

**The Association of Chronic Atrial  
Fibrillation with Right Atrial Dilatation  
and Left Ventricular Dysfunction in the  
Elderly**

Thesis

*Submitted For the Partial Fulfillment of the Master  
Degree in Cardiology*

BY

**Mohamed Ahmed Mostafa**

M.B.B.ch

Under supervision of

**Prof. Dr. / Ramez Raouf Guindy**

*Professor of Cardiology  
Faculty of Medicine- Ain Shams University*

**Prof. Dr. / Sameh Emil Sadek**

*Professor of Cardiology - Military Medical Academy*

**Dr. / Hebatallah Mohamed Attia**

*Lecturer of Cardiology  
Faculty of Medicine- Ain Shams University*

*Faculty of Medicine  
Ain Shams University*

**2010**

---

## *Acknowledgment*

---

It is a great thing to feel success and have the pride of achieving all what is always aspired. Nevertheless, one must not forget all those who usually help and push him onto the most righteous way that inevitably ends with fulfillment and perfection.

When the instant comes to appreciate all those kind-hearted people, I soon mention Professor Dr./ Ramez Raouf Guindy, Professor of Cardiology, Ain Shams University, the person who gave me the honor to be his student. He really helped me by his precious opinions and contributive comments that served much in the construction of this work.

I would like to express my deepest thanks to Professor Dr./ Sameh Emil Sadek, Professor of Cardiology, Military Medical Academy, for his uninterrupted care and advice, his meticulous supervision precious remarks and continuous encouragement.

I wish to express my gratitude to Dr. Hebatallah Mohamed Attia Lecturer of Cardiology, Ain- Shams University, for her kind, active participation and keen interest in the progress and accomplishment of this work.

I would also like to record my thanks and sincere gratitude to my family for their great help and support throughout the work.

I cannot forget the help of, my colleagues, the medical staff and nursing in our Cardiology department for their sincere cooperation in the practical part of this work.

**Mohamed Ahmed Mostafa**

## **LIST OF ABBREVIATION**

ACC	:	American college of cardiology.
AF	:	Atrial fibrillation
AHA	:	American heart association.
ASE	:	American society of echocardiography.
AT-1	:	Angiotensin type I.
AT-2	:	Angiotensin type II.
AV Conduction	:	Atrio-ventricular conduction
AV Node	:	Atrio ventricular node.
CHARM trial	:	Candesartan in heart failure assessment of reduction in mortality.
CHF	:	Congestive heart failure
DIAMOND	:	Danish – investigations of arrhythmia and mortality on dofetilide.
DIG	:	Digitalis investigation group.
ECG	:	Electrocardiogram.
EDV	:	End diastolic volume.
ESV	:	End systolic volume.
LA	:	Left atrium.
LC	:	Light chain.
LC-1	:	Essential light chain.
LC-2	:	Regulatory light chain.

## **LIST OF ABBREVIATION (Cont...)**

LV	:	Left ventricle.
LVEDd	:	Left ventricular end diastolic diameters.
LVEF	:	Left ventricular ejection fraction.
LVESD	:	Left ventricular end systolic diameter.
LVFS	:	Left ventricular fraction shortening.
MHC	:	Myosin heavy chancel molecule.
NYHA	:	New York heart association.
RA	:	Right atrium.
RV	:	Right ventricle.
SA Node	:	Sino-atrial node.
SOLVD	:	Studies of left ventricular dysfunction.

## LIST OF FIGURES

<b>Fig No.</b>	<b>Title</b>	<b>Page No.</b>
<b>Figure (1):</b>	Normal ECG .....	7
<b>Figure (2):</b>	ECG of Atrial Fibrillation.....	7
<b>Figure (3):</b>	Electrophysiology of atrial fibrillation.....	30
<b>Figure (4):</b>	Anatomy of the heart.....	38
<b>Figure (5):</b>	Conductive system of the heart.....	43
<b>Figure (6):</b>	AF-induced LV dysfunction.....	44
<b>Figure (7):</b>	Angiotensin II in the pathogenesis of AF.....	59
<b>Figure (8):</b>	Factors involved in reduced atrial contractility.....	62
<b>Figure (9):</b>	Right artial diameters in apical-4 chamber view, <b>A</b> represents longitudinal axis, <b>B</b> represents minor axis.....	66
<b>Figure (10):</b>	Assessment of left ventricular functions by M-mode.....	67
<b>Figure (11):</b>	Parasternal long axis of the left ventricle .....	67
<b>Figure (12):</b>	Continuous wave Doppler of the Tricuspid valve showing Tricuspid regurge.....	68
<b>Figure (13):</b>	Sex distribution among patients group .....	71
<b>Figure (14):</b>	Correlation between duration of AF and LVEF%.....	73

