

بسم الله الرحمن الرحيم



Sudan University of Science and Technology

College of Graduate Studies

Diagnostic Radiologic Technology Department

Determination of Liver Dimensions for Sudanese using Computed Tomography

**تحديد أبعاد الكبد للسودانيين باستخدام الأشعة
المقطعية**

A Thesis Submitted for Partial Fulfillment of the
Requirement of MSc. Degree in Diagnostic Radiologic
Technology

By:

Mohammed Saadeldein Mohammed

Supervisor:

Assistant professor. Duha Abdu Mohamed Abdu.

March 2013

الآية

بسم الله الرحمن الرحيم

قال تعالى:

**اقراً باسم ربك الذي خلق (1) خلق^٢
الإنسان من علق (2) اقراً وربك الأكرم)
(3) الذي علم بالقلم (4) علم الإنسان ما
آلم يعلم (5)**

صدق الله العظيم

سورة العلق

List of Contents

No.	Title	Page
-----	-------	------

	الأبّه	II.
	List of contents	III.
	List of figures and tables	VI.
	List of abbreviation	IX.
	Dedication	X.
	Acknowledgment	XI.
	Abstract (English)	XII.
	Abstract (Arabic)	XIII.
	Chapter One Introduction and Objectives	
1 - 1	Introduction	2
1 - 2	Research Problem	4
1 - 3	Significance of the Study	4
1 - 4	Research Objectives	4
1 - 5	Research Contents	5
	Chapter Two Theoretical Background and Literature Review	
2-1	Theoretical background	6
2-1-1	The Anatomy of the liver	6
2-1-2	The Physiology of the liver	17
2-1-3	The Pathology of the liver	18
2-1-2	The Physiology	18
2-1-3	The Pathology	29
2-1-4	Computed Tomography	21
2-2	Literature Review	33
	Chapter Three Material And Method	
3 - 1	Material	36
3-1-1	Patient	36
3-1-2	Machines	36
3 - 2	Method	37
3-2-1	Data collection and analysis	37
3-2-2	Method of hepatic measurement	37
3-2-3	Computed tomography Protocol	37
3-2-4	Area of the study	37

	Chapter Four Result	
	Results	38
	Chapter Five Discussion, Conclusion and Recommendations	
5 – 1	Discussion	57
5 – 2	Conclusion	59
5 – 3	Recommendations	60
	References	61
	Appendixes	63

List of Figures And Tables

Fig 2-1	Abdominal subdivisions	7
Fig. 2-2	The surface and bed of the liver	7
Fig.2-3	Relations of the liver	8
Fig. 2-4	The fissures and sectors of the liver	11
Fig. 2.5	Segments of the liver	11
Fig. 2-6	The hepatic artery	15
Fig. 2-7	The main portal vein and its intrahepatic branches	15
Fig. 2-8	Arrangement of the hepatic venous territories	16
Fig 2-9	left hepatic boarder, Right lobe and Caudate lobe	18
Fig 2-10	anteroposterior diameter of left lobe	18
Fig 2-11	X-ray tube diagram	25
Fig 2-12	Schematic drawing of an X-ray tube	25
Fig 2-13	Schematic illustration of the signal conversion chain inside the detector	27
Fig 2-14	Illustration of conventional tomography principle	28
Fig 2-15	First-generation CT scanner geometry	30
Fig 2-16	CT scanners of the second generation	30
Fig 2-17	The third generation of CT scanners	32
Fig 2-18	Geometry of a fourth-generation CT scanner	32

