

Sudan University of Science Technology

College of Graduate Studies

Estimation of Normal Homogenous Thyroid uptake using Technetium-
99mRadiotracer

تقويم الامتصاص الطبيعي للغدة الدرقية باستخدام عنصر التكنيشيوم 99 المشع

Thesis Submitted for Fulfillment of Ph.D. degree in Nuclear Medicine Technology

BY:

Kamal Faisal Youssof Mohamed

Supervisor:

Prof. Mohamed Mohamed Omer

Co. Supervisor:

Prof. Mohamed Elfadil Mohamed

June 2020



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(إِقْرَأْ وَرَبُّكَ الْأَكْرَمُ * الَّذِي عَلَّمَ بِالْقَلَمِ *

عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ *)

صَدَقَ اللَّهُ الْعَظِيمُ ،،،

Dedication:

*To sale of my father, Mather & my little
family*

With my love

Abstract

The main objective of this study was to evaluate the normal range of thyroid uptake and determine the thyroid volume in patients who has normal thyroid function test (T.F.T) (mean of normal range of these patients T3: 3.1-6.8 p, mole/L, T4: 10-24.5 p mole/L & TSH: 0.2-5.5 miU/L) & homogenous distribution of the radiotracer in Sudanese especially in Radiation & Isotope Center Khartoum (RICK) & Elnelain Medical Diagnostic Center. This study includes 400 patients (85.5% female, 14.5% male) in different age, sex, center of origin and type of food and drink intake, for nine months From May 2017 to May 2020. The most frequency of ages distribute as (18-27 36.3%, 28-37 28.5%) the thyroid uptake value in the gamma camera (mediso) & (simens), the result of this study showed that, the normal range of thyroid uptake is in the range between (0.4% —5.0%) & the thyroid volume is in the range of (11.6cm² to 36.7cm²) there was a direct relationship between thyroid uptake and the thyroid volume that when the volume increase the uptake increase that shown in the following equation: $y = 2.98 + 7.08E-3 * x$ where x refers to thyroid volume and y refers to uptake in percent. The result also shown that when weight increase the uptake decrease as shown in the following equation: $y = 2.18 + x + 0.01 * x$ where x refers to patient weight in Kg and y refers to up take in percent. The result shown that high uptake young patient in age between 18 -37 years and slightly stable (reasonable high and low) under fifty, then increase to be high again. The increasing of high uptake in age 18-37 years known area of changes in hormonal activity to be stable, then it becomes slightly stable till below 50 and after that go to increase.

الخلاصة

أهم أهداف هذا البحث هو تحديد المعدل الطبيعي لتشبع الغدة الدرقية بعنصر التكنيشيوم المشع عند السودانيين الذين لديهم نتائج في المعدل الطبيعي لفحص الغدة الدرغية وتشبع متناسق في شكل الغدة وإمتصاصها (خالية من الحبيبات أو الاكياس بنوعيهما البارد والحر) بالأضاقعة لذلك يهدف البحث لمعرفة معدل الحجم الطبيعي للغدة الدرغية لهؤلاء المرضى ، % (ذكور) بمختلف الاعمار والاجناس والولايات بالأضاقعة لأختلاف 14.5% أناث و 84.5 مريض (400 شملت هذه الدراسة طبيعية الطعام والشراب عند هؤلاء المرضى . أجريت هذه الدراسة بالمركز القومي لعلاج بالأشعة والطب النووي الخرطوم ، قسم الطب النووي (القاما كاميرا) ومركز النيلين الطبي الخرطوم لمدة ثلاثة سنوات من مايو 2017 وحتى مايو 2020 كان وكانت النتائج بالنسبة لمستوي لتشبع الغدة الدرقية (28.5% 28-37 , 36.3% 27-18)أعلي توزيع للأعمار كالتالي بعنصر التكنيشيوم في السنة بين (0.4% الي 5.0%) وكان حجم الغدة الدرقية يتراوح ما بين (سم 11.6 الي 36.7 سم) $y =$ كما أنه كلما زاد حجم الغدة الدرقية يذيد تبعاً لذلك كمية التشبع بعنصر التكنيشيوم كم في المعادلة التالية $y = 2.18 + x + 0.01 * x$ بينما تقل كمية التشبع كلما زاد وزن الجسم كما في المعادلة التالية $2.98 + 7.08E-3 * x$ أثبتت الدراسة أن مستوي التشبع للغدة يتباين بأختلاف العمر للمريض

