

# بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ





# شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



# جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
علي هذه الأقراص المدمجة قد أعدت دون أية تغييرات



## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



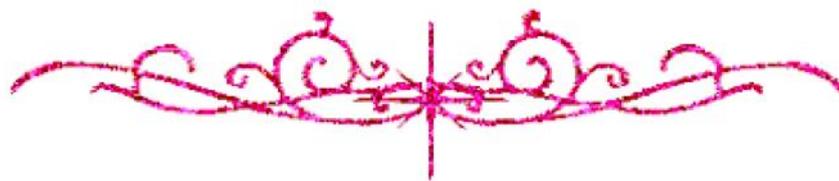


# بعض الوثائق الأصلية تالفة





# بالرسالة صفحات لم ترد بالأصل





# **A Morphological Study of Left Atrial Appendage in Egyptian patients Using multidetector computed tomography (MDCT)**

Thesis

*Submitted for Partial Fulfillment of Master's Degree of Cardiology*

By

**Ahmed Mohamed Hassan Kamel**

*M.B.B.CH.*

Under supervision of

**Prof. Dr. Mona Mostafa Mohamed Rayan(MD)**

*Professor of Cardiology – Cardiology Department  
Faculty of Medicine – Ain Shams University*

**Prof. Dr. Ahmed Mohamed Onsy(MD)**

*Professor of Cardiology – Cardiology Department  
Faculty of Medicine – Ain Shams University*

**Dr. Hazem Mohamed Abdel Menaem (MD)**

*Lecturer of Cardiology – Cardiology Department  
Faculty of Medicine – Ain Shams University*

*Cardiology Department  
Faculty of Medicine  
Ain Shams University*

2020

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# قالوا

لسببائك لا علم لنا  
إلا ما علمتنا إنك أنت  
العليم العظيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

# Acknowledgment

*First and foremost, I feel always indebted to **ALLAH**,  
the Kindest and Most Merciful.*

*I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Mona Mostafa Mohamed Rayan(MD)**, Professor of Cardiology – Cardiology Department Faculty of Medicine – Ain Shams University for her keen guidance, kind supervision, valuable advice, and continuous encouragement, which made possible the completion of this work.*

*I am also delighted to express my deepest gratitude and thanks to **Prof. Dr. Ahmed Mohamed Onsy(MD)**, Professor of Cardiology – Cardiology Department Faculty of Medicine – Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

*I am deeply thankful to **Dr. Hazem Mohamed Abdel Menaem (MD)**, Lecturer of Cardiology – Cardiology Department Faculty of Medicine – Ain Shams University, for his great help, active participation, and guidance.*

*Ahmed Mohamed*

# *List of Contents*

<b>Title</b>	<b>Page No.</b>
List of Tables .....	i
List of Figures .....	ii
List of Abbreviations.....	v
Introduction .....	1
Aim of the Work.....	3
Review of Literature	
The Left Atrial Appendage Anatomical Considerations....	4
Clinical Significance of Left Atrial Appendage.....	14
Noninvasive Imaging of the LAA.....	24
Patients and Methods.....	30
Results .....	40
Discussion .....	57
Study Limitations.....	67
Summary .....	68
Conclusion .....	70
Recommendations .....	71
References .....	72
Arabic Summary.....	—

# *List of Tables*

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
<b>Table (1):</b>	Prevalence of LAA morphology types in various populations.....	13
<b>Table (2):</b>	Comparison of the Different Imaging Modalities for Assessment of the LAA.....	29
<b>Table (3):</b>	Demographic Data and Clinical characteristics of the study sample.....	40
<b>Table (4):</b>	Showing left atrial and left atrial appendage dimensions.....	43
<b>Table (5):</b>	Shows the prevalence of LAA morphology and the number of pulmonary veins entering the left atrium.....	44
<b>Table (6):</b>	Shows the relation of different parameters on LAA morphology.....	46
<b>Table (7):</b>	Distribution of different left atrial appendage morphologies in correlation to the number of pulmonary veins.....	49
<b>Table (8):</b>	Shows the impact of different LA and LAA parameters on LAA morphological subtypes.....	50
<b>Table (9):</b>	Shows the effect of different parameters on LAA volume.....	52
<b>Table (10):</b>	Association between left atrial appendage Volume and age, left ventricular functions and left atrium dimensions.....	53

# *List of Figures*

Fig. No.	Title	Page No.
<b>Figure (1):</b>	Showing the different morphological subtypes of left atrial appendage using 3D reconstruction imaging of MDCT of Wang Model LAA .....	2
<b>Figure (2):</b>	Shows a 3D reconstructed image from our Study of left atrial appendage and its relation to different cardiac structures. ....	5
<b>Figure (3):</b>	Anatomic Variants of LAA Morphology Sample images taken from explanted hearts demonstrating different LAA morphologies.....	7
<b>Figure (4):</b>	Showing cactus morphology of LAA from 3D reconstructed image in our study.....	8
<b>Figure (5):</b>	Shows the Chicken wing morphology of LAA from the 3D reconstructed image in our study.....	8
<b>Figure (6):</b>	Shows the Windsock morphology of LAA from the 3D reconstructed image in our study.....	9
<b>Figure (7):</b>	Shows the Cauliflower morphology of LAA from the 3D reconstructed image in our study.....	9
<b>Figure (8):</b>	LAA morphology types based on Wang's classification with Kimura's quantitative limits .....	10
<b>Figure (9):</b>	Diameter and Area Changes of the LAA Orifice During the Cardiac Cycle.....	15
<b>Figure (10):</b>	LAA: LAA morphology using different imaging modalities.....	27

