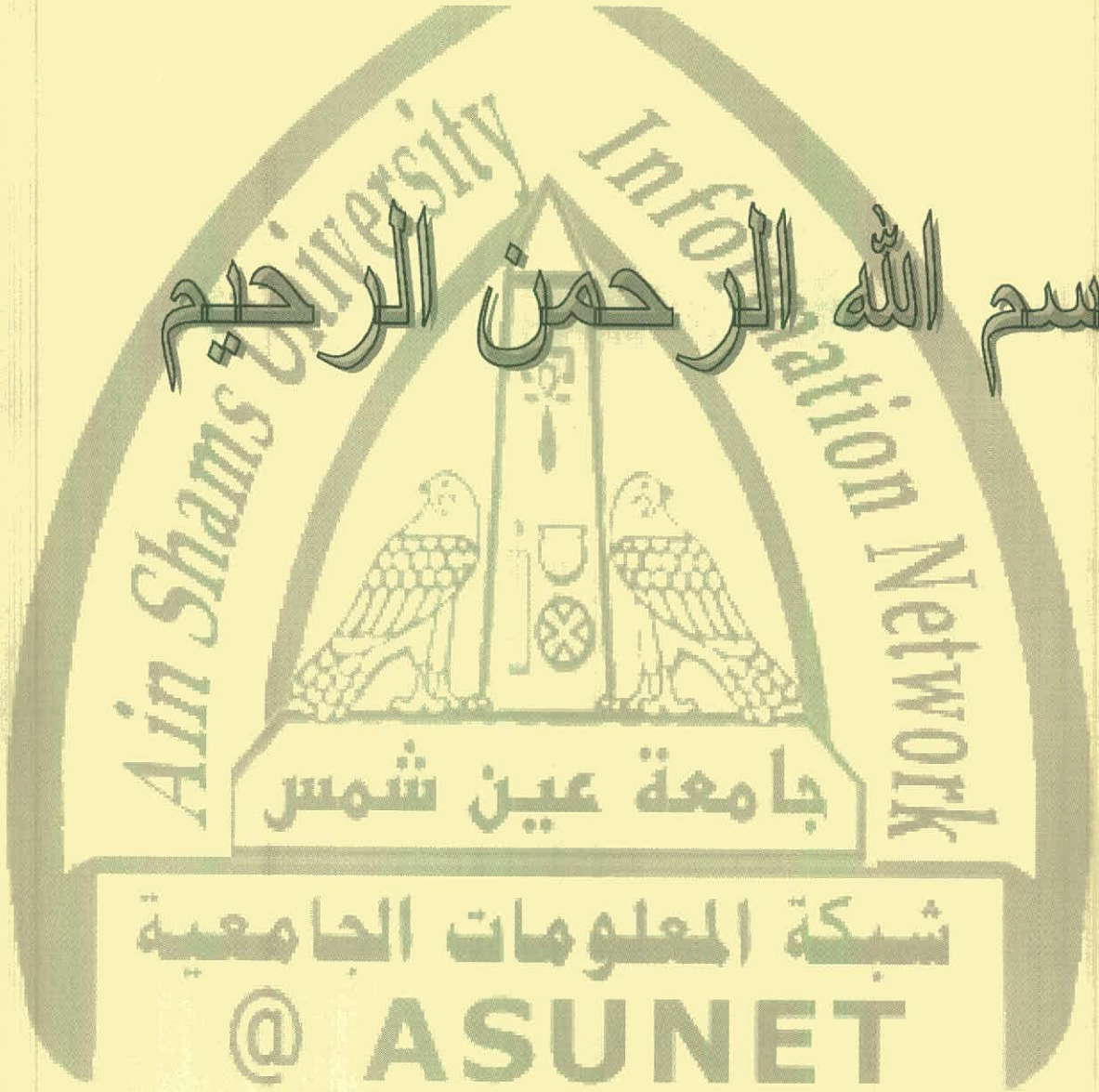
شبكة المعلومات الجامعية



بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
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To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

بعض الوثائـــــــق الاصليـــــة تالفـــة

بالرسالة صفحات لم ترد بالاصل

COMPARATIVE EVALUATION OF MEASURING DEVICES OF RADIATION DOSES AND THEIR USE IN MEDICAL SURVEY

Thesis
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The Degree of Master in Physics

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Hanan Mohamed Ahmed Diab

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CONTENTS

CONTENTS

INTRODUCTION

Medical uses of ionizing radiation contribute significantly to the radiation exposures of individuals and populations. Medical radiation exposures arise from diagnostic use of X-rays and other external radiation sources and internally administered radioisotopes and from therapeutic use of external and sealed internal sources of radiation and radiopharmaceuticals.

The basic information needed for assessment of medical radiation exposures is the frequency of each type of diagnostic or therapeutic procedure and the doses to all parts of the body. Exposure evaluations are required not only for the patients but also for the medical staff [1].

Ionizing radiation is used for two major purposes in medicine : diagnosis and therapy. Diagnosis affects many people but with lower doses to each irradiated person. The benefit desired in diagnostic uses of ionizing radiation is to obtain information which will facilitate decisions on later treatments. Many different radionuclides are used in nuclear medicine, such as ^{99m}Tc, ^{131}I, ^{51}Cr, ^{59}Fe and ^{32}P but the most important ones are ^{99m}Tc and ^{131}I [2].

