

**STUDY OF VENTRICULAR LATE POTENTIALS
IN SYSTEMIC HYPERTENSION WITH
LEFT VENTRICULAR HYPERTROPHY**

Thesis

Submitted for partial Fulfilment of Master Degree
in Cardiovascular Medicine

By

KHALED EL-ARABI DARAHIM, M.B,B.Ch.

*Resident in Department of Cardiovascular Medicine
Ain Shams University*

Under Supervision of

PROF. DR. HASSAN EZZ EL-DIN ATTIA, M.D.

*Professor of Cardiovascular Medicine
Head of Department of Cardiovascular Medicine
Ain Shams University*

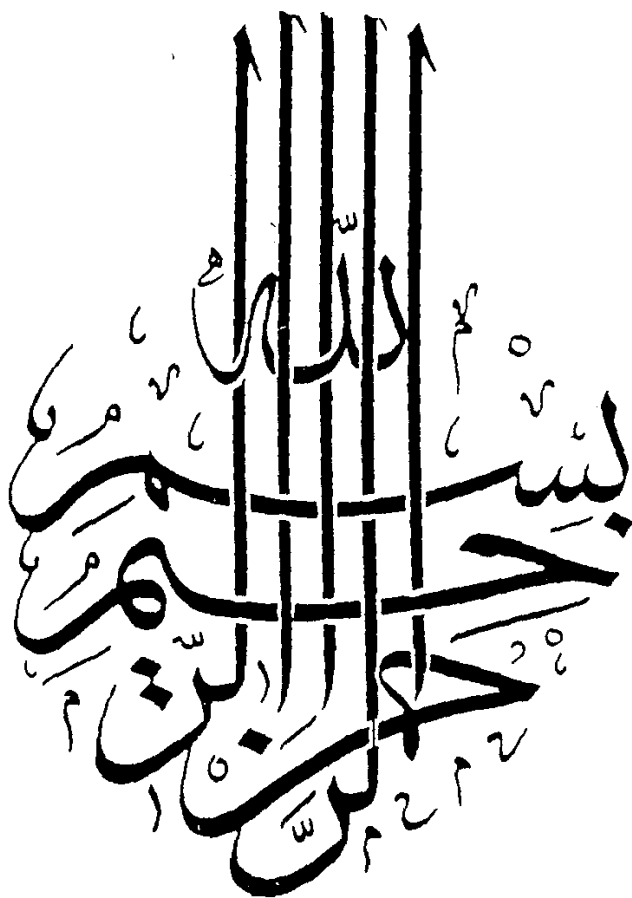
DR. HOSSAM EL-DIN MOHAMED EL-GHETANY , M.D.

*Lecturer of Cardiovascular Medicine
Ain Shams University*

Faculty of Medicine
Ain Shams University

1996





DEDICATION

*Dedicated to my Father and my
Mother; for their support and
encouragement.*

Acknowledgment

First, I am profoundly indebted to Professor Dr. HASSAN EZZ-ELDIN ATTIA, Professor and head of department of cardiology, Faculty of Medicine, Ain Shams University, for his enlightening comments, valuable advice and continuous encouragement. I am most appreciative of his close supervision.

I'm truly grateful to to Dr. HOSSAM EL-DIN MOHAMED EL-GHETANY, Lecturer of cardiology, Faculty of Medicine, Ain Shams University, for his close supervision and sound advice.

I would like to record my thanks to Dr. MERVAT ABU-ELMAATY, Lecturer of cardiology, Faculty of Medicine, Ain Shams University, for her scientific assistance in preparation the review of literature.

CONTENTS

	Page
Introduction and Aim of the work.	1
Review of the literature.	3
• <i>Chapter 1 : Signal-averaged electrocardiography and ventricular late potentials.</i>	3
• Introduction and historical perspectives.	3
• Signal averaged electrocardiography.	
- Methodology.	6
- Time domain analysis.	15
- Normal and abnormal values of signal averaged ECG parameters.	15
- Frequency domain analysis.	19
- Spectral analysis.	24
- Spectro-temporal mapping of the surface ECG	27
- Spectral turbulence analysis	33
- Frequency versus time domain analysis.	43
• Ventricular late potentials.	44
• Pathophysiological basis of late potentials.	47
• Potential indications of signal averaged ECG.	49
• Bundle branch block and signal averaged ECG.	64
• Effects of AF and atrial flutter on the signal averaged ECG.	66
• Gender related differences in signal averaged ECG.	66
• Effect of subadipose tissue on signal averaged ECG.	66
• <i>Chapter 2 : Hypertension and left ventricular hypertrophy.</i>	67
• Etiology of left ventricular hypertrophy.	67
• Pathophysiology of left ventricular hypertrophy.	69
• Detection of left ventricular hypertrophy.	71

