Dedication

To My father's and my sister's memory

My dear mother,

My sister... my soul's twin

Azahir

To my teachers, my friends and my

Colleagues...

God bless them

Acknowledgment

Firstly, thank to my God.

Great thanks to Mr.Eltayb Abdalla at Sudan Atomic Energy commission (SAEC) who is the supervisor of this research, he was a great assistant to me with his guides and directions.

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Abstract

Brachytherapy is the use of encapsulated radioactive sources to deliver a radiation dose at a short distance over a short time for treatment of malignant tumors. In Sudan, mainly in Radiation and Isotopes Centre – Khartoum (RICK) brachytherapy was introduced in 1989 using manual afterloading low dose rate ^{137}Cs for treatment of carcinoma of the cervix, but for safety reasons now it replace by high dose rate ^{192}Ir afterloading system (HDR) with remotely controlled device to deliver controlled radiation dose for treatment of carcinoma of cervix, esophagus and nasopharynx.

This study was carried out in high dose rate ^{192}Ir afterloading brachytherapy equipment (Gamma Med 12i unit) located at RICK to evaluate the performance and to perform comprehensive quality control of the treatment unit with respect to three poles: safety systems, physical parameters and calibration of Ir-192 source through some quality control checks, so as to ensure that the equipment meets the safety standard.

The study shows that all the safety systems which include the mechanical checks are work properly; the average of the dose rate measured at different positions from the treatment unit which represent the leakage radiation by using RDS- 120 universal survey meter is less than10μSv/h.

The physical parameters which include the check of a source position accuracy by using X-OMAT ready pack film and catheter guide tube is 1mm. The source strength that was obtained from the calibration procedures following the IAEA-TEC DOC 1274 protocol by using HDR 1000 plus well type ionization chamber is different from the value of International Standard Laboratory by 1.5%.It was found that the brachytherapy equipment and the source used in

brachytherapy meets the user's requirements except some necessary requirements, so some recommendations was putted include these requirements

الخلاصة

العلاج عن قرب هو إستخدام المصادر المشعة المغلفة لاعطاء جرعة اشعاعية على مسافة قصيرة فى زمن قصير لعلاج الأورام الخبيثة.

فى السودان وتحديدا فى المركز ا لقومى للعلاج بالأشعة والطب النووى أدخلت تقنية العلاج عن قرب فى عام 1989 باستخدام اجهزه التحميل اليدويه للمصادر المشعة ذات معدل الجرعة المنخفض باستخدام مصدر السيزيوم 137 المشع لعلاج سرطان عنق الرحم ولكن لاسباب وقائيه استبدلت هذه الاجهزه باجهزه تحميل المصادر المشعة عن بعد الاتوماتيكيه ذات معدل الجرعة العالي بإستخدام مصدر الإيريديوم 192المشع لعلاج سرطان عنق الرحم،المرئ والبلعوم الأنفى.

أجريت هذه الدراسة على جهاز العلاج عن قرب ذو معدل الجرعة العالي باستخدام مصدر الاريديوم 192 (Gamma Med 12i unit) الموجود في المركز القومي للعلاج بالاشعة والطب النووي – الخرطوم لتقييم اداء وضبط جوده الجهاز فيما يتعلق بثلاث محاور : انظمه الحمايه ، المعاملات الفيزيائيه ، ومعايره مصدر الاريديوم 192 من خلال بعض اختبارات ضبط الجوده وذلك للتاكد من ان الجهاز يفي بكل معايير الحمايه .

اوضحت الدراسة ان كل انظمة الحماية والتي تشمل الاختبارات الميكانيكيه للجهاز تعمل بدقه ، معدل الجرعه المقاس علي مواضع مختلفه من جهاز العلاج باستخدام جهاز المسح الاشعاعي (RDS- 120 universal survey meter) اقل من10 µ Sv /hr .

المعاملات الفيزيائيه والتي تشمل اختبار دقه وضع المصدر المشع باستخدام فلم حساس (XOMAT ready pack film) وانبوب توصيل ان دقه وضع المصدر 1mm . شده نشاط مصدر الاريديوم 192 والتي تم الحصول عليها من عمليه المعايره باتباع بروتوكول الوكاله الدوليه للطاقه الذريه (IAEA – TEC DOC1274) باستخدام غرفه التأين البئريه (HDR 1000 plus well type ionization chamber) تختلف بنسبه 1.5 % من القيمه القياسيه .

خلصت هذه الدراسه الي ان جهاز العلاج عن قرب والمصدر المشع المستخدم في العلاج يفي بمطلوبات المستخدم ماعدا بعض المتطلبات الضروريه لذلك وضعت بعض التوصيات والمقترحات التي تضم هذه المتطلبات.

Abbreviations

AAPM	: American Association of Physics in Medicine
ADCL	: Accredited Dosimetry Calibration Laboratory
GM	: Geiger Muller Dosimeter
HDR	: High Dose Rate
IAEA	: International Atomic Energy Agency
ICRU	: International Commission on Radiation Units and Measurements.
LDR	: Low Dose Rate
MDR	: Medium Dose Rate
NCRP	: National Council on Radiation Protection and Measurements.
NIST	: National Institute of Standard and Technology
PC	: Personal Computer
PDR	: Pulsed Dose Rate
PSDL	: Primary Standard Dosimetry Laboratory
QA	: Quality Assurance
QC	: Quality Control
RAL	: Remote Afterloading
RICK	: Radiation and Isotopes Center –Khartoum