## LIST OF FIGURES (Cont...)

<b>Fig No.</b>	<b>Title</b>	<b>Page No.</b>
<b>Figure (15):</b>	Apical 4- chamber view showing dilated Right atrium.....	74
<b>Figure (16):</b>	Distribution of right atrial dilatation patients group. ....	76
<b>Figure (17):</b>	Correlation between right atrial dilatation and sex in patients group.....	77
<b>Figure (18):</b>	Correlation between right atrial dilatation and age in patients group.....	79
<b>Figure (19):</b>	Correlation between right atrial dilatation and duration of atrial fibrillation in patients group. ....	80
<b>Figure (20):</b>	Correlation between right atrial dilatation and LVEF% in patients group.....	82
<b>Figure (21):</b>	Distribution of patients with IHD .....	83
<b>Figure (22):</b>	Correlation between right atrial dilatation and IHD in patients group.....	85
<b>Figure (23):</b>	Distribution of patients with renal impairment. ....	87
<b>Figure (24):</b>	Correlation between right atrial dilatation and renal impairment in patients group. ....	88
<b>Figure (25):</b>	Distribution of patients with hypertension.....	89
<b>Figure (26):</b>	Apical 4- chamber view showing thrombus in the Right atrium .....	91
<b>Figure (27):</b>	A 2-dimentional echocardiogram in apical 4 chamber view showing bi-atrial dilatation.....	93

## LIST OF TABLES

Table. No.	Title	Page No.
Table (1):	Classification of Atrial Fibrillation.....	11
Table (2):	Sex distribution among patients group. ....	70
Table (3):	Mean age, duration of AF and LVEF% in patients group. ....	72
Table (4):	Correlation between LVEF%, age and duration of AF in patients group. ....	72
Table (5):	Prevalence of right atrial dilatation in patients group. ....	74
Table (6):	Correlation between right atrial dilatation and sex in patients group. ....	76
Table (7):	Correlation between right atrial dilatation and age in patients group.....	78
Table (8):	Correlation between right atrial dilatation and duration of atrial fibrillation in patients group. ....	79
Table (9):	Correlation between right atrial dilatation and LVEF% in patients group.....	81
Table (10):	Distribution of patients with IHD. ....	83
Table (11):	Correlation between right atrial dilatation and IHD in patients group.....	84
Table (12):	Distribution of patients with renal impairment. ....	86
Table (13):	Correlation between right atrial dilatation and renal impairment in patients group. ....	87

## **LIST OF TABLES (Cont....)**

<b>Table. No.</b>	<b>Title</b>	<b>Page No.</b>
<b>Table (14):</b>	Distribution of patients with hypertension.....	88
<b>Table (15):</b>	Relation between right atrial dilatation and the presence of right atrial thrombus. ....	90
<b>Table (16):</b>	The presence of tricuspid regurge. ....	91
<b>Table (17):</b>	Relation between right atrial dilatation and left atrial dilatation .....	92



# LIST OF CONTENTS

Title	Page No.
Introduction .....	1
Aim of the Work .....	2
Review of Literature .....	3
Patients and Methods .....	43
Results .....	70
Discussion .....	94
Summary .....	99
Conclusion .....	100
References .....	101
Appendix .....	--
Arabic Summary .....	--

## INTRODUCTION

Despite an extensive literature on atrial fibrillation since it was first documented by Sir James Mackenzie almost a century ago, certain questions still remain regarding the mechanical consequences of atrial fibrillation. Clinico-echocardiographic studies have demonstrated that left atrial enlargement is very common in patients with atrial fibrillation, and is usually associated with clinical deterioration (*Barker et al., 1993*).

Although left atrial dilatation is generally considered to be the cause of atrial fibrillation, it could be the consequence of atrial fibrillation in the absence of mitral valve disease, as suggested by longitudinal studies. If this is true, atrial fibrillation should produce similar effects on the right atrium (*Dreifus et al., 1982*).