	Page
• Clinical implications of left ventricular hypertrophy in hypertension.	76
• Regression of left ventricular hypertrophy.	80
• <i>Chapter 3 : Ventricular arrhythmias and ventricular late potentials in systemic hypertension with left ventricular hyperrophy.</i>	81
• Ventricular arrhythmias and hypertensive left ventricular hypertrophy.	81
- Nature and prevalence.	81
- Pathogenesis.	82
- Prognostic significance.	84
- Reduction of left ventricular hypertrophy and ventricular arrhythmias.	88
- Techniques for detection.	89
• Ventricular late potentials in systemic hypertension and left ventricular hypertrophy.	90
- Prevalence.	90
- Relation of ventricular late potentials to hypertensive left ventricular hypertrophy.	91
- Relation of ventricular late potentials to pattern of hypertensive left ventricular hypertrophy.	92
- Relation of ventricular late potentials in systemic hypertension to age, blood pressure and systolic ventricular function.	92
- Prognostic value of ventricular late potentials	93
- Effect of therapy on ventricular late potentials in systemic hypertension.	94
Subjects and methods.	95
Results.	103
Discussion.	129
Summary and Conclusion.	138
References.	140
Arabic summary.	

LIST OF TABLES

	Page
1. Normal values of signal-averaged ECG parameters at 11 high pass filter setting in 100 normal subjects.	16
2. Prognostic significance of the signal-averaged ECG in patients after myocardial infarction.	52
3. Predictive value of signal-averaged ECG for induced sustained ventricular tachycardia in patients with syncope or nonsustained ventricular tachycardia.	56
4. Modified criteria for abnormality of the time domain signal-averaged ECG in bundle branch block	65
5. Performance of echocardiographic criteria for detection of left ventricular hypertrophy.	75
6. Ventricular ectopy in patients with normal left ventricular mass and in patients with left ventricular hypertrophy	83
7. Prevalence of abnormal signal-averaged ECG in patients with uncomplicated systemic hypertension	91
8. Classification of blood pressure in adults	97
9. Diagnosis of hypertension in the young	98
10. Baseline characteristic of the study groups	105
11. Prevalence of ventricular late potentials and study of parameters of signal-averaged ECG among study groups	107
12. Prevalence of ventricular late potentials by varying definition in the study groups	110
13. Prevalence of ventricular late potentials and study of parameters of signal-averaged ECG among hypertensive patients with concentric, eccentric left ventricular hypertrophy and without left ventricular hypertrophy versus control subjects	113
14. Selected variables in hypertensive patients with and without ventricular late potentials	115
15. Patient data , Group A	121
16. Patient data , Group B	122
17. Patient data , Group C	123

LIST OF FIGURES

	Page
1. Effect of high-pass filter setting on signal-averaged ECG parameters in a patient with inducible sustained monomorphic ventricular tachycardia	12
2. Effect of high-pass filter setting on signal-averaged ECG parameters in a patient with non sustained ventricular tachycardia without inducible sustained monomorphic ventricular tachycardia.	12
3. Normal and abnormal signal-averaged ECG	18
4. Representaion of time and frequency domain	20
5. Influence of the window function on the frequency analysis of the ST segment	22
6. Effect of direct-current component on the power sectrum	22
7. Energy spectra of the terminal QRS and ST segments from a patient with prior myocardial infarction and sustained ventricular tachycardia and from a patient without sustained ventricular tachycardia.	26
8. Peak frequencies and values for the maguitade ratios for patients with prior infarction with and without sustained ventricular tachycardia.	26
9. Single spectrum analysis of the ST segment	28
10. Spectrotemporal mapping with Fourier transform	28
11. Spectrotemporal mapping in patient after myocardial infarction without ventricular tachycardia	31
12. Spectrotemporal mapping of a noisy signal	31
13. Spectrotemporal mapping in a postmyocardial infarction patient with sustained ventricular tachycardia.	32
14. Spectrotemporal mapping in a postmyocardial infarction patient with sustained ventricular tachycardia and a noisy signal	32
15. Spectral turbulence analysis in a normal subject (time-domain true negative).	38

16.	Spectral turbulence analysis in a postmyocardial infarction patient with sustained ventricular tachycardia (time-domain true positive)	39
17.	Spectral turbulence analysis in a normal subject with RBBB (time-domain false positive)	40
18.	Spectral turbulence analysis in a post myocardial infarction patient with sustained ventricular tachycardia (time-domain false negative)	41
19.	Prevalence of ventricular late potentials among the study groups	106
20.	Prevalence of ventricular late potentials by varying definitions among study groups	111
21.	Prevalence of ventricular late potentials among hypertensive patients with concentric, eccentric left ventricular hypertrophy and no left ventricular hypertrophy versus control subjects	112
22.	Age and gender in hypertensive patients with and without ventricular late potentials	116
23.	Blood pressure levels in hypertensive patients with and without ventricular late potentials	117
24.	Ventricular function in hypertensive patients with and without ventricular late potentials	118
25.	ECG-left ventricular hypertrophy and echocardiographic left ventricular hypertrophy in hypertensive patients with and without ventricular late potentials	119
26.	Pattern of echo left ventricular hypertrophy in hypertensive patients with and without ventricular late potentials	120
27.	Result of a normal signal-averaged ECG	124
28.	Result of an abnormal signal-averaged ECG	125
29.	M-mode echocardiogram of a patient with normal left ventricular mass	126
30.	M-mode echocardiogram of a patient with concentric left ventricular hypertrophy	127
31.	M-mode echocardiogram of a patient with eccentric left ventricular hypertrophy	128