SSDLs	: Secondary Standard Dosimetry Laboratories
TLD	: Thermoluminescence Dosimeter.
NPL	: National Physics Laboratory
ISO	: International Standardization Organization
SI	: System of International Units
NRC	: Nuclear Regulatory Commission

Contents

Topic

page

Dedication…….. .. i

Acknowledgment ……ii

Abstract (in English)……..iii

Abstract (in Arabic)……v

Abbreviation……... ..v

Contents ……vi

Chapter one: General introduction

1.1 Introduction……...…1

1.2 Problem ……..…...3

1.3 Hypothesis ……....3

1.4 Aims of study ……...3

1.5 Importance of study ……. 4

1.6 Methodology ……... 4

Chapter two:

Part one:

2.1 literature review ……..6

Part two: Theoretical background

2.2 Introduction …… 9

2.2.1 Photon source characteristics……10

2.2.1.1 practical considerations …… …10
2.2.1.2 Physical characteristics of photon emitting brachytherapy Sources……..11
2.2.1.3 Mechanical source characteristics…… 12
2.2.2 Clinical use and dosimetry systems……...13
2.2.2.1 Gynecology (Intracavitary)…… ..13
2.2.2.1.1. Types of sources …….....13
2.2.2.1.2 Dose specification……...13
2.2.2.1.3 source arrangement ……....14
2.2.2.1.4 Rectal and bladder dose monitoring ……...14
2.2.3 Interstitial brachytherapy ……14
2.2.3.1 Patterson- Parker system ……....15
2.2.3.2 Quimby system……16
2.2.3.3 Paris system ……...16
2.2.4 Afterloading equipment…….... 17
2.2.4.1 Afterloading……..… 17
2.2.4.2 Manual afterloading……..…18

2.2.4.3 Remotely controlled afterloading equipment ……..19
2.2.4.4 Remotely controlled HDR and PDR equipment…… 22
2.2.5 Advantages and disadvantages of HDR remote afterloaders..… 23
2.2.5.1 Advantages ……23
2.2.5.2 Disadvantages ……24
2.2.6 Description of the Gamma Med 12i system …… . 24
2.2.7 Installation of the Gamma Med 12i system.....25
2.2.8 Treatment head 26
2.2.8.1 The indexer and connection mechanism of the applicators……26
2.2.8.2 The dummy source ……27
2.2.9 Specification of source strength ……...27
2.2.9.1 Mass ……...27
2.2.9.2 Activity ……..28
2.2.9.3 Apparent activity ……...28
2.2.9.4 Equivalent mass of radium …….... 28
2.2.9.5 Exposure rate and air kerma rate constant……..… 29

2.2.9.6 Exposure rate at specified distance ……... 29
2.2.9.7 Air kerma strength ……..…29
2.2.9.8 Argument for air kerma strength……... 30

2.2.10 Quality management ……..31
2.2.10.1 Quality policy ……31
2.2.10.2 Quality assurance ……31

2.2.10.3 Quality assurance on the treatment unit(quality control)…… 32
2.2.10.4 Quality assurance on the planning system ……...33
2.2.10.5 Quality assurance on the patient treatment procedure……..34
2.2.10.6 Quality control ……..35
2.2.11 Acceptance tests …… 36
2.2.11.1 Acceptance testing for HDR remote afterloading system … 36
2.2.12 Contamination, cleaning and sterilization …… 38
2.2.13 Quality control procedures of afterloading equipment …… 39
2.2.13.1 HDR and PDR afterloading equipment …… 39
2.2.13.2 Safety systems……..39
2.2.13.3 Physical parameters……..40
2.2.14 Calibration of brachytherapy sources…… 41
2.2.14.1. Calibration at the Secondary Standard Dosimetry laboratories (SSDLs) and hospital level……..41
2.2.14.1.1 Traceability in calibration at SSDL ……..42
2.2.14.1.2 Traceability in calibration at hospitals …… 42

2.15 Maintenance of standards for Ir- 192 quality……42
2.16 Calibration using well type chamber ……42
2.2.16.1 calibration point inside the well type chamber …… 43
2.2.16.2 Measurement techniques …… 43
2.2.16.3 Measurement corrections ……44
2.2.16.4 Calculation of well type chamber calibration factor ……...45
2.2.16.5 Quality control of well type chamber measurements…… 45
2.2.17 Protection against radiation from brachytherapy source……46
2.2.18 Structural shielding design……47

Chapter three: Materials and Methods

3.1 Quality control checks ……49
3.1.1 Safety system ……49
3.1.1.1 Test to ensure source drive mechanism ……49
3.1.1.2 Test for missing extension hose ……49
3.1.1.3Radiation warning lights test…… 50
3.1.1.4Test of interlock system ……... 50
3.1.1.5Test of the communication equipment and room monitor……. 50
3.1.1.6 Test of catheter attachment lock…… 50
3.1.1.7 Test of hand held monitor …… 51
3.1.1.8 Test of treatment interrupt ……51
3.1.1.9 Test of timer termination ……... 51
3.1.1.10 Integrity of transfer tubes and applicators……51
3.1.1.11 Radiation survey…… 52
3.1.2 Physical parameters …… 52
3.1.2.1 Test to ensure the accuracy of source positioning ……52
3.1.2.2 Test to ensure length of treatment tubes…… 53
3.1.2.3 Test to ensure timer consistency ……53

3.1.2.4 Decay correction factor ……..53
3.1.3 Calibration of Ir-192 brachytherapy source using calibrated well type chamber ……53

Chapter four: Results and Discussion 57

Chapter five: conclusion and Recommendations
5.1 Conclusion……...66
5 . 2 Recommendations.....67

Appendices

References