## **AIM OF THE WORK**

The aim of this study is to assess the prevalence of right atrial dilatation in chronic atrial fibrillation and to evaluate the left ventricular functions by echocardiography.

## Definition of Atrial Fibrillation

### Introduction

Atrial fibrillation (AF), the most common sustained cardiac rhythm disturbance, is increasing in prevalence as the population ages. Although it is often associated with heart disease, AF occurs in many patients with no detectable disease. Hemodynamic impairment and thromboembolic events result in significant morbidity, mortality, and cost. (*Fuster et al., 2001*).

### Definition and electrocardiographic patterns

#### *A. Atrial fibrillation*

Atrial Fibrillation is a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation with consequent deterioration of atrial mechanical function. On the electrocardiogram (ECG), AF is described by the replacement of consistent P waves by rapid oscillations or fibrillatory waves that vary in size, shape, and timing, associated with an irregular, frequently rapid ventricular response when atrioventricular (AV) conduction is intact (*Bellet et al., 1971*)

The ventricular response to AF depends on electrophysiological properties of the AV node, the level of vagal and sympathetic tone, and the action of drugs. Regular RR intervals are possible in the presence of AV block or interference by ventricular or junctional tachycardia. A rapid, irregular, sustained, wide-QRS-complex tachycardia strongly suggests AF with conduction over an accessory pathway or AF with underlying bundle-branch block. Extremely rapid rates (over 200 bpm) suggest the presence of an accessory pathway (*Prystowsky et al., 1998*)

### ***B. Related arrhythmias***

AF can be isolated or associated with other arrhythmias, often atrial flutter or atrial tachycardia. Atrial flutter can arise during treatment with antiarrhythmic agents prescribed to prevent recurrent AF. Atrial flutter is more organized than AF, with a saw-tooth pattern of regular atrial activation called flutter (f) waves on the ECG, particularly visible in leads II, III, and aVF. Untreated, the atrial rate typically ranges from 240 to 320 beats per minute (bpm), with f waves inverted in ECG leads II, III, and aVF and upright in lead V<sub>1</sub>. The wave of activation in the right atrium (RA) may be reversed, resulting in f waves that are upright in leads II, III, and aVF and

inverted in lead V<sub>1</sub>. Two-to-one AV block is common, producing a ventricular rate of 120 to 160 bpm. Atrial flutter can degenerate into AF, AF can initiate atrial flutter, or the ECG pattern can alternate between atrial flutter and AF, reflecting changing atrial activation. Other atrial tachycardias, as well as AV reentrant tachycardias and AV nodal reentrant tachycardias, can also trigger AF. In other atrial tachycardias, P waves are readily identified and are separated by an isoelectric baseline in 1 or more ECG leads. The morphology of the P waves can help localize the origin of atrial tachycardias. A unique type of atrial tachycardia originates in the pulmonary veins, is typically more rapid than 250 bpm, and often degenerates into AF. Intracardiac mapping can help differentiate the various atrial arrhythmias (*Jais et al., 1997*).

## Historical background

Because the diagnosis of atrial fibrillation requires measurement of the electrical activity of the heart, it was not truly described until 1874, when Edmé Félix Alfred Vulpian observed the irregular atrial electrical behavior that he termed "fremissement fibrillaire" in dog hearts (*Vulpian et al., 1874*).

In the mid-eighteenth century, Jean-Baptiste de Sénac made note of dilated, irritated atria in people with mitral stenosis (*McMichael et al., 1992*)

The irregular pulse associated with AF was first recorded in 1876 by Carl Wilhelm Hermann Nothnagel and termed "delirium cordis", stating that "In this form of arrhythmia the heartbeats follow each other in complete irregularity. At the same time, the height and tension of the individual pulse waves are continuously changing" (*Nothnagel et al., 1876*).

Correlation of delirium cordis with the loss of atrial contraction as reflected in the loss of waves in the jugular venous pulse was made by Sir James MacKenzie in 1904 (*MacKenzie et al., 1904*).

Willem Einthoven published the first electrocardiogram showing AF in 1906 (*Einthoven et al., 1906*).

The connection between the anatomic and electrical manifestations of AF and the irregular pulse was made in 1909 by Carl Julius Rothberger, Heinrich Winterberg, and Sir Thomas Lewis (*Rothberger et al., 1909*).