Fig 2-19	Geometry of an electron-beam scanner	33
Fig 4-1	Shows gender distribution.	42
Fig 4-2	Shows age distribution.	43
Fig 4-3	Histogram shows the distribution of transverse dimension of right hepatic lobe.	44
Fig 4-4	Shows Transverse diameter of Right lobe measured by computed tomography.	45
Fig 4-5	Histogram shows the distribution of transverse dimension of anteroposterior diameter of left lobe.	46
Fig 4-6	Shows AP. Diameter of left lobe measured by computed tomography.	47
Fig 4-7	Histogram shows the distribution of transverse dimension of caudate lobe.	48
Fig 4-8	Shows Transverse diameter of Caudate lobe measured by computed tomography.	49
Fig 4-9	Histogram shows the distribution of transverse dimension of caudate lobe.	50
Fig 4-10	Shows the ratio of caudate lobe over right lobe.	51
Fig 4-11	Histogram shows the distribution of left hepatic boarder angle.	52
Fig 4-12	Shows Left Hepatic Boarder measured by computed tomography.	53
Fig 4-13	scatter plot shows the relation between the patient height and Transverse Diameter of right lobe	56

Fig 4-14	scatter plot shows the relation between the patient age and left hepatic boarder angle	58
Table 4-1	Shows gender distribution.	42
Table 4-2	shows age distribution	43
Table 4-3	Shows Transverse diameter of Right lobe measured by computed tomography (mean± SD.)	44
Table 4-4	Shows AP. Diameter of left lobe measured by computed tomography (mean± SD.)	46
Table 4-5	Shows Transverse diameter of Caudate lobe measured by computed tomography (mean± SD.)	48
Table 4-6	Shows the ratio of caudate lobe over right lobe as had been calculated and expressed as mean ± SD.	50
Table 4-7	Shows Left Hepatic Boarder measured by computed tomography (mean± SD.)	52
Table 4-8	Shows the liver dimension measurements for both genders expressed as mean ± SD in respect to age group.	54
Table 4-9	Shows significance for hepatic measurements in respect to gender difference.	54
Table 4-10	Shows correlation of hepatic measurement in respect to patient age and height.	55
Table 4-11	Shows coefficients of Transverse Diameter of right lobe in respect to patient height.	55

Table4-12	Shows correlations of hepatic measurement in respect to patient age and height.	57
-----------	---	----

List of Abbreviations

CT	Computed Tomography
MPR	Multi Planner Reconstruction
MIP	Maximum Intensity Projection
SSD	Surface Shaded Display
EMI	Electro Mechanical Industries
TD	Transverse Diameter
AP.	Anteroposterior
A.P.D	Anteroposterior Diameter
CL	Caudate Lobe
RL	Right Lobe
CL/RL	Caudate Lobe over Right Lobe

L.H.B	Left Hepatic Boarder
--------------	----------------------

Dedication

To my family for having faith on me...

To my Teachers Who teach me how to be successful, diligent and an ideal person, who keeps encouraging me foreword to achieve goals I planned

....

To my friends and colleague...

I dedicate my research and I hope that I was succeeded to satisfy all the wanted information.

Acknowledgments

I present my deepest thanks and tribute to the one who provides me services and she has the favor for accomplishing my research,

I present my pure appreciation for
my great supervisor

Dr. Duha Abdu Mohamed Abdu who
keeps helping, advising and
treating me right to perform this
research.

Abstract

This is an analytical descriptive research, carried out in Khartoum state in the period of December 2012 and February 2013 at Jarash international specialized hospital which aimed to determine the liver span dimensions among Sudanese people, the researcher examined a random sample of 50 Sudanese patients their age ranged from 19 and greater than 63 years old in order to fulfill the research objectives, the researcher extracted despite of the gender difference that the Anteroposterior diameter of left lobe equals 6.09 ± 1.212 cm, Transverse diameter of right lobe equals 8.21 ± 1.03 cm, Transverse diameter of caudate lobe equals 4.32 ± 1.12

cm, Left hepatic boarder angle equals 46.33 ± 10.39 degrees and Caudate Lobe/Right Lobe found to be 0.53 ± 0.14 .