List of contents

No	Name of content	Page no
	Dedication	Ii
	Acknowledgment	Iii
	Abstract (English)	Iv
	Abstract (Arabic)	V
	List of content	Vi
	List of table	Ix
	List of figure	X
	List of appendix	Xi
1	Introduction	1
1-1	Iodine deficiency in Sudan	2
1-2	Diagnosis	3
1-2-2	Measurement of Serum Thyroid Hormones T3 by RIA	3
1-2-3	Measurement OF Pituitrary production of TSH	3
1-2-4	Thyroid Uptake Test	4
1-2-5	Thyroid ultrasound	5
1-2-6	Problems	6
1-2-7	Thyroid scan	7
1-2-8	Objectives of the study	9
1-3	Problems	15
1-4	Purpose of the study	15
1-5	Specific objective	16
1-6	Significances of the study	16
1-7	Overview of the study	16
2	Theoretical background and previous study	17
2-1	Anatomy of the Thyroid Gland	17
2-2	Physiology of Thyroid Gland	18
2-2-1	A DNA-binding domain	18
2-2-2	A ligand- binding	19
2-2-3	Metabolism	19
2-2-4	Lipid metabolism	21
2-2-5	Carbohydrate metabolism	21
2-2-5-2	Growth	22
2-2-5-3	Development	22
2-2-6	Other effect	23
2-2-7	Common Thyroid problems	24
2-2-8	Goiter	25
2-2-9	Thyroid cancer	26
2-2-9-1	Solitary thyroid nodule	26

2-2-9-2	Hyerthyroidism	26
2-2-9-3	Hypothyroidism	27
2-2-9-4	Thyrodities	27
2-2-9-5	Hashimotos thyroiditis	27
2-2-9-6	De quervians thyroiditis	27
2-3	Silent thyroiditis	28
2-3-1	Thyroid uptake	28
2-3-2	Material and method	29
3-1	Instrumentation	31
3-2	Quality control of the gamma camera	36
3-3	Method of data method	36
3-4	Thyroid uptake method	38
3-5	Patient preparation	40
4	Technique of uptake	41
4-1	Patient preparations	42
4-2	Technique of uptake	
5	Result	45
	discussion	56
6-1	Conclusion	60
6-2	Recommendations	61
6-3	The reference	62
6-4	Appendix	65

VII

List of tables

No	Name of table	Page No
3.2	Patients data	34
4.3	Summary of the Means and Std. Deviation of Patients Age , weight, Height, Uptake, Volume,T3,T4,TSH	47
4.4	Shows the correlations of patients weight, height, Age, Uptake ,Volume, T3,T4 & TSH	55

List of figures

No	Name of figures	Page No
1-1	Normal , hot and cold thyroid scan	9
1-2	Cold nodule image	12
2-1	Location of Thyroid Gland in the Body	17
2-2	Thyroid Tissue	18
2-3	Mechanism of thyroid hormones syntheses	20
2-4	Chemical structure of thyroid hormones	20
2-5	Thyroid receptor structure	22
4-1	Shows the distribution of sample based on their gender	44
4-2	Shows the distribution frequency of age of patients	44
4-3	Shows the distribution frequency of weight of patients	45
4-4	shows the distribution frequency of height of patients	45
4-5	shows the distribution frequency of T3 of patients	46
4-6	shows the distribution frequency of T4 hormone of patients	46
4-7	shows the distribution frequency of TSH hormone of patients	47
4-8	shows the distribution frequency of thyroid volume of patients	47
4-9	shows the relation between thyroid Volume and weight o the pt	48
4-10	shows the relation between thyroid Volume and Height o the pt	48

4-11	shows the relation between thyroid Volume and age o the pt	49
4-12	shows the distribution frequency of uptake of patients	50
4-13	shows the relationship between the thyroid uptake and volume	51
4-14	shows the relation between thyroid uptake and age of the pt	52
4-15	shows the relation between thyroid uptake and weight of the pt	53
4-16	shows the relation between thyroid uptake and Height of the pt	55

List of Appendix

No	Name of table	Page No
Appendix 1	Images result	66
Appendix2	Reports	70

ABBREVIATIONS

TSH.....	Thyroid Stimulating Hormone.
T4	Thyroxin.
T3	Ti iodothyronine.
RICK	Radiation & Isotope Center Khartoum.
TFT	Thyroid Function Test.
RIA	Radio Active Iodine.
TG	Thymoglobulin.
TPO	Thyroid Peroxides.
GD.....	Graves Disease.
ATA	American Thyroid Association.
T ½	Half—Life.
PTU	Propylene thiouracil.

Acknowledgment

I would like to express my sincere gratitude to

prof. Mohamed Mohamed Omer Mohamed Yousef

who has given me great advice and help in the whole process of my thesis for his fruitful day to day supervision, guidance, endless help and encouragement that built confidence in my work for his valuable and continuous help, his patience through all the years that made this work possible for giving this opportunity of study, and for endless encouragement and unlimited support.

*My thanks to **Prof. Mohamed Elfadil** for help and encouragement, Extend my thanks also to my colleagues who contribute in the sample collections.*

I would like to thank everyone who assisted by one way or another to bring this study to the light.