The dose per procedure is less for ^{99m}Tc, which has a shorter half-life (6.02 h), and used in the majority of cases. The usage of ^{131}I is still make an important contribution to the collective dose.

The purpose of this study is to develop measurement data from routine clinical nuclear medicine procedures to assess the public health impact of radiation emitted by the used radio-isotopes; and also for nuclear medicine patients injected by radioisotopes. Thermoluminescent dosimeters were used to measure integrated dose to nuclear medicine workers, during the preparation and diagnosis of various radiopharmaceuticals. The ion chamber and Geiger Mueller survey meters were also used for the same purpose.

The radiopharmaceuticals studies included Dimercaptosuccinic acid (DMSA) and ^{99m}Tc-DTPA for kidney scan, Methylene Diphosphonate with ^{99m}Tc(MDP) for bone scan, Cardiolite with ^{99m}Tc for heart scan and ^{99m}Tc pertechnetate for thyroid scan. These radiopharmaceuticals were chosen because, they are the most widely used in the hospitals of Egypt.

Study of the distribution of radiation dose across both hands during the dispensing and administration of radiopharmaceuticals is carried out; by measuring the dose at five locations on each hand, to represent a mean hand dose [3]. Also, the radiation doses for workers were measured at different positions of the whole body during nuclear medicine routine work.

SURVEY OF SOME DIAGNOSTIC USE OF RADIO-PHARMACEUTICAL

Estimation of doses to staff in medical radiation usage is not entirely straightforward. As stated in the UNSCEAR 1988 Report (United Nations Scientific Committee on the Effects of Atomic Radiation), medical radiation workers are often exposed to point sources close to the body, so that exposure is very non-uniform over the body [4].

In a study of cardiac staff at two hospitals in Canada, good agreement was obtained between the upper estimates of annual effective dose equivalent obtained using seven thermoluminescent dosimeters worn by each staff members (18 and 13 mSv were recorded by this method at the two hospitals), and the maximum effective dose equivalents determined by conventional monitoring with a single dosimeter (18 and 14.4 mSv were recorded in this way at the same two hospitals) [5].

Most reports dealing with occupational doses to medical staff do not distinguish nuclear medicine from other medical radiation usage. Thus, estimates were given of mean effective dose equivalents of 0.7 mSv in 1980 for all diagnostic staff in the United States, 0.26 mSv in 1988 for all medical staff in Sweden, 0.13 mSv in 1987 for all medical staff in the former Federal Republic of Germany, and 0.05 mSv annually in 1970 - 1986 for all medical staff in Kenya [6].

Some case studies are available, such as the experience of one regional radiopharmacy in Scotland, where the average effective dose equivalent in 1988, (6 mSv), was less than half of that in 1974, despite a constant workload per person. Lens and hand doses were well below relevant limits, and internal contamination contributed little to the dose [7]. In another case study, typical staff doses for various operations in a British hospital were given by Harding et al. Harding studies doses incurred by relatives, other staff and accompanying nurses in the waiting room at a hospital in the United Kingdom. Median doses were about 2μSv or less, with a maximum of 33μSv. Similar conclusions were drawn by Siewert [7] for the former Democratic Republic of Germany.

The information provided by Hughes et al. [8] permits separation of staff in nuclear medicine in the United Kingdom. The mean effective dose equivalent in 1986 was 0.12 mSv, corresponding to a collective effective dose equivalent for 6400 nuclear medicine staff of 0.8 Sv. Table (1-1) shows the distribution of dose to medical staff in different countries.

Table (1-1) The distribution of dose to medical staff in different countries

Country	Year	Annual effectiv (mSv)	Number of staff exposed			
			X-ray	R.T	Nuc. Med.	Total
Canada	1984	0 - 0.19	21493	262	2439	24194
		0.2 - 0.5	3282	364	850	4495
		5.1 - 15.0	16	20	103	139
		15.1 - 50.0	0	2	0	3
		>50	0	0	0	0
France	1988	0 - 0.19	44210	3988	3873	
		0.2 - 0.5	3305	757	380	
		5.1 - 15.0	363	65	23	
		15.1 - 50.0	113	22	6	
		>50	17	1	0	
Germany	1985-1986	0-5	40332	2184	1703	50229
		5.1-15.0	68	70	15	166
		15.1-50.0	12	7	0	28
		>50	0	0	0	0
Sweden	1988	0-0.09				6901
		0.1-5.0				4004
		5.1-10				24
		10.1-20				1
		20.1-50				2
		>50				3
United-Kingdom	1986	0-5	10212	3766	2667	
		5.1-15.0	14	56	5	
		15.1-50	0	4	0	
		>50	0	0	0	

The mean value for the United States corresponds to a collective effective dose equivalent for all diagnostic staff of 410 man (Sv). Cardiologists were mentioned as a higher exposure group with annual doses up to 18 mSv [9].

In 1988, 10100 medical workers were monitored by the Swedish National Institute of Radiation Protection, and 4000 of these obtained a recorded dose of at least 0.1 mSv [10]. The mean effective dose equivalent for all medical staff was 0.26 mSv. The report did not distinguish between X-ray or nuclear medicine examinations or therapy.