## *List of Figures Cont...*

Fig. No.	Title	Page No.
<b>Figure (11):</b>	Showing different morphological subtypes of left atrial appendage according to Wang model using multidetector computed tomography (MDCT) in our study. ....	34
<b>Figure (12):</b>	Showing LAA volume measured by multi-detector computed tomography by using three-dimensional reconstructed images and modified axial images.....	35
<b>Figure (13):</b>	Showing LAA length measured by multi-detector computed tomography by using three-dimensional reconstructed images and modified axial images.....	35
<b>Figure (14):</b>	Showing LAA orifice measured by multi-detector computed tomography by modified axial images.....	36
<b>Figure (15):</b>	Showing Left atrial volume measured by multi-detector computed tomography by using three-dimensional reconstructed images and modified axial images. ....	36
<b>Figure (16):</b>	Showing coronary arteries by multi-detector computed tomography.....	37
<b>Figure (17):</b>	A pie chart showing Gender distribution of the whole study population (69.3% involved in the study were males and 30.7% were females). ....	41
<b>Figure (18):</b>	Clinical characteristics of the whole study population. ....	41
<b>Figure (19):</b>	Pie chart showing the distribution of associated CAD among the studied patients. ....	42

## *List of Figures Cont...*

Fig. No.	Title	Page No.
<b>Figure (20):</b>	Distribution of different left atrial appendage morphologies. ....	45
<b>Figure (21):</b>	Distribution of the number of pulmonary veins entering the left atrium among the study population. ....	45
<b>Figure (22):</b>	Distribution of different left atrial appendage morphologies adjusted for age. ....	47
<b>Figure (23):</b>	Shows the relation of age and gender on different LAA morphologies. ....	47
<b>Figure (24):</b>	Shows the impact of estimated EF on LAA morphologies. ....	48
<b>Figure (25):</b>	Shows the impact of different risk factor profiles on LAA morphology. ....	48
<b>Figure (26):</b>	Distribution of number of pulmonary veins in each morphological type of LAA. ....	49
<b>Figure (27):</b>	Left atrial appendage length in each morphological type of LAA. ....	51
<b>Figure (28):</b>	Shows the impact of age on LAA volume. ....	53
<b>Figure (29):</b>	Shows the impact of estimated EF on LAA volume. ....	54
<b>Figure (30):</b>	Shows the impact of LA diameter on LAA volume. ....	54
<b>Figure (31):</b>	Shows the impact of LA volume on LAA volume. ....	55
<b>Figure (32):</b>	Shows the impact of LAA orifice size on LAA volume. ....	55
<b>Figure (33):</b>	Shows the impact of LAA length on LAA volume. ....	56

# List of Abbreviations

Abb.	Full-term
3D .....	Three Dimensional
AF .....	Atrial fibrillation
ANF .....	Atrial natriuretic factor
ASUSH .....	AinShams University Specialized Hospital in Cairo, Egypt
CABG.....	Coronary artery bypass graft
CAD.....	Coronary artery diseases
CHA2DS2-VASc.	Congestive heart failure, Hypertension, Age (> 65 = 1 point, > 75 = 2 points), Diabetes, previous Stroke/transient ischemic attack (2 points), vascular disease (peripheral arterial disease, previous myocardial infarction, aortic atheroma), and sex category (female gender) is included in this scoring system.
CMR.....	Cardiac magnetic resonance
CT .....	Computed tomography
ECG .....	Electrocardiogram
EF .....	Ejection Fraction
HS.....	Highly significant
IHD .....	Ischemic Heart Disease
IQR .....	Interquartile range “is a measure of variability, based on dividing a data set into quartiles. Quartiles divide a rank-ordered data set into four equal parts. The values that divide each part are called the first, second, and third quartiles; and they are denoted by Q1, Q2, and Q3, respectively.”

## *List of Abbreviations Cont...*

<b>Abb.</b>	<b>Full-term</b>
LA .....	Left atrium
LAA.....	Left atrial appendage
LDL-C.....	Low-density lipoprotein cholesterol
MDCT .....	Multidetector computed tomography
NS .....	Non-significant
PCI .....	percutaneous coronary intervention
ROC .....	Receiver operator characteristic
SD .....	Standard Definition
SD .....	Standard deviation
SEC.....	Spontaneous echocardiographic contrast
SR.....	Sinus rhythm
TEE.....	Transesophageal echocardiography
TTE.....	Trans-Thoracic Echocardiography