In this study the researcher test the anteroposterior diameter of left lobe, transverse diameter of right lobe, transverse diameter of caudate lobe and left hepatic boarder angle with patient age and height and found that only the left hepatic boarder and the transverse diameter of right lobe have a significant correlation with the patient age and height as constant predictors through those equations respectively $\{0.197 \times \text{age} + 37.26\} \pm 9.8$ and $(0.027 \times \text{height} + 3.727) \pm 2.063$.

The conclusion is that the Sudanese people have larger liver span dimensions regarding the anteroposterior diameter of left lobe, transverse diameter of right lobe, transverse diameter of caudate lobe and the left hepatic boarder angle in addition to caudate right lobe ratio in contrast with the global reference of liver span dimensions, where globally the normal ratio between the caudate lobe and right lobe is 0.37 ± 0.16 were in the researcher study is found 0.53 ± 0.14 in addition to that the anteroposterior diameter of left lobe is 6.09 ± 1.212 cm were it been reported globally to equal 5 cm when had been measured on the paravertebral line.

ملخص الدراسة

هذه دراسه تحليليه وصفيه، أجريت في ولاية الخرطوم في الفترة من ديسمبر 2012 وحتى فبراير 2013 بمستشفى جرش التخصصي الدولي، بها فحص الباحث عينة عشوائية من المرضى السودانيين وقدرها 50 مريضا تراوحت اعمارهم ما بين

19 و اكبر من 63 عاماً هدف الباحث من خلال هذه الدراسة تحديد أبعاد الكبد لدي السودانيين اخذا اربعة ابعاد تلي القياس للكبد البشريه, وقد توصل الي الاتي, البعد الامامي الخلفي للفص الايسر يساوي 6.09 ± 1.212 سم. البعد العرضي للفص الايمن يساوي 8.21 ± 1.03 سم. زاوية الحد اليسر للكبد تساوي 46.33 ± 10.39 درجه. البعد العرضي للفص الذيلي يساوي 4.32 ± 1.12 سم. بينما وجد الباحث النسبه ما بين الفص الذيلي للفص الايمن تساوي 0.14 ± 0.53 .

بفحص الباحث لنتائج قياسات الكبد للشريحه موضوع البحث وهي البعد الامامي الخلفي للفص الايسر, البعد العرضي للفص الايمن, البعد العرضي للفص الذيلي و زاويه الحد الايسر للكبد اتضح للباحث انه بالمقارنه مع طول المريض فقط نتائج البعد العرضي للفص الايمن هي التي تتضمن علاقه ارتباط مصاحبه لطول المريض و بالمقارنه مع عمر المريض فقط نتائج زاويه الحد الايسر للكبد هي التي تتضمن علاقه ارتباط مصاحبه لعمر المريض وذلك من خلال هاتان المعادلتان لتوقع كل من البعد العرضي للفص الايمن و زاويه الحد الايسر للكبد مع طول و عمر المريض علي التوالي ($0.027 * \text{طول المريض} + 3,727$) $\pm 2,063$ و ($0,197 * \text{عمر المريض} + 37,26$) $\pm 9,8$.

بنهايه الدراسة توصل الباحث الي ان المريض السوداني يتميز بأبعاد كبد أكبر عن ما هو مذكور بالمراجع مقارنة بالبعد الامامي الخلفي للفص الايسر, البعد العرضي للفص الايمن, البعد العرضي للفص الذيلي و زاويه الحد الايسر للكبد اضافه الي النسبه ما بين الفص الذيلي الي الفص الايمن للكبد حيث ان المتعارف عليه عالميا ان النسبه ما بين الفص الذيلي الي الفص الايمن تساوي 0.37 ± 0.16 بينما وجدها الباحث حسابيا تساوي 0.14 ± 0.53 لضافه لذلك وجد الباحث ان البعد الامامي الخلفي لفص الكبد الايسر يساوي 6.09 ± 1.212 سم بينما عالميا البعد الامامي الخلفي لفص الكبد الايسر يساوي 5 ± 1.212 سم.